Conservation of Bendire's and LeConte's Thrashers at Solar Development Sites: Site Evaluation, Selection, and Design Considerations to Benefit Desert Thrashers

DTWG
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The development of utility-scale solar projects can have significant impacts on wildlife and their habitat. In order to maintain wildlife populations, and maintain the viability of their habitats, it is important to consider approaches that maximize the likelihood of continued use of habitats by various species. These recommendations include measures such as minimizing the footprint of the solar project, avoiding key habitats and nesting areas, and implementing wildlife-friendly designs that minimize the potential for collisions with solar infrastructure. By taking these considerations into account, we can ensure that the development of renewable energy occurs in concert with continued persistence of our wildlife resources.

Figure 1. LeConte's Thrasher. Photo credit: Micah Reigner

Bendire's Thrasher (*Toxostoma benderei*) and LeConte's Thrasher (*Toxostoma lecontei*) are species of conservation concern across their ranges and are included on numerous lists of conservation concern held by various organizations and agencies (See Desert Thrasher Conservation Strategy for full discussion). They are considered Species of Greatest Conservation Need in all states where they occur in the United States, Bureau of Land Management (BLM) Sensitive Species, and U.S. Fish and Wildlife Service Birds of Conservation Concern, among others. They are protected under the Migratory Bird Treaty Act (MBTA) which prohibits take of any bird or its parts (including killing, capturing, selling, trading, and transport) occurring intentionally or incidentally, without authorization from the USFWS. However, the MBTA does not offer legal protection to habitats used by migratory birds. While renewable energy offers opportunity to generate energy without carbon emissions, enhances reliability of the power grid, and can help with job creation through a growing industry, utility-scale solar facilities present a new and relatively unknown potential risk to wildlife (Lovich and Ennen 2011[1]). While the main concerns to wildlife are indirect impacts such as habitat loss and fragmentation, there also are potential direct impacts, including collisions with panels, fencing, gen-ties lines, and transmission lines, as well as other risks such as artificial light at night, evaporation ponds, and fencing (Kosciuch *et al*. 2020[2], Conkling *et al*. 2021[3]).

Figure 2. Bendire's Thrasher. Photo credit: John Diener

We anticipate a high degree of overlap between habitat and landscape requirements between sites suitable for utility-scale solar development and these two thrasher species (e.g.,

[1] Lovich, JE and JR Ennen. 2011. Bioscience 61:982-992
[2] Kosciuch, K, et al. 2020. PLoS ONE 15(4): e0232034
[3] Conkling, TJ et al. 2021. R.Soc. Open Sci. 9: 211558.

Figure 3. Example of LeConte's Thrasher habitat in Nevada with Atriplex, creosote, cholla, and yucca species.

flat, sparsely vegetated, and in areas of high solar resource) and/or loss of large swaths of occupied habitat will likely contribute to further population declines. The Desert Thrasher Working Group (DTWG) recommends the following proactive and voluntary measures to prevent further population declines, reduce the need to afford these species additional legal protections, and provide conservation benefit to these two species of conservation concern. These recommendations reflect our current level of knowledge; as information gaps are filled, these recommendations will be updated to reflect results of those studies.

These recommendations outline a process for determining the likelihood of Bendire's or LeConte's Thrasher (hereafter collectively referred to as "desert thrasher") occupancy through both desktop analysis and on-site surveys, measures to avoid and minimize impacts for occasions when development and thrasher occupancy may conflict, post-construction monitoring needs, and potential conservation opportunities to benefit desert thrashers.

Step 1: Preliminary Site Evaluation (Desktop Analysis)

A. Landscape level assessment.

1. Will the project occur within Bendire's Thrasher or LeConte's Thrasher range?
    a. Use eBird and/or standard range maps. Suggestions below:
        i. Bendire's Thrasher:
            a. Bendire's Thrasher eBird map
            b. Bendire's Thrasher range map
        ii. LeConte's Thrasher:
            a. LeConte's Thrasher eBird map
            b. LeConte's Thrasher range map
2. Will the project occur within suitable habitat for desert thrashers?

a. Slopes of less than 5–6%

    i. Thrashers occupy slopes of less than 6% for Bendire's Thrasher, and 5% for LeConte's Thrasher.

b. Desert, desert scrub, desert grassland, Joshua tree woodland, juniper savanna habitats.

Figure 4. Example of Bendire's Thrasher habitat in juniper savanna. Photo credit: Corrie Borgman

c. Vegetated desert washes or microphyll woodlands (e.g., "small-leaved", drought-deciduous desert trees and shrubs such as mesquite, palo verde (*Parkinsonia* spp.), desert ironwood (*Olneya tesota*), catclaw acacia (*Senegalia greggii*), and desert willow (*Chilopsis linearis*), among others.

3. If the answer is "yes" to 1, 2a, and 2b, desert thrashers are possible at the project site. Continue to B "Site Level Assessment".

4. If the answer is "no" to 1, 2a, or 2b, desert thrashers are unlikely at the project site. Continue to Step 3B: General minimization measures to benefit a broad suite of wildlife.

B. Site Level Assessment

1. Are either desert thrasher species documented to occur within 5 miles of the project area as shown from eBird, Rapid Avian Information Locator (RAIL), Natural Heritage databases, Avian Knowledge Network (AKN), or any other sources of local data?

    a. Justification: Desert thrashers are difficult to detect, and full distributions are incomplete. Additionally, populations are sometimes patchy in distribution, thus nearby positive survey detections may indicate a higher likelihood of desert thrashers occurring within similar/adjacent habitats.

    b. There may not be data available for the project area. Lack of positive known desert thrasher data within an area of suitable habitat should not be interpreted as absence of desert thrashers.

2. Is the proposed project area within an important hotspot or identified priority area for desert thrashers? [GIS Desert Thrasher Priority Areas]

3. These "Priority Areas" are geographic areas known to provide habitat for relatively high numbers of breeding Bendire's or LeConte's Thrashers based on various research activities and surveys (including DTWG plot-based surveys). These "Priority Areas" are meant to assist in project planning, and they are not a comprehensive representation of all areas important to desert thrashers.

4. Continue to next step: Site Characterization

C. Site Characterization

1. If the project is outside of either desert thrasher species' range or will occur outside of potentially suitable habitat types, i.e., if the answer was "no" to B1, there is likely a **low risk to desert thrashers.**

    a. Implement measures listed Step 3B: General minimization measures to benefit all species during construction and operation of the project.

2. If the project is planned within desert thrasher ranges and suitable habitat types, or if existing data show desert thrasher occurrence on or within 5 miles of the site (high likelihood of occupancy), there is likely a **moderate to high risk to desert thrashers**.

    a. Continue to D: Site Level Avoidance and Minimization Measures.

    b. Step 2: Field Surveys are recommended.

3. If the project is planned within an important hotspot for desert thrashers [GIS Desert Thrasher Priority Areas], the DTWG strongly recommends avoiding development within the area (e.g., overlap with Thrasher Priority Layer = **very high risk to desert thrashers**).

    a. Recommend constructing project outside of Desert Thrasher Priority Areas.

D. Site Level Avoidance and Minimization Measures

1. Minimize impacts to thrashers and other wildlife

a) Select sites for development that offer limited potential for wildlife use and/or sites that minimize conversion of native or intact habitats for solar development to reduce impacts to thrashers and other wildlife. Preferred sites for development with low risk to desert thrashers include:

    i. Previously disturbed or developed areas.

    ii. Areas of low plant diversity, such as homogeneous woody cover dominated by single-aged, low-stature creosote (*Larrea tridentata*) or mesquite (*Neltuma* spp., formerly *Prosopis*), or areas dominated by invasive grasses with little woody vegetation structure.

2. Avoid desert washes and ecotones

a) **Avoid development in and around vegetated desert washes of all sizes.** Desert thrasher territories are often associated with vegetated desert washes, which are also biodiversity hotspots. Avoiding these features will provide conservation benefit to desert thrashers as well as numerous other species.

Figure 5. Example of vegetation within a desert wash. Photo credit: Jennifer Tobin

b. **Retain vegetation and avoid construction in areas of at least 200' (~60 m) on sides of washes, and ¼ mile (~400 m) from riparian washes.** These distances are consistent with the Desert Renewable Energy Conservation Plan.

c. **Retain microphyll woodlands.** These desert-wash woodlands are often, but not always, associated with washes. Associated species include "small-leaved", drought-deciduous desert trees and shrubs such as mesquite, palo verde, desert ironwood, catclaw acacia, and desert willow, among others.

d. Avoid fencing across washes.

Step 2: Field Surveys

A. Desert Thrasher Surveys. In project areas identified as moderate to very high risk to desert thrashers, surveys can be conducted at a site level to gather specific information about desert thrasher occupancy and abundance to further evaluate risk and inform micro-siting decisions, which will assist with proper avoidance and minimization measures to the greatest extent practicable. Occupancy and abundance data from surveys will identify key areas for avoidance and will factor into the amount and location of habitat that should be retained to avoid and minimize impacts to desert thrashers (see Step 3, C).

1. Follow survey protocol developed by the DTWG; the DTWG Clearance Survey Protocol, which provides:

    a. Rapid assessment methodology to determine desert thrasher occupancy.

b. An outline of important considerations such as timing, number of visits, and audio playback.

c. Clearance Survey Protocol

2. Use results from field surveys to evaluate risk and inform micro-site decisions.

a. NOTE: if surveys determine presence of desert thrashers, and/or if the site includes important desert thrasher habitat features, or it occurs within a desert thrasher priority area, and there is minimal potential for implementing avoidance and minimization measures described below, we recommend that the solar facility site be relocated.

b. Avoid disruption of habitats occupied by desert thrashers to the extent practicable.

c. Retain patches of unoccupied habitat (when applicable) that connect patches of occupied habitat.

3. If desktop analyses or field surveys indicate presence of desert thrashers within the project area, OR within 5 miles of project area AND potential desert thrasher habitat is present, continue to Avoidance and Minimization Measures in Step 3.

a. If unable to conduct desert thrasher surveys within areas of moderate to very high risk (See Site Characterization, C), proceeding with avoidance and minimization measures described in Step 3 is recommended, and desert thrasher occupancy should be assumed. In occupied areas, field surveys are very beneficial to identify specific areas for avoidance.

Step 3: Project Design and Construction Avoidance and Minimization Measures

If Steps 1 and 2 show occupied habitat, overlap with important desert thrasher areas, or a high likelihood of occupancy (e.g., known desert thrasher occurrence within 5 miles and appropriate habitat present), we recommend implementing additional avoidance and minimization measures as described below. We list avoidance and minimization measures first that predominantly apply to desert thrashers in section 3A, though these should provide benefit to numerous other species such as other avian species, mammals such as kit fox, and desert tortoises. However, these recommendations do not supersede any federal or state established practices for the conservation of listed species. General avoidance and minimization measures that are designed to benefit all species are included in section 3B.

3A: Measures to Minimize Impacts to Desert Thrashers

A. Avoid development in swaths of habitat where important plant associations (below) for desert thrashers occur. These plant species are of particular importance when co-occurring with one another or when occurring adjacent to desert washes of any size, including:

1. Areas of high plant diversity, especially when including species described below in 1a – 4, other potential nest shrubs > 1 m, fruit-bearing shrubs, and areas of high heterogeneity.

a. Important species include: Mesquite spp., palo verde, desert ironwood, catclaw acacia, desert willow, box-thorns (*Lycium* spp.), *Rhus* spp.

2. Saltbush species (*Atriplex canescens*) and (*A. polycarpa*) > 1 m tall.

3. *Yucca* species > 1.5 m tall or with multiple branches. This includes all *Yucca* spp., but particularly Joshua tree (*Y. brevifolia*), Mojave yucca (*Y. shidigera*), and soaptree yucca (*Y. elata*).

4. Large cholla, especially silver cholla (*Cylindropuntia echinocarpa*), and buckhorn cholla (*C. Acanthocarpa*) > 1 m.

Figure 6. Example of a LeConte's Thrasher nest site in a cholla. Photo credit: Great Basin Bird Observatory.

B. Retain adequately sized, connected patches of habitat within or adjacent to the project footprint.

1. In areas occupied by LeConte's thrashers, retain patches of at least 20 acres. Average LeConte's Thrasher territory size is 7.5 ha (18.5 ac), but this species may require large swaths of unbroken habitat for occupancy.

2. In areas occupied by Bendire's thrashers, retain patches of at least 5 acres. Average territory size for Bendire's Thrasher is 1.7 ha (4.2 ac) but has not been measured across the range.

3. Leave corridors to connect patches of retained habitat. Connecting habitat should be at least 100 m wide. Connecting habitat should not cross features that could be significant sources of mortality, such as major roadways.

3B. General Measures to Minimize Impacts

A. Follow basic beneficial management practices during site preparation and construction.

1. Follow conservation measures outlined by the USFWS for project development to reduce impacts to birds and their habitats:

2. Follow guidelines outlined by APLIC for Avian Protection Plans

3. Follow other solar recommendations prepared by local, state, or federal agencies.

B. Implement timing restrictions to avoid loss of active nests and individuals during construction. This applies to all avian species protected under MBTA.

1. Avoid construction during bird breeding season, which varies per region, but is generally encompassed by the timeframe of January 1–August 30.

    a. Nests of all species protected under MBTA should be considered, but the following dates are provided for awareness of desert thrasher breeding periods (Table 1).

2. For other species aside from Desert Thrashers, it may be appropriate to prepare a Nesting Bird Management Plan that outlines the pre-construction process to locate and monitor active nests and establish appropriate buffers around nests until nests are no longer active. Management plans should be developed in coordination with or reviewed by state wildlife agencies and/or a USFWS Migratory Bird Office.

Table 1. Breeding dates for Bendire's and LeConte's thrashers, and general dates for all migratory birds by state and subregion. States or regions indicated by an asterisk only have presence of Bendire's Thrashers.

Location	**Subregion**	**Bendire's/LeConte's Thrasher Breeding Timeframe**
Arizona	Lower desert < 549 m	15 January – 30 April
Arizona	Upper desert > 550 m	15 March – 30 June
Arizona*	Southeastern grasslands, Colorado Plateau juniper-savanna	1 June – 15 August
California	Southern California	15 January – 30 April
New Mexico*	Chihuahuan desert/Madrean archipelago	1 March to 30 May
New Mexico*	Colorado Plateau/ juniper-savanna	15 April – 30 June
Nevada	South of Las Vegas	15 February – 30 June
Nevada	North of Las Vegas	15 March – 30 June
Utah*	All	15 March – 30 June
Baja California and Sonora	Lower desert < 549 m	1 January – 15 May
Sonora	Upper desert > 550 m	15 February – 15 May

C. Desert thrashers spend significant time foraging on the ground, often make low flights, and utilize arroyos for flight paths. Design features that minimize collision, entrapment, and predation risk to thrashers will also benefit other birds, mammals, and herps.

1. Avoid fencing across washes.
2. Avoid using guyed towers.
3. Use line markers for gen-tie lines or other infrastructure and fence markers on fencing.
4. Minimize gen-tie line distances, less than 2 miles is recommended, but the shorter the better.
5. Collocate gen-tie lines with existing infrastructure.
6. Bury or install collector lines under PV panels.

D. Minimize security fencing to decrease risk of collision and entrapment for desert thrashers and other wildlife.

1. We recommend fencing the project perimeter only, rather than fencing individual development sections.
2. Limit road construction to within the perimeter fence to reduce impacts to vegetation outside the project perimeter.
3. Implement wildlife permeable fencing practices, such as raising fences by 8 inches, creating access via wildlife access gaps, or using wider-spaced chain link to allow for wildlife access without the use of fence gaps (see Making Solar Wildlife-Friendly | The Nature Conservancy).

E. Use low impact construction methodologies to promote compatibility with continued wildlife use of the site. These best management practices provide benefit to thrashers and other wildlife by minimizing ground disturbance and compaction, promoting natural vegetation recovery, preventing spread of invasive annuals (weeds), retaining groundwater infiltration, and maintaining connectivity.

1. Minimize vegetation loss as much as possible through the following:
    a. Site projects in areas and use technology that would require grading in less than 20% of project's total development area.
        i. Limit grading, scraping, and leveling activities to designated main access roads, substations, operations and maintenance facilities, temporary laydown areas, and equipment pads.
    b. Avoid "Drive and Crush" and "Disc and Roll" or other similar techniques that remove all vegetation and compact soil.
    c. Retain native vegetation and associated root systems to the maximum extent possible. Allowing for vegetation that may provide foraging opportunities and cover

for desert thrashers and other wildlife will allow for smaller buffers of undisturbed habitat to be more effective.

d. Maintain 70% of the native vegetation cover in the solar array fields/blocks (refer to Gemini project in Nevada[4], which implemented many of these vegetation management techniques, or BLM SNDO Resources Integration Alternative[5]). We recommend "Overland Travel" as described within the BLM SNDO Rough Hat Clark Solar Project EIS[2] and select mowing/trimming in areas when absolutely necessary.

    i. Overland travel generally includes the use of rubber-tired or rubber-tracked vehicles instead of heavy equipment such as front-end loaders, that minimally compacts soils, leaves vegetation above-ground with the ability to recover and keeps the seedbank in place[2].

    ii. If native vegetation cover is lost during construction, each solar panel array block should be restored to 60–70% of pre-disturbance and/or reference site conditions with native vegetation as soon as construction is complete.

2. Minimize water use as much as possible by using low impact construction methodologies, such as "Overland Travel," to minimize vegetation loss and dust emissions, thus reducing the amount of water needed for dust control.

3. Develop a site Restoration Plan for recontouring and revegetating disturbed areas post-construction.

F. Develop and implement a robust and adaptive weed management plan to ensure invasive plants are not spread.

1. Record the herbicide used on target species, as well as the timing and location of application to determine which invasive species present persistent issues on site. Avoid widespread herbicide application and use adaptive Integrated Pest Management methods to target returning plants.

2. Include a fire management and prevention plan. Fire management plans should specifically address the role of invasive annuals in elevating fire risk.

Step 4. Post-construction Monitoring

The impacts of habitat loss and degradation and potential sources and scale of infrastructure-related direct mortality are not well known. Monitoring can provide important data regarding the direct and indirect impacts of solar development, resulting in improved conservation measures for these species. The DTWG is available to provide advice on study design.

A. Post-construction monitoring:

1. To determine presence (pre- and post-construction occupancy surveys)

[4] Gemini Solar Project Plan of Development, https://eplanning.blm.gov/public_projects/nepa/100498/173998/211417/Gemini_Revised_POD_.pdf

[5] Draft Environmental Impact Statement and Draft Resource Management Plan Amendment, Rough Hat Clark Solar Project, DOI-BLM-NV-S010-2022-0063-EIS. https://eplanning.blm.gov/eplanning-ui/project/2019992/570

a. Use DTWG clearance survey protocol.

2. To determine use of adjacent habitats to developed areas, within "leave islands" of habitat, or in facilities with vegetation left on the ground.

3. To determine direct mortality:

    a. Methods should explicitly address measures of searcher efficiency and carcass persistence.

    b. Surveys should cover at least 30% of the project area and include searches of gen-tie lines and fencing.

    c. Monitoring should be conducted during all seasons, with specific attention to migratory time frames (spring and fall).

Step 5. Conservation Opportunities

If the project is constructed within areas recommended for avoidance, consider providing voluntary mitigations to increase understanding of desert thrashers, benefit desert thrashers, and maintain their populations. The following are potential projects or research that could benefit desert thrashers and serve as voluntary mitigations. The DTWG can provide input to interested parties on priority research needs, methods, potential sites, or other information.

1. Restore abandoned farmland or other potential habitat.

2. Establish land use protections in important use areas (e.g., land purchase, conservation easements).

3. Contribute to addressing desert thrasher research needs that can help refine Beneficial Management Practices:

    a. These include topics such as determining pre- and post-construction occupancy, survival, and productivity, use of habitats adjacent to developed sites, studies to determine efficacy and methods for habitat restoration, and evaluation of buffer sizes and retained habitat patch sizes, among others. The Desert Thrasher Working Group can provide advice on current science needs and suggested methodology.

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