# Literature review on impacts to avian species from solar energy collection and suggested mitigations

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## INTRODUCTION

Renewable energy development is increasing in the United States (US). It has increased more than 50% since 2004 and the greatest solar resource potential in the US occurs in six states in the southwest (Walston Jr. et al. 2016). There are two basic types of solar technology currently available, photovoltaic (PV) and concentrated solar power (CSP). Facilities using PV generally are groups of solar collecting panels that convert the solar energy into electricity. An example of CSP would be the Ivanpah Solar Electric Generating Station in California. There they use mirrors to concentrate solar rays (heat) onto a central collector. Risks to birds from the two types of solar energy collection vary. At LANL, only the PV method is being considered.

## POTENTIAL IMPACTS FROM PV TO AVIAN SPECIES AT LANL

Songbirds have been in decline for decades and it's well accepted that habitat loss is the primary driver for these declines. Early research by Rappole (1996) started pointing at habitat loss and hundreds of papers in the scientific literature since then have confirmed this. Habitat loss is not just the removal of habitat, but includes edge effects and habitat isolation which both contribute to habitat fragmentation. Locally, this problem is being exacerbated by the effects of warming temperatures and increased climate variability and devastating wildfires. Habitat loss is an indirect cause for avian mortality. There are many anthropogenic stressors that lead to direct avian mortality. Loss et al. (2015) have determined that billions of birds per year are killed in the US from anthropogenic sources.

The primary impact on birds from developing PV facilities at LANL is from the land conversion and loss of habitat for breeding birds. Due to recent wildfires, most of the primary forests left on the eastern slopes of the Jemez are on LANL property and neotropical migrant birds flock to these areas each spring to breed. LANL is home to federally-listed birds such as the Mexican Spotted Owl and Southwestern Willow Flycatcher (LANL 2015) and is home to several sensitive avian species that may be federally-listed in the future (USFWS 2008).

Avian interactions with PV facilities themselves are not well understood. The primary threats are from collisions with PV equipment and transmission lines and electrocutions from the substation and distribution lines. Collisions from PV systems can include direct collisions into guy wires or transmission lines. Other collisions are less understood such as the "lake effect" theory. First described in Horvath et al. (2009) as polarized light pollution (PLP). PLP refers predominantly to highly and horizontally polarized

light reflected from artificial surfaces, which alters the naturally occurring patterns of polarized light experienced by organisms in ecosystems. Utility-scale PV facilities may attract migrating waterfowl and shorebirds through the "lake effect", whereby migrating birds perceive the reflective surfaces of PV panels as bodies of water and collide with the structures as they attempt to land on the panels. There are many anecdotal events, but to date no empirical research has been conducted to evaluate the attraction of PV facilities to migrating waterfowl or songbirds. Water seeking insects also can be attracted to PV panels which may have an effect on food webs.

# POTENTIAL IMPACTS FROM ADDITIONAL POWER TRANSMISSION AND DISTRIBUTION LINES

The primary threats from the movement of electricity comes from collisions and electrocution of birds on power equipment. The Avian Power Line Interaction Committee (APLIC) is an organization in the US that serves as a focal point for avian interaction issues as they pertain to utilities. Current membership is greater than 50 utilities across the US. They have developed two books to address threats from utilities including *Suggested Practices for Avian Protection on Powerlines: The State of the Art in 2006* (2006) and *Reducing Avian Collisions with Powerlines: The State of the Art in 2012* (2012). Biologists at LANL are certified in APLIC standards and just received new training in February of 2016. Avian mortality from electrocution is not permitted under the Migratory Bird Treaty Act (MBTA). This law is a strict liability law and violations are a risk to the institution. Biologists work with LANL utilities to retrofit problem poles and self-report electrocutions to U.S. Fish and Wildlife Service (USFWS) special agents to avoid enforcement actions. It would greatly benefit LANL and reduce risk to the institution if a formal Avian Protection Plan (APP) was developed and accepted between the Department of Energy (DOE) and the USFWS. In Loss et al. (2015), annual migratory bird mortality in the US from power line collisions and electrocutions is estimated to be 22.8 million and 5.6 million birds.

# CONCLUSIONS

The scientific literature is growing with regards to avian impacts from solar facilities (Horvath et al. 2009, Loss et al. 2015, Smith and Dwyer 2016, Grippo et al. 2015, and Walston Jr. et al. 2016), but more research is needed. In the *Multiagency Avian-Solar Science Coordination Plan* (MASCWG 2016), which was prepared by various federal and state agencies including DOE, identified information and data needs regarding avian impacts from solar. Several of these data gaps could be studied at LANL as part of the overall solar program. Other DOE facilities have also weighed in on the existing knowledge and possible mitigations for utility-scale solar facilities (DOE 2015) and also suggested monitoring designs for avian mortality (Huso et al. 2016).

## Suggested Mitigations

- During site selection, brownfield sites or canopies over parking lots should be prioritized over previously disturbed sites.
- For land conversions in forested habitats for solar facilities, an equal amount of land should be rehabilitated or enhanced elsewhere at LANL to offset the loss of habitat. This would be coordinated by staff biologists to direct efforts to areas of the greatest need at LANL.

- Long-term avian demographics studies should be initiated in the habitat surrounding the current and future sites selected for use.
- All PV sites must work with staff biologists to develop weekly or twice-weekly avian mortality surveys.
- All PV sites must be fenced to keep large ungulates and carnivores out of the area. This will reduce wildlife damage to facilities and will aid in avian mortality surveys.
- The DOE Field Office should direct LANS to develop an APP in coordination with the USFWS and APLIC. This plan would facilitate a formal procedure for interactions between LANL Utilities and Environmental Protection and Compliance staff as well as interactions between the DOE and USFWS regarding electrocuted birds.

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