Solar Studies Resource Library

Study Title	Author(s)	Topic Area	Short Description	Key Findings
A Mosaic of Microclimates: Biodiversity Outcomes and Wildlife Habitat Potential in Large-Scale Solar Facilities	Tom Armstrong; Caleb L. Loughran; Joshua R. Ennen; Kristoffer H. Wild; Eric J. Nordberg	**Heat Effects**	Reviews how utility-scale solar facilities alter microclimates.	The study examined 33 peer-reviewed publications dealing with microclimates in large-scale solar facilities. Among the studies that measured air temperature: • 42.9% found no significant difference; • 35.7% found warming; • 14.3% found cooling; • one study reported mixed effects. For the smaller subset measuring land-surface temperature, all four studies found lower LST within solar farms relative to comparison areas.
How Utility-Scale Photovoltaic Configuration Reshapes Coupled Atmospheric-Soil Microclimate: A Global Multivariate Meta-Analysis	Xinyi Tang; Xudong Li; Qing Yang	**Heat Effects**	Global meta-analysis evaluating how solar project design affects air temperature, soil temperature, and soil moisture.	This analysis covered 457 observations from 61 publications. It found that, across the literature, utility-scale PV deployment generally: • decreased air temperature by about 1.5% in the meta-analytic response metric; • decreased soil temperature by about 10%; • increased soil moisture by about 26%.
Ground-Mounted Photovoltaic Solar Parks Promote Land Surface Cool Islands in Arid Ecosystems	Li Guoqing; Rebecca R. Hernandez; George Alan Blackburn; Gemma Davies; Merryn Hunt; James Duncan Whyatt; Alona Armstrong	**Heat Effects**	Demonstrates that solar facilities can create localized land-surface cooling effects extending beyond project boundaries.	The researchers studied two large solar parks in arid regions: the 850-MW Longyangxia park in China and the 300-MW Stateline park in California. They used satellite images to compare land-surface temperatures before and after the parks were built, and they also took measurements on the ground. Solar farms created a “cool island.” The land around the solar parks was cooler than comparable land farther away.
Gemini Solar Project Information Brief	U.S. Geological Survey Southwest Biological Science Center; Bureau of Land Management Southern Nevada District Office	**Heat Effects**	Summarizes monitoring results related to vegetation, soils, microclimate, and species conservation at the Gemini Solar Project in southern Nevada.	The Gemini facility moderates soil moisture and soil surface temperatures compared to controls, cooling on average (-0.32 °C) areas under panels in the warm season, and warming, on average (+1.31°C), areas under panels in the cool season. Wind erosion did not significantly increase at Gemini compared to control areas.
Response to Technical Queries Associated with Permit No. 2017-301:	Greg A. Barron-Gafford, Ph.D.	**Heat Effects**	Expert testimony addressing his 2016 study on photovoltaic heat island effects published in	Dr. Barron-Gafford asserted in this testimony that his 2016 study published in Nature found that the air temperature over a photovoltaic solar facility was

Statement of Evidence on Solar Heat Islanding Issues			Nature.	indistinguishable from air temperatures over native vegetation when measured at a distance of 30 meters from the edge of the PV array. This pattern held true for both daytime and nighttime conditions. Because the PV panels themselves trap the energy from diffuse sunlight that was able to reach the ground underneath them, air temperatures remain elevated within a PV array. As you leave this "overstory" of PV panels, energy is able to radiate back towards the atmosphere, as it does in a natural setting, and the heat quickly dissipates.
Shedding Light on Large-Scale Solar Impacts: An Analysis of Property Values and Proximity to Photovoltaics Across Six U.S. States	Salma Elmallah; Ben Hoen; K. Sydny Fujita; Dana Robson; Eric Brunner	**Property Values**	Examines how proximity to utility-scale solar projects may affect residential property values across six U.S. states.	This 2022 study of several states found no statistically significant effect on home sale prices beyond 1 mile from a large-scale photovoltaic solar project.
Property Value Impacts of Commercial-Scale Solar Energy in Massachusetts and Rhode Island	Vasundhara Gaur; Corey Lang	**Property Values**	Evaluates residential property value impacts associated with commercial-scale solar development in New England.	This 2020 study of solar facilities in Massachusetts and Rhode Island found that property values in rural areas did not decline due to proximity to a large-scale solar facility.
Lake Effect or Data Mirage? How Accounting for Technology Differences at Utility Scale Solar Energy Facilities Can Change Data Interpretation	Karl Kosciuch; Daniel Riser-Espinoza; Marisa Mitchell	**"Lake Effect"**	Reviews bird mortality research at solar facilities and reevaluates evidence behind the solar "lake effect" hypothesis.	Kosciuch and his team found that a dataset from just a single early-generation, fixed-tilt PV facility (built before the widespread commercial use of anti-reflective coatings) was reused across eight different summary papers and cited by 14 out of 16 papers discussing aquatic bird mortality. When the researchers separated data from older, fixed-tilt panel installations from modern single-axis tracker panel facilities, evidence supporting broad avian attraction to solar arrays as faux-lakes largely vanished. Broad assumptions about aquatic bird fatalities derived from early solar sites do not accurately reflect modern utility-scale solar energy (USSE) technologies.