Solar Deployment – Rising Expectations

Preliminary modeling shows that decarbonizing the entire U.S. energy system could result in as much as $3,200 \text{ GW}_{ac}$ of solar energy.

Solar Futures Study, DOE SETO 2021

Concretely, this would require the deployment of roughly 2,500 gigawatts (GW) of wind and solar generation (30 times present capacity) in a high renewables scenario.

Williams et al. 2014
• How does site management and materials impact bifacial PV performance?
• How does site management and materials impact bifacial PV temperature and albedo?
• How sustainable are such materials?
Sixth Mass Extinction – Meet 30 x 30 Vision

brided white-eye, ivory-billed woodpecker, Bachman’s warbler

On September 29th 2021, the U.S. Fish and Wildlife Service declared 23 species (see slide), including nine birds and one bat species, officially extinct.

Currently, only 12% of US land, 11% of freshwaters, and 26% of oceans have some degree of conservation-based protection.

little Mariana fruit bat

October 12, 2021
Board Strategic Development Committee and Special SMUD Board of Directors Meeting

Public comment may be submitted via e-mail to PublicComment@smud.org.
Energy development is now the largest driver of land-use and land-cover change in United States (Trainor et al. 2016, *PLOS One*).
How will we meet our rapid renewable energy goals while maintaining our need for food production and conservation?
Ecological Restoration for Techno-Ecological Synergies of Solar Energy: Promoting Vegetation, Pollinators, Soil Quality, and Ecosystem Services

Study Site: The Sacramento Municipal Utility District’s Rancho Seco II ground-mounted solar PV site.

Ecological restoration at solar energy facilities may serve as a mechanism to increase techno-ecological synergies of solar energy development, yet both the practical implementation and potential benefits of restoration is understudied.
Vegetation in the Central Valley of California was historically characterized as a flower-dominated prairie biome.

When naturalists descended into the Central Valley in 1868 and found a sea of flowers, one wrote, “Here it is not as in our great western prairie, flowers sprinkled in grass, but grass in the flowers.”

Native California grasslands, with fibrous root systems, are a more resilient C sink than California forests in response to 21st century changes in climate (Dass et al. 2018).
Objectives

1. Native plant mix selection and re-establishment, across PV array areas (with assessment of PV performance) and as hedgerows

2. Plant and pollinator habitat assessment, with biodiversity and trait analyses

3. Soil properties characterization, including of soil carbon sequestration; crevice restoration options for California tiger salamanders

4. Techno-ecological synergy analysis, including impacts on PV performance and cultural services owing to the beautification of an energy landscape
Ground-mounted photovoltaic solar energy installations create novel microsites. Restoration across microsites may uniquely impact PV performance, plant establishment, pollinator behavior, and amphibian settlement activities.
Soils, Sequestration, and Salamanders

i. Does ecological restoration in a Central Valley PV solar energy facility improve soil carbon sequestration (e.g., owing to fine root production and melanization) and other indicators of soil quality?

ii. What impact does conventional site preparation and ecological restoration have on crevices and burrows of the Central Valley California tiger salamander and can this inform habitat restoration for this threatened species?

iii. What are the perceptions and values of tribal members and tribal-stakeholders towards ecosystem service restoration in a California prairie?

California ground squirrel (Otospermophilus beecheyi) or other mammalian-formed burrow at Rancho Seco that California tiger salamanders (Ambystoma californiense) may settle in.

Public comment may be submitted via e-mail to PublicComment@smud.org.
Cultural Services

We will conduct a survey to understand and quantify the role and importance of such restoration efforts on landscape-level aesthetics (i.e., “beautification”), customer satisfaction, corporate responsibility, and the extent to which it serves as a cultural ecosystem service.

Cultural ecosystem services are identified as ecosystems providing recreation, aesthetic enjoyment, physical and mental health benefits, and spiritual experiences.
Stacking Energy Systems & Ecosystems Outcomes

Over the course of *four years* we anticipate the following outcomes:

1) Practical, science-informed guidance on the stacking of ecosystem restoration and PV solar energy development, emphasizing impacts on PV performance;

2) High impact scientific research outcomes on PV-restoration interactions, including industry- and policy-relevant knowledge (e.g., native vegetation selection, soil carbon sequestration, listed species implications, tribal engagement) for PV development in the Central Valley of California and beyond;

3) Broad-scale quantification of techno-ecological synergies of ecological restoration at solar facilities, and;

4) Educational opportunities, outreach activities, and job training.