PHOTOVOLTAICS SUPPORTING CULTURAL AND COMMUNITY ECOSYSTEM SERVICES (PV-SUCCESS)

ASSESSMENT OF ECOSYSTEM SERVICE TOOLS

Solar energy development has met opposition in local and state permitting processes due to community concerns about impacts on natural and cultural resources, agriculture, and rural character. Decision-makers often lack tools to address these concerns, and developers may use mitigation strategies that are not well-suited to solar projects. However, research shows that solar sites can provide ecosystem services such as habitat creation, water quality improvements, and carbon sequestration, which can help mitigate community concerns.

Monarch Joint Venture

The PV-SuCCESS project aims to develop a decision-making framework that integrates ecosystem services into solar project planning through field research, modeling, and community engagement. This document provides an overview of existing tools and frameworks for assessing ecosystem services and their trade-offs in solar development. By aligning science-based best practices with regulatory and development processes, stakeholders can proactively enhance the environmental and social benefits of solar energy projects.

NREL InSPIRE

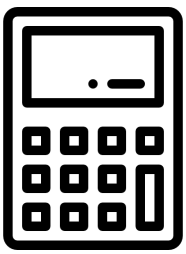
Biophysical Services
E.g., Healthy soil, clean water, habitats and biodiversity, carbon sequestration

Sociocultural Services
E.g., Recreation, cultural and spiritual values, aesthetics, agricultural identity

How do existing tools and frameworks address these values?

Currently available tools and frameworks have variable goals, intended scales of application, and approaches to quantifying services, but many fit within one of the following general categories.

Calculation and Models

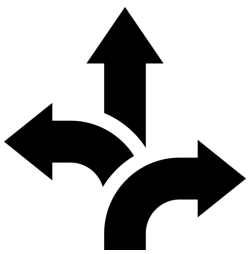


- Focused on specific biophysical processes (e.g., hydrology)
- Rely on site-relevant data or models

Landscape Analysis

- Most relevant for solar siting decisions
- Do not usually incorporate site-level management choices

Decision Support



- Helps navigate a decision-making process
- Based on values, priorities, and risk tolerances
- Often involves using other tools

OVERVIEW OF EXISTING ECOSYSTEM SERVICE TOOLS

While many tools exist, we focused on those that illustrate key variations in methodology and purpose, acknowledging that each was developed to address different decision-making needs and trade-offs.

GIS-Based Evaluations

- Uses GIS data to assess solar site suitability and potential impacts.
- Used for preliminary site assessments.
- Can incorporate community input to reflect local priorities.
- Compatible with InVEST and other modeling approaches.

Scorecard-Based Tools

- Provide qualitative or quantitative evaluations of solar site characteristics.
- Commonly used for pollinator-friendly solar programs with habitat criteria.
- NYSERDA's Smart Solar Siting Scorecard assesses broader environmental and social co-benefits.

InVEST

- Open-source tool modeling multiple ecosystem services, widely used.
- Spatially explicit, process-based models using GIS landscape data.
- Not solar-specific, but adaptable.
- Cultural service modules (e.g., scenic quality, recreation) have limited solar applications.

AFT Smart Solar

- Policy framework to balance solar development with farmland preservation.
- Provides qualitative, stakeholder-driven recommendations rather than quantitative assessments.
- Addresses soil health, water access, and cultural value of farmland.

PV-SMaRT

- Estimates stormwater runoff impacts of solar using site-specific parameters.
- Models developed from empirical research across U.S. solar facilities.
- PV-SMaRT is being integrated with Hydrus 3D for improved soil and water modeling.

SPIES

- Synthesizes literature on management practices and ecosystem service impacts.
- Focuses on site-level decisions
- Evidence quality and quantity varies and is mostly derived from non-solar contexts.

SYNTHESIS

- There is no one-size-fits-all approach to ecosystem service analysis.
- Ecosystem service evaluation tools for solar projects vary in precision, usability, and decision-making support.
- Scientific rigor differs across tools, with empirical models offering precision, and guidance tools focusing on broader applicability.
- Aligning tool characteristics with project needs and stakeholder priorities is critical for effective decision-making.

NEXT STEPS

- **Address Sociocultural Gaps.** Enhance tools to incorporate cultural ecosystem services, such as sense of place and identity, which are currently underrepresented.
- **Improve Stakeholder Engagement & Data Integration**. Strengthen community input mechanisms and refine indicators to connect biophysical and sociocultural considerations.
- **Develop a Solar Ecosystem Services Framework.** Build a conceptual framework to enable comprehensive, multi-criteria decision analysis using different tools.

This material is based upon work supported by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) under the Deploying Solar with Wildlife and Ecosystem Services Benefits funding program, award number DE-EE0010385. Learn more at: https://pv-success.betterenergy.org/.