C2C: Clean Energy *to* Communities
U.S. DEPARTMENT OF ENERGY

Expert Match

# Agrivoltaics Basics

This guide will offer an overview of potential agrivoltaic systems and configurations, including benefits and tradeoffs of implementation.

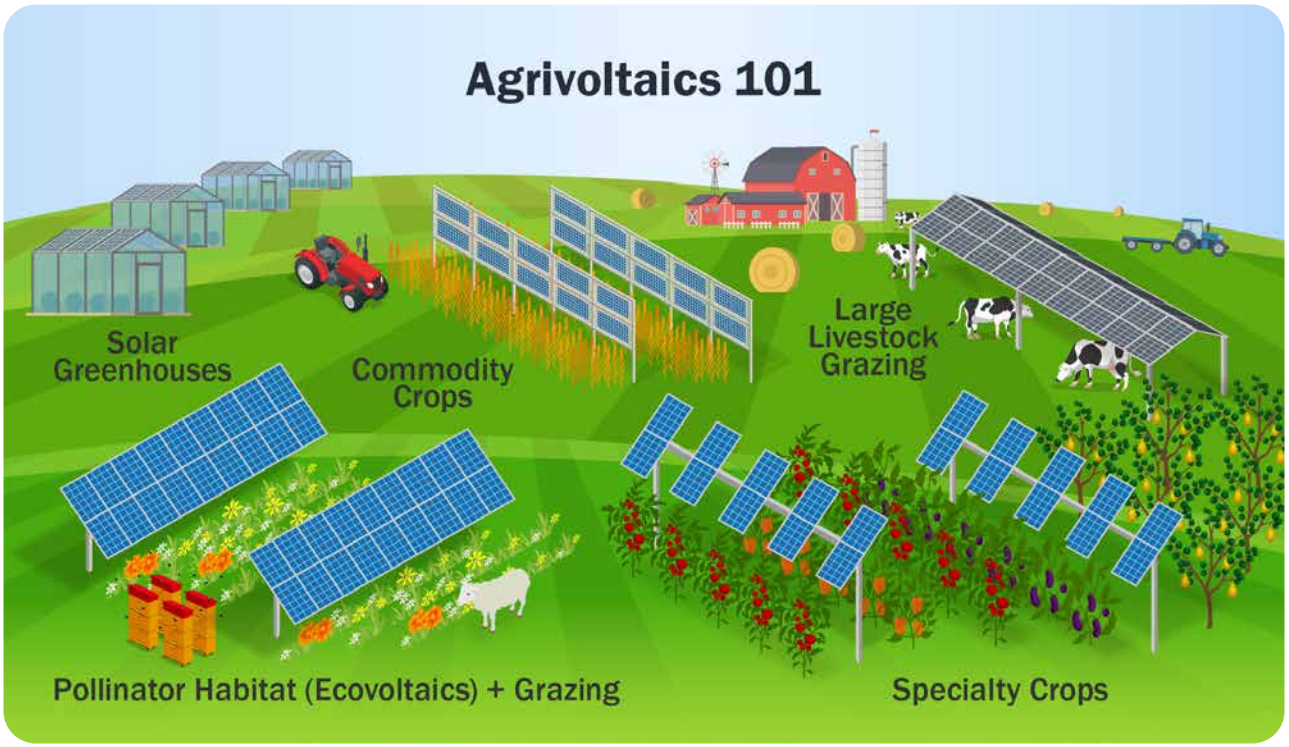



*Illustration by Tom Hickey and Al Hicks, NREL*

- Agrivoltaics is a configuration that allows for dual land use through the deployment of on-farm solar while maintaining agricultural production on the land underneath and/or in between the solar panels. **Agrivoltaic activities** can span **crop production and livestock production/grazing**. Similarly, **ecovoltaics** combines **pollinator habitat or native landscapes** with solar energy production to provide ecosystem services. Ecovoltaics can potentially be combined with agrivoltaic grazing.
- The concept of agrivoltaics was first proposed in Germany in the early 1980s to preserve farmland while deploying solar energy. Agrivoltaics is now deployed and studied across the globe, with sites on every continent besides Antarctica. In the United States, as of October 2024, there were **more than 580 agrivoltaic and ecovoltaic sites** (openei.org/wiki/InSPIRE/Agrivoltaics_Map), which spanned more than 62,000 acres and supported over 10,000 megawatts (MW) of solar power. The majority of sites supported grazing and pollinator habitat.
- Agrivoltaics can come in different forms: integrated in traditional ground-mounted photovoltaic (PV) designs or in alternative PV configurations that may include elevated panels or widely spaced rows. Certain livestock production (sheep, chickens, rabbit) and pollinator habitat establishment (ecovoltaics) are the easiest to integrate with traditional PV designs, while crop production and larger livestock production (e.g., cattle) often require alternative PV designs.

## Potential Benefits

- Decreased plant stress and increased yields for certain crops.
- Lower irrigation requirements in certain climates.
- Improved forage quality in grazing systems.
- Improved soil health and decreased land degradation.
- Improved biodiversity conservation.
- Increased crop marketabililty.
- Improved farmer and livestock health.
- Increased community acceptance of solar.
- Decreased vegetation management costs.

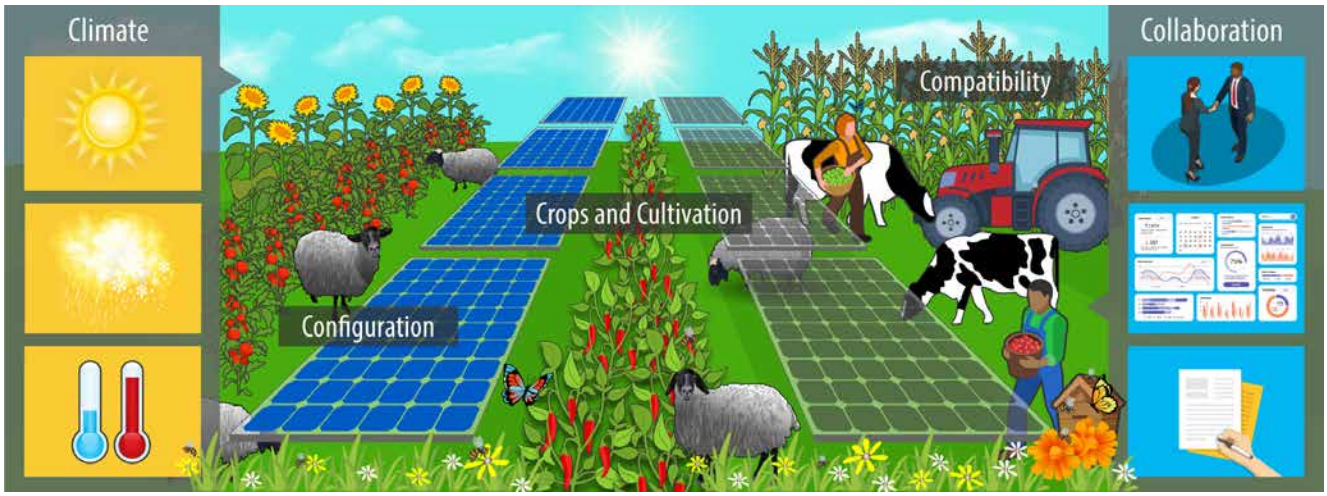
- Agrivoltaics can also include solar greenhouses, where farmers can use generated electricity to directly offset greenhouse energy loads, such as heating, cooling, ventilation, and lighting. Novel technologies, such as semi-transparent panels, can be used in solar greenhouses to allow more sunlight to filter through to the plants below (when compared to traditional solar panels).
- Urban agrivoltaics is an emerging field where rooftops and small, unused urban plots can be developed with agrivoltaic systems to increase food and energy security in urban environments.
- Agrivoltaic systems have potential agricultural, solar, and economic benefits and tradeoffs when compared to traditional agricultural systems. Benefits and tradeoffs can vary drastically based on project-specific designs, cropping or livestock systems, and local climate and soils.

## Potential Tradeoffs

- Decreased yields for certain crops.
- Decreased land-use for agricultural production.
- Decreased soil health or increased soil compaction.
- Delayed harvests.
- Uneven soil moisture distribution.
- Increased upfront investment costs.

**Learn more about agrivoltaics basics, case studies, and benefits and tradeoffs by visiting:**

- The National Renewable Energy Laboratory's **agrivoltaics research** (nrel.gov/solar/market-research-analysis/agrivoltaics.html) and **InSPIRE project** (openei.org/wiki/InSPIRE)
- InSPIRE's **5 Cs of Agrivoltaic Success report** (openei.org/wiki/InSPIRE/5_Cs) and **agrivoltaics map** (openei.org/wiki/InSPIRE/Agrivoltaics_Map)
- AgriSolar Clearinghouse's **case studies** (agrisolarclearinghouse.org/category/case-study)
- **American Solar Grazing Association** (solargrazing.org)
- American Farmland Trust's **Smart Solar Program** (farmland.org/solar)




The "Five Cs"—climate, configuration, crops and cultivation, compatibility, and collaboration—are key to ensuring an agrivoltaic project's long-term success. More information is available on the InSPIRE website: **openei.org/wiki/InSPIRE/5_Cs.** *Illustration by Al Hicks, NREL*

**For more information, visit:**
**openei.org/wiki/InSPIRE**

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