Matching Land Use to Light: Understanding Agrivoltaic Growing Intensities

As agrivoltaics expand across Hawai'i and beyond, a key question emerges: How do we match what we grow to the land and light available under solar panels? This is especially important in single-axis tracking systems, where panels rotate from east to west, casting shifting shade throughout the day.

Rather than seeing this variability as a limitation, producers can use it to their advantage—aligning crop types, livestock, and management strategies with microclimates and site conditions.

But growing under panels isn't just about shade. Topography, soil, and water access all matter:

- Rocky or sloped land may limit equipment use, making solar grazing with sheep a better fit.
- Flat, fertile areas with good access to irrigation can support diversified crops, planted to match light availability (e.g., sun-loving crops in the center, shade-tolerant ones beneath the panels).
- Mechanized monocropping may be ideal where access is easy and infrastructure is already in place.

Water availability is also key. Cropping systems need reliable irrigation, while grazing or rain-fed pastures may work in lower-rainfall zones.
The most successful agrivoltaic systems are site-responsive. Whether your goal is food, energy, or land stewardship, matching your strategy to the landscape helps maximize productivity.
This bulletin highlights three models—grazing, monocropping, and diversified cropping—each suited to different conditions and goals. With thoughtful planning, agrivoltaics can enhance resilience and yield while generating clean energy.

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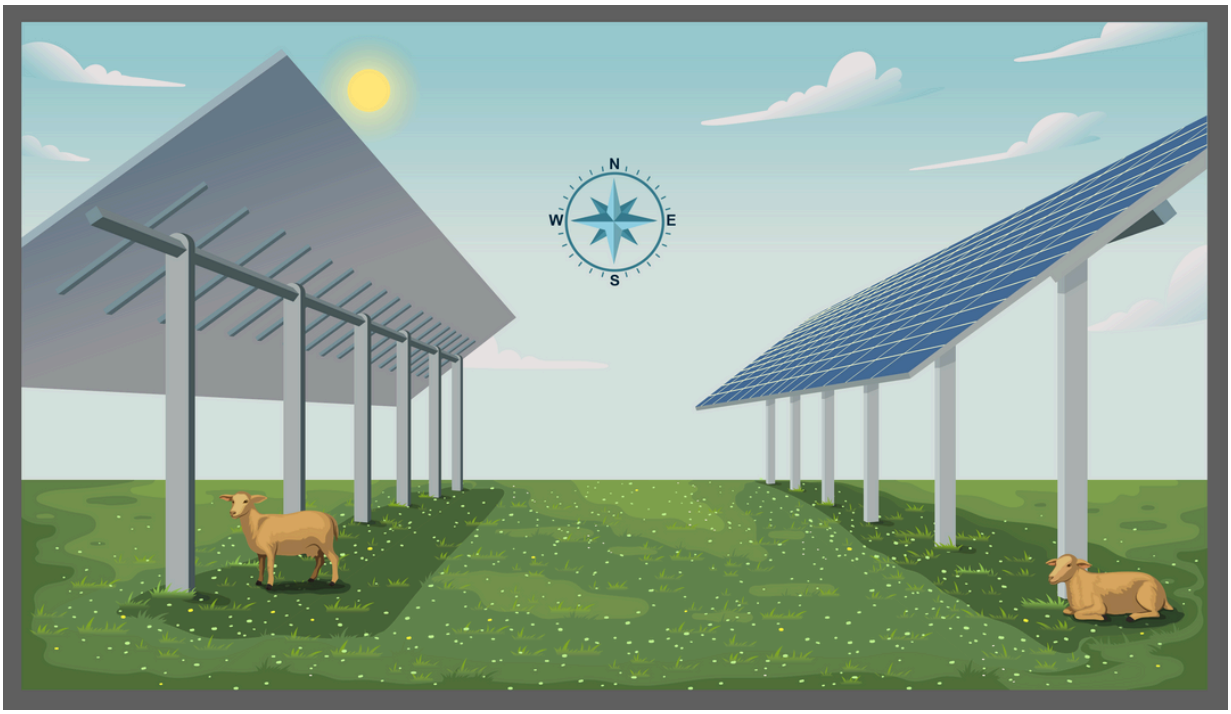
1. Low-Intensity: Solar Grazing



In low-intensity models, animals like sheep graze beneath and around solar panels, providing a practical, low-cost solution for vegetation management. These systems are especially useful where labor is limited, water is scarce, or the terrain makes cropping difficult.

- System type: Works with single-axis tracking, fixed-tilt, and even sloped installations—as long as panel height and spacing allow animal movement.
- Shade use: Passive; panels offer shelter from sun and rain, improving animal welfare.
- Management intensity: Minimal; grazing replaces mechanical mowing and reduces the need for herbicides.
- Site suitability: Ideal for rocky or uneven terrain, areas without irrigation infrastructure, or regions where access to machinery is limited.
- Benefits: Lowers operations costs, enables dual land use, supports local meat or fiber production, and helps maintain healthy perennial groundcover.

2. Moderate-Intensity: Mechanized Monocropping

This approach focuses on a single crop—like grains, legumes, or cover crops—managed with tractors or other conventional equipment. While it doesn't fully capitalize on the microclimate variability under panels, it prioritizes scale, simplicity, and mechanization.

- System type: Best suited for single-axis tracking or wide fixed-tilt arrays with adequate height and spacing for equipment access.
- Shade use: Partial; crops are selected to tolerate intermittent shading as panels track the sun.
- Management intensity: Moderate; efficient for large-scale planting and harvest with minimal labor.
- Site suitability: Works well in flat, accessible terrain with reliable irrigation or rainfall; less suited to rocky or steep areas.
- Benefits: Enables efficient, broadacre production in solar-integrated settings; ideal for cover cropping, rotational grains, or feed crops in dual-use systems.

3. High-Intensity: Diversified Mixed Cropping

High-intensity systems take full advantage of the shade gradient created by tracking panels, placing different crops in zones that match their light and water needs. This design maximizes land productivity and is well-suited for high-value specialty crops.

- System type: Optimized for single-axis tracking, especially with east-west row orientation, but adaptable to other layouts with predictable shading.
- Shade use: Fully utilized; crop selection is zoned—shade-tolerant crops (e.g., mamaki, mushrooms) directly beneath panels, leafy greens on the edges, sun-loving crops (e.g., tomatoes, peppers) in the center.
- Management intensity: High; requires detailed planning, crop rotation, and irrigation design.
- Site suitability: Best for flat to gently sloped land with good water access and sufficient labor or management capacity.
- Benefits: Supports year-round productivity, diversification, and market resilience—ideal for farmers pursuing food system innovation, education, or value-added products.