

AGRIVOLTAICS 101

THURSDAY, FEBRUARY 6, 2025 • 7:45 AM - 8:15 AM



Dorthy Lsoto
RENEW Wisconsin



Nolan Stumpf
OneEnergy



Sarah Glover
OneEnergy



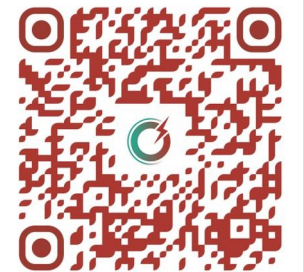
Josh Arnold
*University of Wisconsin-
Madison*



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Agrivoltaics 101

Dorothy Lsoto (Energy Analysis and Policy Intern)

Defining Agrivoltaics

Cannon Valley Graziers



Jack's Solar Garden



Stockton Solar (OneEnergy)

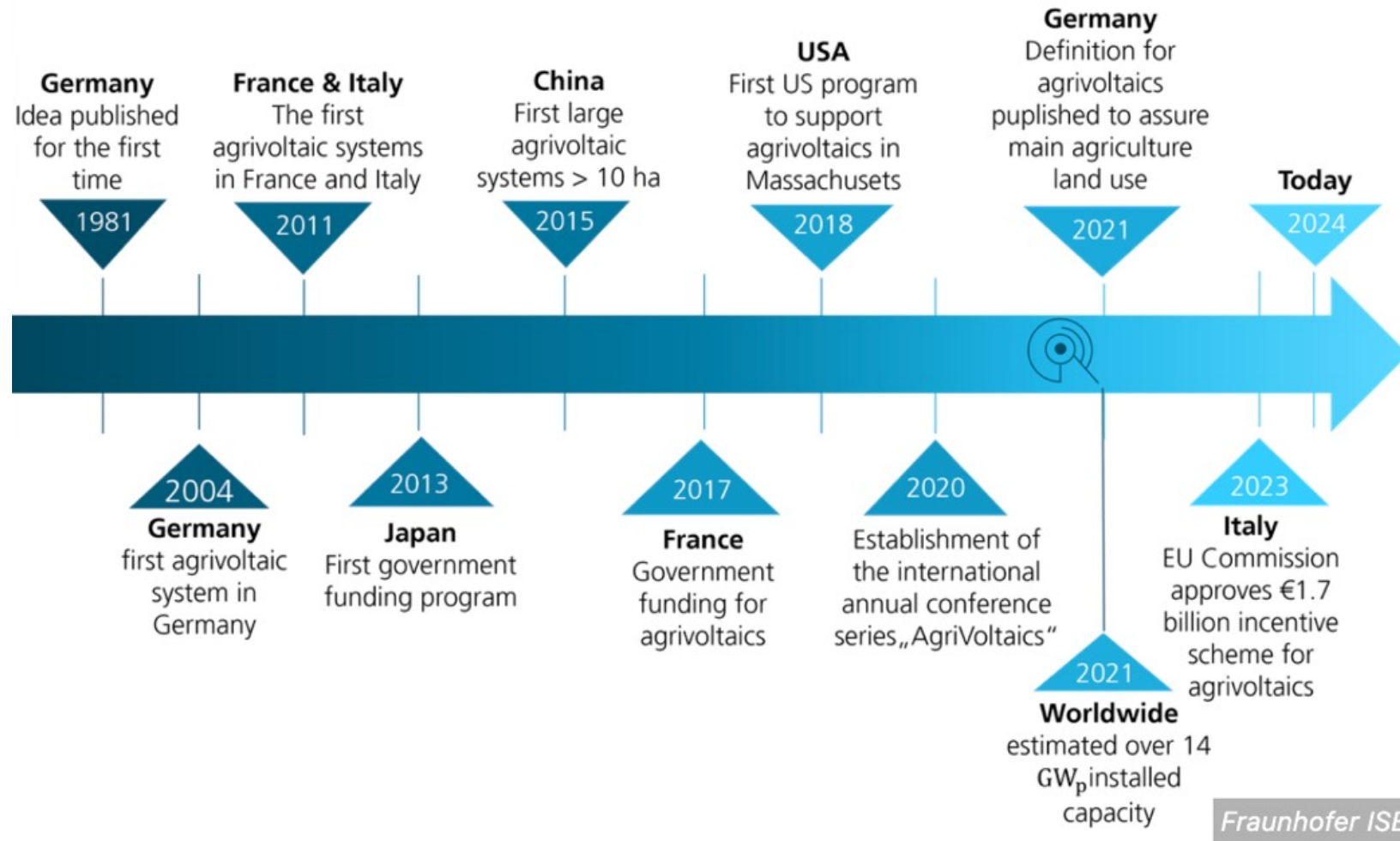


Webster Creek Solar (OneEnergy)



University of Minnesota - Morris

Research and Development



Source: Fraunhofer ISE

Agrivoltaics in Africa (2010-2020)



Renewable and Sustainable Energy Reviews

Volume 208, February 2025, 115066



Harvesting the sun twice: Energy, food and water benefits from agrivoltaics in East Africa

R.J. Randle-Boggis ^{a,1} ✉, G.A. Barron-Gafford ^b, A.A. Kimaro ^c, C. Lamanna ^d,
C. Macharia ^e, J. Maro ^f, A. Mbele ^f, S.E. Hartley ^a

Agrivoltaic systems contribute to energy security, food production, and water conservation in East Africa

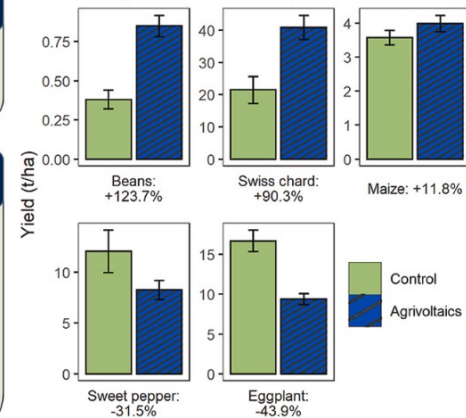
Two agrivoltaic pilots: Tanzania and Kenya

Crop yield/value, irrigation, energy and environmental data collected from two agrivoltaic systems over two years.

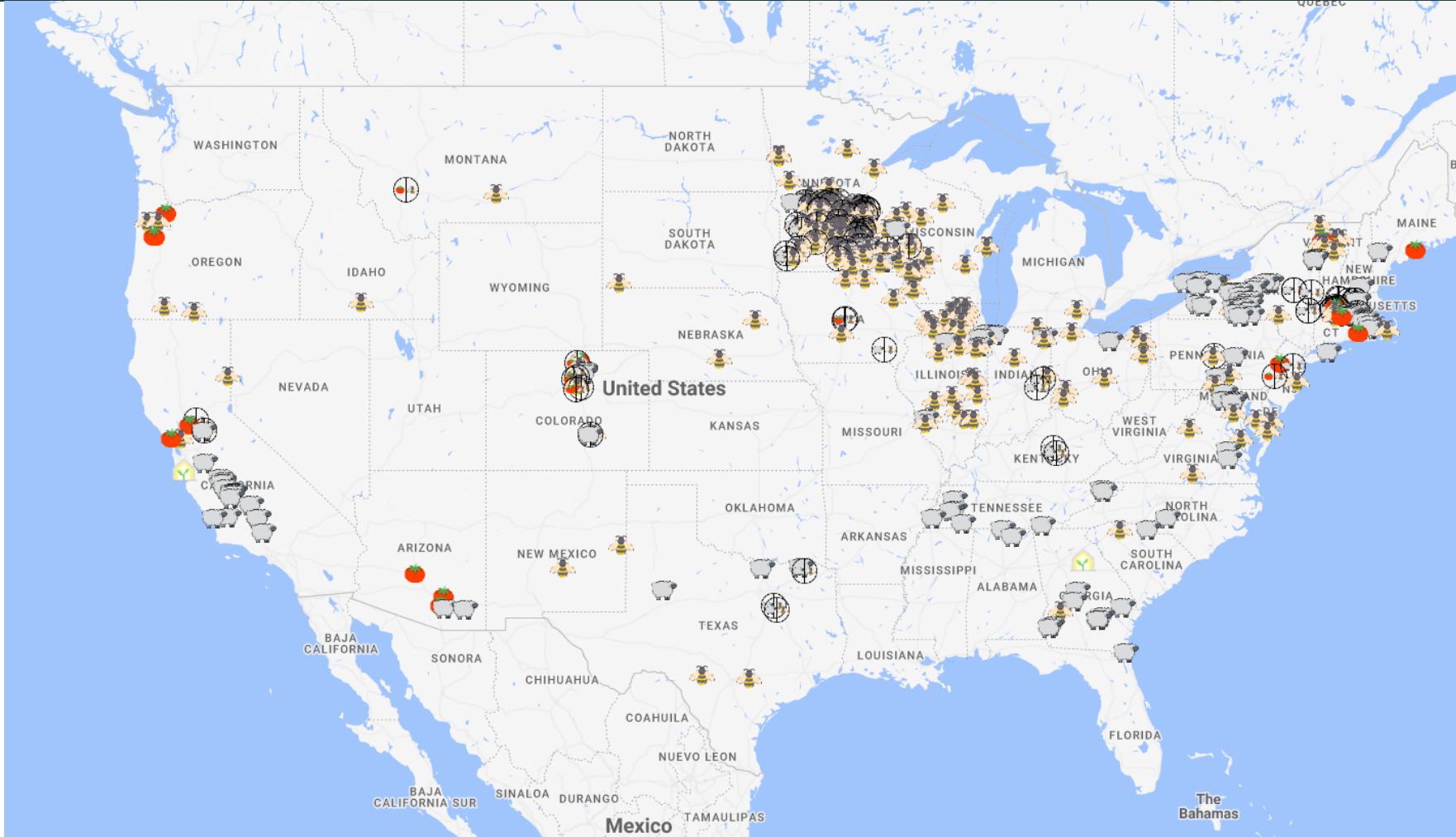
Food-energy-water benefits demonstrated

- Agrivoltaics can support off-grid electrification and reduce energy insecurity in rural East Africa.
- Crop yields vary, with some crops producing more food with less water input.
- Evaporative water loss reduced and plant survival rates improved.
- Land use productivity is higher in all cases studied.

Example agrivoltaic crop yields in Tanzania



Existing Projects in the US



- Agrivoltaic Activities**
- 🍅 Crop Production
 - 🐝 Habitat
 - 🐑 Grazing
 - 🏠 Greenhouse
- Photovoltaic Technology**
- Monocrystalline PV
 - Bifacial PV
 - Translucent PV
- System Size MWdc**
- < 1 MW
 - 1-5 MW
 - 5-10 MW
 - >10 MW
- Type of Array**
- Fixed
 - Single-axis Tracking
 - Dual-axis Tracking

Source: InSPIRE

Examples of National Projects

Jack's solar garden

- 1.2 MW
- Xcel
- Namaste Solar
- 4 acres
- 16 string inverters
- Single-axis tracking
- **Monofacial**
- **8' panel height when flat**
- 17' between rows
- **Cables 3' deep**

Source: Jack's solar garden and OneEnergy



Thank you!



University of Wisconsin-Madison Agrivoltaics Research Station

Madison, Wisconsin, USA (42.959527, -89.290824)



A living laboratory designed to advance knowledge and education about win-win opportunities for pairing renewable energy with agricultural activities and research.

Total Station Area
16.44 acres (6.65 hectares)
66,530 m²

Solar Array
5,424 bi-facial modules
2250 kW (AC) / 2287 kW (DC)

Commissioned 2025

Single-Axis Trackers
Area = 8,093 m²
480 modules, 200 kW
pivot height: 5 ft (1.52m)

Activities:
Horticulture (TBD)
Monitor electricity production

Area = 15,000 m²
Activities:
Commercial agriculture
Control for research

Elevated Fixed Tilt
Area = 2,023 m²
144 modules, 50 kW
Base: 8.0 ft (2.43m)
Top: 14 ft (4.27m)

Activities:
Tours/events
Education
Demonstration (TBD)

Area = 30,000 m²
Activities:
Commercial agriculture
Control for research

Recreational trail

Area = 30,000 m²
Activities:
Commercial agriculture
Control for research

Fixed Tilt
Area = 23,472 m²
4800 modules, 2000 kW
Base: 2.5 ft (0.762m)
Top: 9.0 ft (2.74m)

Activities:
Soil sensing and monitoring
Birds and wildlife
Agronomic productivity

Fixed Tilt
Extended row spacing
32 ft (9.7m)

Activities:
Microclimate (Flux Tower)
Tour pathway

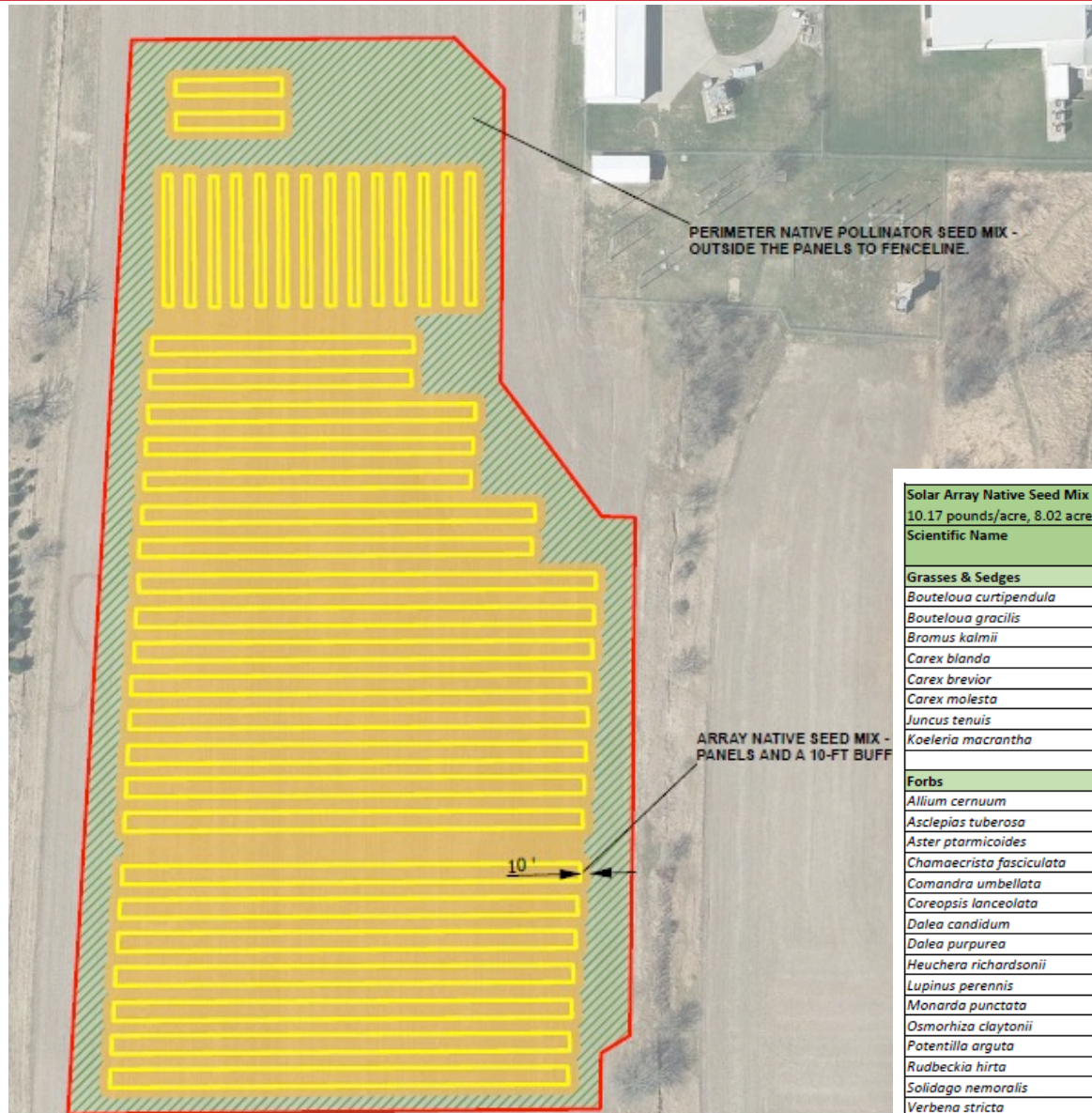
Fixed Tilt
Standard row spacing
17 ft (5.4m)

Activities:
Forage Trials
Pollinator Monitoring
Ecophysiology



Seeding Approach and Native Seed Mixes

| Perimeter Native Pollinator Seed Mix | | | | |
|--------------------------------------|--------------------------|-------------|--------------------------|-------------------------|
| 9.64 pounds/acre, 2.29 acres | | | | |
| Scientific Name | Common Name | Height (in) | Seeding Rate (lb/ac PLS) | Total Quantity (lb PLS) |
| Grasses & Sedges | | | | |
| <i>Andropogon gerardii</i> | Big Bluestem | 30-78 | 0.90 | 2.06 |
| <i>Bouteloua curtipendula</i> | Sideoats Grama | 18-24 | 0.70 | 1.60 |
| <i>Bromus kalmii</i> | Prairie Brome | 10-12 | 0.06 | 0.14 |
| <i>Carex brevior</i> | Plains Oval Sedge | 12-24 | 0.11 | 0.25 |
| <i>Carex molesta</i> | Field Oval Sedge | 12-24 | 0.14 | 0.32 |
| <i>Elymus canadensis</i> | Elymus canadensis | 18-54 | 0.48 | 1.10 |
| <i>Elymus trachycaulus</i> | Slender Wheatgrass | 12-36 | 0.30 | 0.69 |
| <i>Panicum virgatum</i> | Switchgrass | 36-66 | 0.12 | 0.27 |
| <i>Schizachyrium scoparium</i> | Little Bluestem | 18-36 | 0.95 | 2.18 |
| <i>Sorghastrum nutans</i> | Indiangrass | 36-78 | 1.05 | 2.40 |
| <i>Sporobolus compositus</i> | Rough Dropseed | 12-42 | 0.04 | 0.09 |
| <i>Sporobolus heterolepis</i> | Prairie Dropseed | 15-33 | 0.03 | 0.07 |
| Grass & Sedge Total | | | 4.88 | 11.18 |
| Forbs | | | | |
| <i>Agastache foeniculum</i> | Anise Hyssop | 24-48 | 0.08 | 0.18 |
| <i>Allium stellatum</i> | Nodding Onion | 12-18 | 0.08 | 0.18 |
| <i>Asclepias syriaca</i> | Common Milkweed | 30-54 | 0.24 | 0.55 |
| <i>Asclepias tuberosa</i> | Butterfly Milkweed | 18-24 | 0.08 | 0.18 |
| <i>Astragalus canadensis</i> | Canada Milk Vetch | 24-36 | 0.20 | 0.46 |
| <i>Baptisia alba</i> | White Wild Indigo | 24-42 | 0.16 | 0.37 |
| <i>Chamaecrista fasciculata</i> | Partridge Pea | 12-24 | 0.78 | 1.79 |
| <i>Dalea candidum</i> | White Prairie Clover | 18-24 | 0.24 | 0.55 |
| <i>Dalea purpurea</i> | Purple Prairie Clover | 18-24 | 0.40 | 0.92 |
| <i>Desmodium canadense</i> | Showy Tick Trefoil | 24-66 | 0.16 | 0.37 |
| <i>Eryngium yuccifolium</i> | Rattlesnake Master | 24-54 | 0.04 | 0.09 |
| <i>Gentiana flavida</i> | Cream Gentian | 12-30 | 0.02 | 0.05 |
| <i>Heliopsis helianthoides</i> | Ox-eye Sunflower | 24-66 | 0.16 | 0.37 |
| <i>Lespedeza capitata</i> | Round-headed Bush Clover | 24-54 | 0.20 | 0.46 |
| <i>Liatris pycnostachya</i> | Prairie Blazingstar | 24-54 | 0.24 | 0.55 |
| <i>Monarda fistulosa</i> | Wild Bergamot | 24-42 | 0.08 | 0.18 |
| <i>Potentilla arguta</i> | Prairie Cinquefoil | 12-24 | 0.04 | 0.09 |
| <i>Pycnanthemum virginianum</i> | Mountain Mint | 24-36 | 0.04 | 0.09 |
| <i>Ratibida pinnata</i> | Yellow Coneflower | 36-78 | 0.16 | 0.37 |
| <i>Rosa arkansana</i> | Prairie Wild Rose | 6-36 | 0.20 | 0.46 |
| <i>Rudbeckia hirta</i> | Black-eyed Susan | 18-24 | 0.16 | 0.37 |
| <i>Silphium laciniatum</i> | Compass Plant | 36-108 | 0.10 | 0.23 |
| <i>Solidago rigida</i> | Stiff Goldenrod | 12-54 | 0.08 | 0.18 |
| <i>Solidago speciosa</i> | Showy Goldenrod | 12-54 | 0.04 | 0.09 |
| <i>Symphyotrichum laeve</i> | Smooth Blue Aster | 18-30 | 0.16 | 0.37 |
| <i>Symphyotrichum novae-angliae</i> | New England Aster | 36-78 | 0.08 | 0.18 |
| <i>Symphyotrichum oolentangiense</i> | Sky Blue Aster | 24-36 | 0.06 | 0.14 |
| <i>Thalictrum dasycarpum</i> | Purple Meadow Rue | 24-78 | 0.04 | 0.09 |
| <i>Tradescantia ohiensis</i> | Ohio Spiderwort | 24-36 | 0.00 | 0.00 |
| <i>Verbena stricta</i> | Hoary Vervain | 18-24 | 0.12 | 0.27 |
| <i>Zizia aurea</i> | Golden Alexanders | 24-36 | 0.32 | 0.73 |
| Forb Total | | | 4.76 | 10.90 |



| Solar Array Native Seed Mix | | | | |
|---------------------------------|-----------------------|-------------|--------------------------|-------------------------|
| 10.17 pounds/acre, 8.02 acres | | | | |
| Scientific Name | Common Name | Height (in) | Seeding Rate (lb/ac PLS) | Total Quantity (lb PLS) |
| Grasses & Sedges | | | | |
| <i>Bouteloua curtipendula</i> | Sideoats Grama | 18-24 | 2.95 | 23.66 |
| <i>Bouteloua gracilis</i> | Blue Grama | 8-12 | 0.75 | 6.02 |
| <i>Bromus kalmii</i> | Prairie Brome | 10-12 | 0.57 | 4.57 |
| <i>Carex blanda</i> | Common Wood Sedge | 6-20 | 0.04 | 0.32 |
| <i>Carex brevior</i> | Plains Oval Sedge | 12-24 | 0.10 | 0.80 |
| <i>Carex molesta</i> | Field Oval Sedge | 12-24 | 0.08 | 0.64 |
| <i>Juncus tenuis</i> | Path Rush | 6-20 | 0.06 | 0.48 |
| <i>Koeleria macrantha</i> | June Grass | 10-20 | 0.06 | 0.48 |
| Grass & Sedge Total | | | 4.61 | 36.97 |
| Forbs | | | | |
| <i>Allium cernuum</i> | Nodding Onion | 12-18 | 0.07 | 0.56 |
| <i>Asclepias tuberosa</i> | Butterfly Milkweed | 18-24 | 0.04 | 0.32 |
| <i>Aster ptarmicoides</i> | Upland White Aster | 12-18 | 0.08 | 0.64 |
| <i>Chamaecrista fasciculata</i> | Partridge Pea | 12-24 | 1.17 | 9.38 |
| <i>Comandra umbellata</i> | Bastard Toadflax | 3-12 | 0.03 | 0.24 |
| <i>Coreopsis lanceolata</i> | Sand Coreopsis | 18-24 | 0.85 | 6.82 |
| <i>Dalea candidum</i> | White Prairie Clover | 18-24 | 0.95 | 7.62 |
| <i>Dalea purpurea</i> | Purple Prairie Clover | 18-24 | 1.30 | 10.43 |
| <i>Heuchera richardsonii</i> | Prairie Alumroot | 18-24 | 0.01 | 0.04 |
| <i>Lupinus perennis</i> | Wild Lupine | 12-24 | 0.09 | 0.68 |
| <i>Monarda punctata</i> | Spotted Bee Balm | 12-24 | 0.09 | 0.72 |
| <i>Osmorhiza claytonii</i> | Sweet Cicely | 12-24 | 0.08 | 0.64 |
| <i>Potentilla arguta</i> | Prairie Cinquefoil | 12-24 | 0.09 | 0.72 |
| <i>Rudbeckia hirta</i> | Black-eyed Susan | 18-24 | 0.40 | 3.21 |
| <i>Solidago nemoralis</i> | Gray Goldenrod | 18-24 | 0.09 | 0.72 |
| <i>Verbena stricta</i> | Hoary Vervain | 18-24 | 0.23 | 1.84 |
| Forb Total | | | 5.56 | 44.59 |

Source: Merjent Consulting, Draft Vegetation Management Plan (Fall 2023)

Agrivoltaics Resources

Agrivoltaics: Solar and Agriculture Co-Location (Solar Energy Technologies Office)
<https://www.energy.gov/eere/solar/agrivoltaics-solar-and-agriculture-co-location>

Electric Power Research Institute, Power in Pollinators
<https://www.epri.com/pages/sa/pollinators>

International Energy Agency, Photovoltaic Power Systems Programme
<https://iea-pvps.org/>

InSPIRE, U.S. Department of Energy, National Renewable Energy Laboratory,
<https://openei.org/wiki/InSPIRE>

National Center for Appropriate Technology, AgriSolar ClearingHouse
<https://www.agrisolarclearinghouse.org/>

RENEW Wisconsin <https://www.renewwisconsin.org/solar-and-agricultural-land>

Solar Farm Summit <https://solarfarmsummit.com/>

World Agrivoltaics Conference <https://www.agrivoltaics-conference.org/>

Goals: Inform, Engage, Inspire

Please contact us for more information

Thank you!





101 SESSION - DUAL-USE SOLAR

SARAH GLOVER | LAND STEWARDSHIP & COMMUNITY ENGAGEMENT

NOLAN STUMPF | PROJECT DEVELOPMENT & MANAGEMENT



OneEnergy Renewables

- OneEnergy Renewables is an independent developer of distributed generation, community solar, and large utility solar projects.
- Our Madison office develops, engineers, constructs and operates solar farms throughout the Midwest.
- As a Public Benefit Corporation, we pursue public benefit and operate in a responsible and sustainable manner.



948 ACRES POLLINATOR HABITAT CREATED

155 ACRES GRAZED BY SHEEP

AND COUNTING...

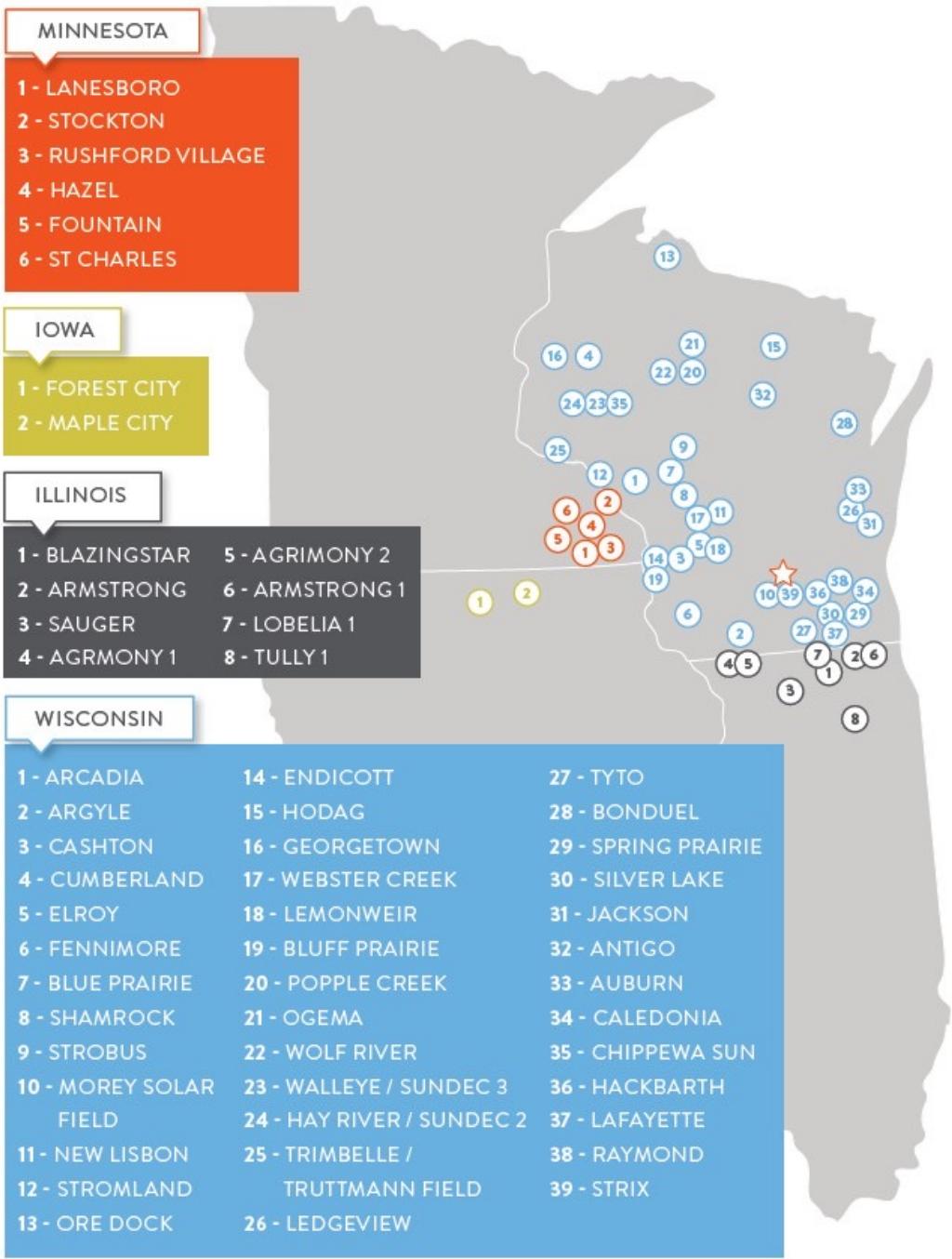


Photo: Wiscovery Grazing



Why Dual-Use Solar Matters

- Ecosystem services
- Neighborly development
- Public opinion



Photo: Olivia Halbur



Photo: Andrea Burns



Photo: Jana Rose Schleis

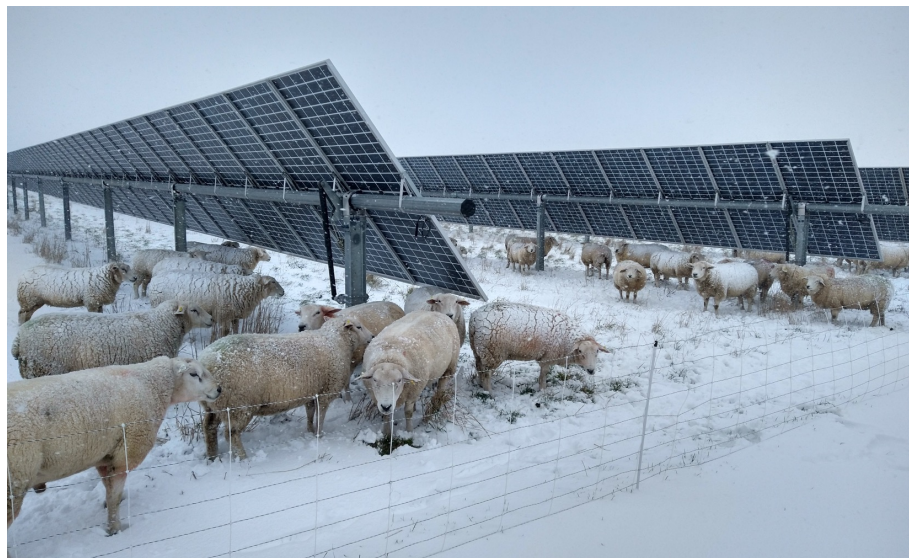


Photo: Olivia Halbur

Ledgeview Solar & Halbur's Heavenly Hill

Fond du Lac, WI
5 MW & 30 acres

WOOLY WATTS



Ledgeview Solar & Halbur's Heavenly Hill

Fond du Lac, WI
5 MW & 30 acres

WOOLLY WATTS

Photos: Olivia Halbur

Tyto Solar &
Wiscovery
Grazing
Fitchburg, WI
6 MW & 30 acres



Photo: Wiscovery Grazing




**Blue Prairie Solar &
CarMel Australian
Shepherds**
Black River Falls, WI
2.5 MW & 20 acres



Photo: Heather Oslie





Farmers for Solar Tour at Blue Prairie Black River Falls, WI 2.5 MW & 20 acres

Photos: Clean Wisconsin



Webster Creek
Solar & Ard's Bees
New Lisbon, WI
1.5 MW & 9 acres





Strobus Solar
Mastodon Portfolio
Black River Falls,
WI
1.5 MW & 9 acres

Stockton Solar
Mastodon Portfolio
Winona, MN
2.5 MW & 20 acres



Land Stewardship

“We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect.”

Aldo Leopold



Land Access for Emerging Farmers

Big Lake Agrivoltaics Project in MN

Collaboration between US Solar, The Food Group, NREL, Connexus, and GPI

**Not a OneEnergy project but a great pilot*

