WHAT IS POLLINATOR-FRIENDLY SOLAR?

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Pollinator-friendly solar sites take an alternative approach to site design and management by using low-growing seed mixtures that stabilize soil while also providing a meaningful amount of value to pollinators, project owners, and the community.

Enel Green Power's 150 MW Aurora Solar project
Credit: Jake Janski

WHY POLLINATOR-FRIENDLY SOLAR?

There are several reasons why communities, developers, energy buyers, and landowners may wish to pursue pollinator-friendly solar in Indiana. Of primary importance to all groups is the increased potential short and long-term conservation value of a pollinator-friendly site. Pollinating species (predominantly insects like butterflies, hover flies, and bees) need flowering plants for food and nesting sites. Charismatic pollinators like the Monarch Butterfly, for example, require nesting and feeding sites on milkweed plants and Indiana is a critical migration stop. Pollinator-friendly solar also provides additional habitat value to heritage birds like pheasant and quail, grassland songbirds, and small mammals. These spaces can also be used for agricultural insects such as honey bees.

Early evidence on solar acceptance suggests that residents are more likely to accept a neighboring solar installation if it is aesthetically more pleasing than the previous land use. Pollinator-friendly solar may therefore provide a means to increase public acceptance. It also provides an opportunity for developers to advertise their commitment to green initiatives.

Pollinator plantings under and around solar panels can be less expensive to maintain in the long-term than traditional turfgrass. The long-term savings are made through reduced mowing frequency. Furthermore, the integration of grazing sheep can altogether eliminate the need to mow and provide additional financial benefits to landowners.

BENEFITS AND CHALLENGES

Pollinator-friendly solar can benefit developers, landowners, surrounding agriculture, the public and pollinators. Specific benefits include:

- Potential reduction in long-term maintenance costs
- Increased likelihood of public acceptance
- Potential increase in yield for pollinator-dependent crops in the surrounding area
- Creation of nectar and pollen food sources for native and local pollinator species
- Reduced water run-off and erosion
- Increased soil organic matter and soil health

Some developers experience challenges when doing their first pollinator-friendly solar projects. Specific challenges can include:

- Selecting an experienced landscape or ecological consultant
- Changing "status quo" of grass-only turf-type seed mixtures to incorporate clovers and/or other flowering species
- Perceptions associated with seed supply and cost
- Perceptions associated with sting risks or whether pollen will accumulate on solar panels
- Ensuring the planting is beneficial to the local landscape

To help find ways to offset extra costs some developers may perceive, incentives can be available through habitat-landowner assistance programs, and these programs should be looked into by developers for their areas.

On Costs

The cost of pollinator-friendly solar can vary based on the desired groundcover, the site layout, and the maintenance plan. Each of these should be considered when planning. The example seed mix provided below has an estimated retail cost of $66.78/acre for 100+ acres. A comparable high-diversity seed mix with no panel-height restrictions can cost as much as $300-$600/acre. This range is well within the range expected of turfgrass. An additional benefit of pollinator-friendly seed mixes is the reduced mowing schedule. Substantial savings can be made in the long-term by reducing the number of annual site visits for mowing.

POLICY AND PLANNING CONSIDERATIONS

Planning

Large-scale solar development requires a team of consultants and contractors. When planning for a pollinator-friendly solar site it is essential to contact an expert on pollinator-friendly planting before beginning the process. This expert will develop site-appropriate seed mixes and a site-management plan. Indiana is home to several regional and national firms with applicable expertise.

Specific recommendations for plants species include:

- Ensuring species planted near-to and underneath panels do grow tall enough to shade the panels
- Selecting shade-tolerant species for spaces under panels
- Confirming with state regulators that there are no invasive plant species in the seed mix
- Ensuring a mix of plant species that will have blooms throughout the growing season
- Including native grasses and forbs in the seed mix
- Ensuring that seeds are untreated with pesticides and are purchased from a trusted provider
- Planning an effective buffer area composed of woody shrubs and other species

Planting experts should also consider how to eliminate previously-planted vegetation in the site and take measures to control weeds before seeding. The use of a cover crop seed mix (e.g. oats, winter wheat, etc) is highly recommended for soil stabilization. Soil testing and soil preparation before planting will vary based on specific site requirements. Soil testing is strongly encouraged.

No matter what kind of ground cover is used on a solar site, it will require management. For pollinator-friendly solar sites, a common goal is for the project to require just one annual mow or grazing after the vegetation is established. During the first 3-5 years, a landscaping contractor will visit the site three or more times per year. This should be included in budgeting and site planning. Broadcast herbicides or insecticides are strongly discouraged.

It is strongly recommended that a detailed site management plan is developed to ensure the long-term health of the site.

Pollinator-friendly ground cover in a solar facility should not be thought of as a native restoration. A native restoration might use local-ecotype seed mixtures that are only commercially available in very limited quantities. Pollinator-friendly ground cover in a solar facility is an improvement on the use of mono-crop of turf-type grasses and should be expected to include clovers and other regionally appropriate plant species.

Visible signage indicating that the site is pollinator-friendly can be encouraged and may increase public acceptance.

Panel height

Panel height is critically important to the long-term success of a pollinator-friendly solar site. When the lower edge of the photovoltaic (PV) solar panels is too close to the ground, a deep shadow is created and vegetation performance can suffer. Solar racking manufacturers and the National Renewable Energy Laboratory have made recommendations regarding the height of solar panels and associated costs and energy performance benefits. We encourage landowners to seek information about the long-term benefits, such as increased soil organic matter when deep-rooted plants are used as ground cover.

Vegetative buffer areas

Buffer areas provide screening around the solar site. Buffer areas can also be used to plant pollinator-friendly species. The buffer provides an area where one can plant flowering shrubs, trees, grasses and forbs. Buffer requirements will vary based on the specifics of the desired site.

Vegetation Management
Electricity and transportation right-of-way managers have been sharing best practices in vegetation management for more than a decade. Use of Integrated Vegetation Management (IVM) — the combination of trained staff, spot- and landscape mowing, targeted spot-use of herbicides, and manual extraction — is recognized as the approach that delivers the best outcomes at the least cost. Using IVM to manage pollinator-friendly solar is straightforward. During the establishment period, the site is mowed to knock-back fast-growing undesirable plant species. Annual mowing can also be performed on pollinator-friendly solar sites and ideally timed for late fall. Spot mowing (only mowing problem areas) can be performed when necessary. Contractors should be expected to ensure their equipment does not inadvertently move seeds from one site to another. Discussing IVM options with site managers and local biologists is highly recommended.

Grazing
In addition to IVM practices, vegetation management in the facility can be completed through the use of sheep grazing. Recommended by the American Solar Grazing Association, rotational grazing (also called "conservation grazing") practices should be used and have been shown to benefit overall biodiversity and is a compatible practice for pollinator-friendly ground cover. Continuous grazing, where the sheep are left on site all year with little supervision, has been shown to attract coyotes and Sheep work nicely for the grazing of solar sites as they are small enough to not disrupt the panels. The employment of sheep grazing at facilities in place of mowing provides for a more holistic approach to land use.

Unwanted species
Indiana Invasive Species Council Official Indiana Invasive Plant List

- https://growindiananatives.org/invasive-plants/indiana-invasive-species-council-official-indiana-invasive-plant-list/

Exotic & Invasive Plants

- https://www.in.gov/dnr/3123.htm

Pollinator-Friendly Solar Scorecard
Standards establishing what constitutes "pollinator-friendly" within the managed landscape of a large-scale solar farm have been published by agencies and leading universities in 13 states, including Purdue University. Scorecards help establish and build trust between the local community and the solar developer and provide a check against the temptation to make exaggerated marketing claims. Using a scorecard serves to look over the quality of seed mixes beneath the panels, the plant species in the site, and the plant species in the vegetative buffer areas. A scorecard will also assess site management and insecticide risk. A scorecard for Indiana was recently developed by Purdue University and can be used for sites across Indiana. The 2020 scorecard can be found at the end of this section. More recent scorecards for Indiana can be found online through Purdue Extension.

EXAMPLE OF LARGE-SCALE POLLINATOR-FRIENDLY SOLAR

The 1,200 acre, 150 MW Aurora Solar project owned meets the applicable pollinator-friendly solar scorecard standard. A diverse mixture of low-growing flowering plants and grasses is used throughout the project. Because of the fixed cost to mobilize equipment, doing pollinator-friendly ground cover on larger projects is more economically attractive than doing it on small projects.

Credit: Jake Janski/Minnesota Native Landscapes

A series of presentations at the Society of Soil and Water Conservation Symposium are recorded and available online. https://youtu.be/r9DRNEs5-Co

EXAMPLE SEED MIX

Seed mixes should be carefully crafted to be site-appropriate. They should consider exposure, panel height, soil conditions, local flora, and seed availability.

There is no generic seed mix that will be appropriate for all solar sites in Indiana. This seed mix was kindly developed by the Conservation Blueprint. It assumes a 30-inch maximum height for plants.

Species	Scientific Name	PLS lbs per acre	PLS seeds per sq ft	% PLS	Bloom Period
Alsike Clover	*Trifolium hybridum*	0.7	10.93	17.37	June - July
Blackeyed Susan	*Rudbeckia hirta*	0.25	9.04	14.37	June - July
Clasping Coneflower	*Rudbeckia amplexicaulis*	0.2	7.35	11.67	April - May
Crimson Clover	*Trifolium incarnatum*	1.8	6.19	9.83	June - July
Golden Alexander	*Zizia aurea*	0.08	0.32	0.51	April - May
Gray Goldenrod	*Solidago nemoralis*	0.008	0.19	0.29	August - October
Ladino or White Clover	*Trifolium repens*	0.3	4.9	7.79	June - July
Lanceleaf Coreopsis	*Coreopsis lanceolata*	0.25	1.27	2.02	June - July
Lemon Mint or Lemon Bee Balm	*Monarda citriodora*	0.08	2.64	4.2	June - July
Missouri Goldenrod, Native Source	*Solidago missouriensis*	0.008	1.16	1.84	June - July
Purple Coneflower	*Echinacea purpurea*	0.2	0.53	0.84	June - July
Red Clover	*Trifolium pratense*	0.5	3.12	4.96	June - July
Western Yarrow	*Achillea millefolium*	0.05	3.27	5.2	April - May
White Dutch Clover	*Trifolium repens*	0.6	12.01	19.08	June - July
Rice Hulls	*N/A*	3.5	0	17.37	--
Wildflower/Forb/Legume Total:		5.026	62.93	100	
Filler Total:		3.5	0	0	
Total Mixture:		8.526	62.93	100	

ADDITIONAL RESOURCES AND REFERENCES

- MACOG Technical Guide on Solar and Pollinator-Friendly Solar - http://macog.com/solar_energy.html
  EG Research Report Pollinator-Friendly in Indiana - https://eq-research.com/eq-publications/pollinator-friendly-solar-in-indiana/
- Illinois Solar Score Card - https://www2.illinois.gov/dnr/conservation/PollinatorScoreCard/Pages/default.aspx
- Indiana Solar Score Card - https://mdc.itap.purdue.edu/item.asp?itemID=24467
- Walston, Leroy J., et al. "Examining the potential for agricultural benefits from pollinator habitat at solar facilities in the United States." *Environmental science & technology* 52.13 (2018): 7566-7576.
- Hernandez, Rebecca R., et al. "Techno–ecological synergies of solar energy for global sustainability." *Nature Sustainability* 2.7 (2019): 560-568.