FACT SHEET:

NATIVE VEGETATION AND SOLAR PROJECTS IN NEBRASKA

Across the U.S., the solar industry is booming. Solar project sites often occupy several acres of land and are projected to cover 2 million acres by 2030.[1] To produce 1 megawatt of electricity (enough to power approximately 130 homes in Nebraska), utility-scale solar plants may require five to 10 acres of land.[2]

The first utility-scale solar project in Nebraska was deployed in 2016, providing 3.6 megawatts of power to the electric grid.[3] By the end of 2020, Nebraska had 28 megawatts of utility-scale solar capacity installed.[4] Combining solar projects with native perennial vegetation (including naturalized, non-invasive species) offers an opportunity for project developers to demonstrate their commitment to environmental stewardship.

ADDING PROJECT VALUE

Solar project sites provide many ancillary benefits when seeded with native vegetation. These benefits may include improved soil health and water quality, habitat creation for wildlife and pollinator species, and carbon sequestration.

PLANNING, COST, AND SEEDING

Planning

- Planning at least one year before the seed goes into the ground is recommended; this provides adequate time to reach out for technical assistance, review and select a site, determine the existing dominant vegetation (if any), conduct two or more herbicide applications to suppress existing vegetation (if needed), and gather quotes for a native seed mix.[5]

Cost

- The extra costs associated with pollinator-friendly solar panels include the original seed and raising the panels from 12 inches to 30 inches off the ground.[6] These changes usually have minimal effect on the overall project budget.[7] Industry experts say developers can expect to spend as much as three times less on operations and maintenance costs over 20 years when compared to managing turfgrass sites, according to the National Renewable Energy Laboratory.[8]

Best practice: Include native vegetation in the initial planning of a project. Incorporating this desired outcome into the process will allow for a holistic consideration of all factors including construction, management, establishment, and more.

Seeding

- Timing is key to success; frost-seeding between Nov. 1 and June 1 is ideal for maximum germination and ensuring stand establishment through a full growing season.[9] August and late summer should be avoided as a stand won't have enough time to establish before cold temperatures. Native grass seeds need good seed-to-soil contact and should be planted no deeper than one-fourth of an inch deep. Ideally, native prairie seeds should rest on top of the soil.[10]

Best practice: A site may take time to establish aesthetic native vegetation. Signage saying "Pollinator habitat in progress" can mitigate public concern. Keep in mind each seedbed is different and may not need discing—these decisions should be made with a professional after review of site-specific information such as existing vegetation, moisture levels, and soil type.

Sources

1 Dreves, Harrison. "Beneath Solar Panels, the Seeds of Opportunity Sprout." National Renewable Energy Laboratory, April 1, 2019, nrel.gov/news/features/2019/beneath-solar-panels-the-seeds-of-opportunity-sprout.html. Accessed June 2022.
2 "What's in a Megawatt?" Solar Energy Industries Association, seia.org/initiatives/whats-megawatt. Accessed June 2022.
3 "Solar Energy Generation in Nebraska." Nebraska Department of Environment and Energy, 2022, neo.ne.gov/programs/stats/inf/198.htm. Accessed June 2022.
4 "Electric Power Monthly." U.S. Energy Information Administration, eia.gov/electricity/monthly/epm_table_grapher.php?t=table_6_02_b. Accessed June 2022.
5 "Habitat How-To." Iowa Monarch Conservation Consortium, Iowa State University, 2022, monarch.ent.iastate.edu/habitat-how. Accessed June 2022.
6 "Procurement and Pollinator-Friendly Solar." Fresh Energy, fresh-energy.org/wp-content/uploads/2021/06/Procurement-and-Pollinator-Friendly-Solar-Fresh-Enegy-Resource-061621.pdf. Accessed June 2022.
7 Klein, Jesse. "Dual-use solar farms welcome nature back to the land." GreenBiz, June 10, 2020, greenbiz.com/article/dual-use-solar-farms-welcome-nature-back-land. Accessed June 2022.
8 Personal communication, Fresh Energy, Argonne National Laboratory, produced for the U.S. Department of Energy's InSPIRE Study, April 2020.
9 "Habitat How-To." Iowa Monarch Conservation Consortium, Iowa State University, monarch.ent.iastate.edu/habitat-how. Accessed June 2022.
10 "Now is the time to sow native grass and forbs seeds. Here's why." Purdue University, Forestry and Natural Resources Extension, Feb. 13, 2020, purdue.edu/fnr/extension/sow-native-grass-and-forbs-seeds. Accessed March 2022.

MANAGEMENT AND CONSTRUCTION

Construction and design

- Being flexible when it comes to the height of a solar energy system is important for project success. Three to 4 feet is widely viewed as the maximum clearance between the lowest edge of the solar panel and the ground without substantially increasing material costs and creating the need for elevation of workers for operations and maintenance.[11] A seed mix should include plants that don't reach a peak height that could shade the low, tilted edge of ground-mounted solar energy systems unless developers plan to use strategic mowing or livestock grazing (i.e., sheep) to avoid interfering with project efficiency.

Best practice: Although project managers may have to strip-mow to maintain project efficiency, remember that taller native vegetation provides better habitat for wildlife and pollinators.[12] Striking a balance between quality and height can equalize cost.

Best practice: Utilizing solar grazing instead of mowing allows farmers to increase and diversify revenues without taking land out of food production and reduces or eliminates the need for mowing at solar sites, cutting emissions and costs.[13] However, developers should avoid introducing grazing until the three-year establishment period is over and should follow a robust rotational grazing plan when livestock is introduced to avoid reductions in habitat value.

Management

- **Year one:** Regular mowing (three to four times) during the first growing season prevents weeds from shading out seedlings and going to seed. The first mowing should be at a height of 4 to 6 inches soon after seeding; the next two mowings should be at a height no less than 8 inches.[14]
- **Year two:** With a successful planting, years subsequent to establishment provide the opportunity for less maintenance, needing only an occasional disturbance to encourage desirable species.[15]
- **Years three and four:** Mowing and baling approximately every three years is the preferred management option for solar project sites.[16]

Timing impacts wildlife and pollinators

- After year two, avoid or minimize mowing between April 1 and Aug. 1 to reduce impacts during the nesting season of upland birds such as pheasants and quail.[17] Delaying mowing to late September facilitates a more welcoming habitat for migrating pollinators such as monarch butterflies, as the highest population of monarch eggs is often found on milkweed plants in late July and early August.[18] Spot mowing and/or herbicide application could be used during this period if necessary.

Best practice: Every site is unique and all timelines should be adjusted to the needs of a project. Experts suggest evaluating the ratio of native species to weeds and invasive vegetation before making mowing and other management decisions. If native vegetation is struggling to establish a strong stand, mowing is likely necessary; if the opposite is occurring, mowing may not be in a site's best interest.

Photo provided by Center for Pollinators in Energy

Sources

11 Personal communications, City of Cedar Falls, Oct. 26, 2019; Kertech, LLC, Oct. 30, 2019.
12 "Native Seed Program." Iowa Pheasants Forever, iowapf.net/native-seed-program. Accessed June 2022.
13 "What is Solar Grazing?" American Solar Grazing Association, solargrazing.org/what-is-solar-grazing. Accessed June 2022.
14 "Habitat How-To." Iowa Monarch Conservation Consortium, Iowa State University, monarch.ent.iastate.edu/habitat-how. Accessed June 2022.
15 Ibid.
16 "Iowa Monarch Conservation Consortium." Iowa State University, monarch.ent.iastate.edu. Accessed June 2022.
17 "Native Seed Program." Iowa Pheasants Forever, iowapf.net/native-seed-program. Accessed June 2022.
18 "Habitat How-To." Iowa Monarch Conservation Consortium, Iowa State University, monarch.ent.iastate.edu/habitat-how. Accessed June 2022.

SELECTING A SEED MIX

Numerous factors should be considered when selecting a seed mix for a solar site. The clearance between the ground and the solar panels is a primary concern. Other factors include project location, soil type and moisture, the species of vegetation native to the area, planned management of the site, and more. Consider desired outcomes including providing wildlife habitat, increasing pollinator populations, or reducing erosion to help guide action. Some of these outcomes may be more fully achieved by implementing two different seed mixes for the project area—one with shorter-growing species for the array area under the solar panels, and one with taller-growing species for the buffer area around them. Conservation Blueprint, a custom seed mix company that specializes in the design, establishment, and management of pollinator and wildlife habitat for solar panel projects, recommends considering the following factors when selecting a seed mix.

1. Pollinator value

- One of the key objectives of the project is to provide significant benefits for a wide range of pollinating insects, birds, and mammals. The plant species used in both the array area and buffer area seed mixtures should have a documented high pollinator value, extend their pollinator benefits over an entire growing season, and be designed to benefit a wide range of pollinator species.

2. Vegetative height restrictions

- With a lower panel height of 20 to 24 inches, a seed mixture used within the array area should be designed to have a maximum growth height of 18 to 20 inches. While this objective produces significant constraints on how a seed mixture is designed, it is an important consideration that affects future operations and management efforts, budget, and the efficiency of the energy production on the site.

3. Response to future mowing activities

- Once established, the seed mixture used within the array area will likely be mowed several times a year to control the height of the vegetation and weed growth on the site. An important factor is selecting plant species in the seed mixture that can withstand the mowing pressure and persist on the site for 20 to 30 years. Unfortunately, most native wildflower species cannot handle the mowing pressure at a rate of two times per year and would disappear within just a few years.

4. Ease of establishment

- To meet the requirements of a Conditional Use Permit (CUP) and/or Stormwater Pollution Prevention Plan (SWPPP), seed mixtures should be designed to establish quickly. If a seed mixture were designed with a focus on native wildflower species, it may take an extended period of time to reach full establishment. For this reason, cover crops and/or plant species that establish quickly should be used in seed mixture designs.

5. Longevity and ability to persist

- Most solar energy projects are leased for a minimum of 20 to 30 years. As such, consider selecting plant species with a documented ability to persist with minimal and limited future management. Most native wildflower species require some form of regular, annual management. Since some of the tools that would regularly be used to maintain plant diversity (prescribed fire, cattle grazing, etc.) are not an option on solar projects, plant species must be aggressive enough to be maintained with the limited options of mowing and herbicide application.

6. Adaptation to geography and site conditions

- Plant species known to occur in the project area and that perform well on the site's soil conditions (sandy, loamy, clay, etc.) should be selected for use in the project seed mixtures. This will help ensure a higher likelihood of successful establishment.

7. Tolerance to partial shading

- Plant species (both grasses and forbs) known to tolerate and perform in partial shading or areas with less than full sunlight are required in the array area seeding mixture. Fescues, bluegrass, and white Dutch clover perform well under those conditions.

8. Soil health benefits

- Seed mixtures that perform with increased soil health benefits, extended root depths, nitrogen-fixing capabilities, and enhanced water percolation attributes will produce both short-term and long-term benefits for the site.

9. Carbon sequestration benefits

- For some solar projects, the opportunity to "bank carbon credits" is a potential vehicle by which to meet sustainability, greenhouse gas emission, and carbon-neutral goals. Using plant species in seed mixtures—like clover (Trifolium spp.)—that are known to sequester carbon can help meet these current and future objectives.

SEED MIX CONSIDERATIONS FOR BUFFER AREA GROUND COVER

Seed mixture diversity

- For portions of the project where vegetation height restrictions are not applied, consider designing seed mixtures with a minimum of 40 native wildflower species to increase the pollinator benefits and diversity. Increased diversity will help produce a vegetative cover that will perform well in hot years vs. cold years, wet years vs. dry years, etc.

Meeting "traditional" pollinator seed mixture considerations

- Because the buffer area comes without any vegetative height restrictions, a more traditional pollinator seed mixture can be designed and used on this section of the project. These seed mixtures are typically designed using only native plant species adapted to the geography and the region.

FIGURE 1: PROJECT SITE PLACEMENT OPPORTUNITIES FOR NATIVE AND NATURALIZED, NON-INVASIVE VEGETATION