Minutes - Woodbury County Zoning Commission Meeting – November 27, 2023

The Zoning Commission (ZC) meeting convened on Monday, November 27, 2023, at 5:00 PM in the Board of Supervisors' meeting room in the Basement of the Woodbury County Courthouse, 620 Douglas Street, Sioux City, IA. The meeting was also made available via teleconference.

Meeting Audio:
For specific content of this meeting, refer to the recorded video on the Woodbury County Zoning Commission "Committee Page" on the Woodbury County website:

- County Website Link:
  - https://www.woodburycountyiowa.gov/committees/zoning_commission/
- YouTube Direct Link:
  - https://www.youtube.com/watch?v=Me_SPKOFaHM

ZC Members Present:	Chris Zellmer Zant, Corey Meister, Jeff O'Tool, Barb Parker
County Staff Present:	Dan Priestley, Dawn Norton
Public Present:	Roger Brink, Gwen Brink, Russ Petersen, Bob Fritzmeier, Christopher Widman, Leo Jochum, Bev Jochum, Naomi Widman, William Widman, Ezra Widman, Eliyanah Widman, Aliza Widman, Steve Corey, Denise Knaack, Robert Knaack, Bill Jochum, Tony Ashley, Doyle Turner, Greg Jochum, Tom Jochum, Mike Wright, Jeanette Williams, Mark Wetmore, Bethany Widman, Kalyn Heetland, Josh Heetland, Deb Harpenau, Kevin Alons, Rebekah Moerer, Ann Johnston, Emily Segura, Daniel Segura, Elizabeth Widman, Jenny Barber, Genise Hallowell
Telephone:	Tom Treharne, Robert Wilson

Call to Order
Chair Chris Zellmer Zant formally called the meeting to order at 5:02 p.m. Tom Bride was absent.

Public Comment on Matters Not on the Agenda
None

Approval of Previous Meeting Minutes – October 23, 2023
Motion to approve the minutes: Parker. Second: Meister. Motion carried: 4-0.

Public Hearing: Solar Energy – Utility-Scale Solar Systems – Consideration of Solar Ordinances for Recommendations(s) to the Board of Supervisors
Priestley offered background about the utility-scale solar energy system proposals. Staff and the Commission have been mindful these past several weeks aboutthe harvest season and have used the available meeting opportunities to collect resources and input from the public. During this timeframe, three potential concepts for consideration have been established including: 1) Consideration of a new utility-scale solar energy conditional use process for the General Industrial (GI) Zoning District only; 2) Establishment of an overlay district to facilitate utility-scale solar within the Agricultural Preservation (AP) Zoning District; 3) Adoption of the first concept and then transfer the utility-scale solar debate on agricultural land to the "Comprehensive Plan" adoption process that will likely occur in early 2024.

Priestley stated that he received materials Alex Delworth from the Center for Rural Affairs and asked that they be received into the record. Motion to receive O'Tool. Second by Parker, Approved 4-0. Copy available for review in the appendix.

Bob Fritzmeier (Sioux City) addressed the Commission offering support for a utility-solar overlay district and the evaluation scorecard by referencing positive benefits to the environment. Fritzmeier indicated that 75% of flowering plants are dependent on pollinators, native grasses and plants would provide good habitat, pollination, improve environment, and air quality. He requested that information from USDA, National Institute of Food and US Department of Energy be received and placed into record. Motion by Meister to receive. Second by O'Tool. Carried 4-0. Copy available for review in the appendix.

Kevin Alons (Salix) addressed the Commission offing his opposition to the utility-solar overlay district over agricultural land. He indicated that utility-solar is not compatible with agriculture. He referenced the fall of or degrading of production of solar as systems degrade and he questioned how long they operate. Alons referenced concerns with federal subsidies and indicated that most of the proposed solar options abut the City of Salix.

Robert Wilson (Rangeland Energy Management) addressed the Commission in support of solar projects by discussing the changing nature of projects and compatibility with agriculture with agrivoltaics. He referenced practices such as sheep herding for vegetation control and made reference to CRP land and decommissioning and bond requirements. Wilson addressed solar as replacement when coal plants are retired.

Doyle Turner (Moville) addressed the Commission in support of completing the comprehensive plan for 2040. He indicated that solar doesn't create revenue from property tax, it creates revenue from the electricity that is produced. Turner said that the overlay is something that is worth looking at but not until after the comprehensive map has been developed.

Christopher Widman (Bronson) addressed the Commission indicating that solar does not have a place on agricultural preservation land. He indicated that utility-solar should stay on industrial. Widman referenced the comprehensive plan and said it could be taken into consideration to increase industrial parks and not cherry pick out in the middle of the county. He indicated that contracts signed by landowners in areas are not compatible with the comprehensive plan and should be for the general welfare of the county and not a few. Widman encouraged waiting until the comprehensive plan is complete. Widman made a request that materials including questions be received and placed into record. Motion by O'Tool to receive. Second by Parker. Carried 4-0. Copy available for review in the appendix.

Elizabeth Widman (Sergeant Bluff) addressed the Commission urging them to delay the decision until the comprehensive plan is completed. She indicated that the comprehensive plan is a guide for the next 20 years and that board members and others come and go. Widman asserted that utility-solar belongs on industrial land and the agricultural preservation district is meant to protect ag.

Tom Treharne (NextEra Energy) addressed the Commission inquiring about the consideration of a specific proposal. He requested that in the development of a proposal that it consider issues that would pose challenges such as the 1000 ft. setbacks from dwellings, grading limitations, and the restriction to industrial ground only. Treharne indicated that the restriction to industrial land would create a host of challenges to industrial areas. He indicated that the overlay district is a good way to go and used Linn County as an example.

Roger Brink (Onawa) addressed the Commission indicating that government is paying farms to set aside CRP land and suggested that spraying field is worse than solar panels would be. Brink stated that the solar farms in Monona County don't seem to bother anyone.

Leo Jochum (Salix) addressed the Commission in support of Option #2 to allow for the overlay district. He offered concerns about the discrepancies with CSR1 vs. CSR2 because of the rainfall factor. Jochum discussed compatibility with grass and plant selection to ensure soil quality will be preserved. He stated that no concrete and blacktop is used which allows for transition back to agriculture. Jochum discussed setbacks of 150 to 300 ft from residences and questioned the two mile setback from the cities and the distances from the county right-of-way. He requested for material be received and placed into record by the Commission. Motion to receive Parker. Second by O'Tool. Carried 4-0. Copy available for review in the appendix.

Naomi Widman (Bronson) addressed the Commission and suggested that the motivations of people for ag solar need to be looked at, individuals will profit, not the county as a whole. Widman indicated that she is not opposed to solar, just not on ag land or an overlay district. She stated that the solar debate should be delayed until the comprehensive plan is completed. She indicated that it is important to the best interest of the entire community versus particular individuals who have a very significant financial interest. Widman stated that cherry picking parcels in the middle of ag land is not the best route.

Steve Corey (Salix) addressed the Commission indicating that Salix is in the dark in this debate. He offered concerns with what the county has to deal with as far as carbon sequestration, wind farms, and solar. Corey indicated that he is concerned about subsides and the weight on the taxpayers and the pandora's box this creates.

Greg Jochum (Salix) addressed the Commission offering support for the overlay on the Agricultural Preservation (AP) Zone. He indicated that the infrastructure is already in place with area transmission lines. Jochum is in favor of the overlay scorecard in place of the CSR2 rating that he explained at the Moville meeting. He suggested that the scorecard encourages more desirable native grass, plans, and pollinators. The NRCS would be involved in the selection of the best seed.

Rebekah Moerer (Sioux City) addressed the Commission asking about the benefit to those who live in the cities and to the people who own the land. She offered information about her experience of potentially equipping her property with solar and offered concerns about the expense. Moerer offered concerns about the costs to taxpayers with decommission fees. She suggested that utility-solar should be subject to land restrictions.

Motion to close public hearing by Parker. Second by O'Tool. Carried 4-0.

Priestley discussed the three utility-solar options and suggested for a work session in preparation of a recommendation to the Board of Supervisors.

Parker expressed interest in having a work session to prioritize the concepts before the Commission. She suggested streamlining this with the development plan process. Meister concurred. O'Tool indicated that it would be important to look into whether you expand industrial areas which would be part of the development plan versus an overlay district. He also stated it would be important to get more valid information about land values near solar. O'Tool indicated he would support another work session and expressed the importance of getting this right the first time. Zellmer Zant facilitated a scheduling discussion that resulted in January 17, 2023 at 5:00 PM for the work session. The regular meeting will be held on January 22, 2023 at 5:00 PM.

Public Comment on Matters Not on the Agenda
None

Commissioners Comment or Inquiry
None

Staff Update
None

Adjournment
Motion to adjourn Meister. Second by O'Tool. Carried 4-0. Meeting conclude 6:12 p.m.

Daniel Priestley Received from Alex Delworth, 11-27-23 - Woodbury County Zoning Commission Meeting

From: Alex Delworth <alexd@cfra.org>
Sent: Monday, November 27, 2023 10:58 AM
To: Daniel Priestley
Subject: Utility - Scale Solar Zoning
Attachments: Policy Approaches for Dual-use and AgriSolar Practices.pdf; making-the-case-for-solar-grazing-web.pdf; Environmental Impacts of Renewable Energy.pdf; Woodbury Zoning Comment.docx.pdf

Good Morning Daniel,

I am reaching out to provide a comment on behalf of the Center regarding the zoning meeting on utility-scale solar. Attached is our comment and a few resources that we shared earlier but may still be useful.

Feel free to reach out if you have any questions.

Thank you,

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Alex Delworth | Clean Energy Policy Associate
Center for Rural Affairs
1400 Fawcett Pkwy, Suite D2 | Nevada IA 50201
(402) 687-2100 x 1016
alexd@cfra.org | cfra.org

CENTER *for* RURAL AFFAIRS

11/27/23

Daniel Priestley
620 Douglas Street, 6th Floor
Sioux City, IA 51101

Re: Utility-Scale Solar Ordinance

The Center for Rural Affairs is a private non-profit organization that advocates for policies that strengthen rural communities to create a more vibrant future. Renewable energy projects have demonstrated significant potential to bring in new tax revenue, provide additional income for landowners, and create new jobs in rural areas. Given these benefits, we think ordinances regarding wind and solar should be fair and balanced. We commend the zoning board for their time and invitation for public input in this process for the two main proposals.

The first proposal being considered for the Utility-Scale Solar Energy Systems (US-SES) includes prudent requirements around the native vegetation and decommissioning sections. Planting native or perennial vegetation under the panels can increase soil health and provide pollinator habitat over the lifespan of the US-SES. Decommissioning plans ensure that the county won't bear any of the costs when projects are deconstructed and allowing the financial surety to be paid in intervals allows project owners to absorb the expense as an operating cost.

The second proposal for the US-SES Overlay District includes a few items that the commission may want to consider. The setback of 1,000 feet away from occupied dwellings is far greater than the distances we have seen most often, which are between 50-300 feet. However, the inclusion of a waiver will allow impacted landowners the flexibility to make decisions that affect their land.

Finally, the inclusion of a restriction on development on lands with a CSR2 of 65 or more for the US-SES Overlay District will severely limit the potential for solar development in Woodbury County. Using CSR2 designation restricts private property rights for landowners with higher-quality land. Renewable energy facilities can help keep the family farm financially sustainable by providing supplemental income to the operation. Additionally, restricting development on lands with a CSR2 of 65 or more would automatically eliminate almost 50% of land in Woodbury County for potential development.

Solar projects generally have minimal impact on land quality, and land can be returned to farming at the end of the project's life cycle if desired. Practices such as planting native or perennial vegetation under the panels can increase soil health and provide pollinator habitat. Site vegetation can also be managed through grazing, offering local farmers additional income opportunities and providing an avenue for the land to stay in agricultural use at the same time. Additional dual-use practices such as beekeeping and crop production under the panels offer additional opportunities to combine solar and agriculture, demonstrating that clean energy and agriculture do not require an either/or approach.

CENTER *for* RURAL AFFAIRS

This letter includes a few of our solar energy siting resources we hope you will find useful during discussions. One of our recent reports, *Policy Approaches to Dual-Use and Agrisolar Practices*, might be especially helpful given the central discussion around CSR and preserving agricultural lands. Additionally, our full clean energy siting library can be viewed at cfra.org/cleanenergysiting.

Sincerely,

Alex Delworth
Policy Associate
402.687.2100 EXT. 1016
alexd@cfra.org

Resources:
Policy Approaches for Dual-Use and Agrisolar Practices
Amplifying Clean Energy with Conservation
Native Vegetation and Solar Projects in Iowa

1400 FAWCETT PKWY SUITE D2 | NEVADA, IA 50201 | 402.687.2100 EXT. 1016 | CFRA.ORG

Policy Approaches for Dual-Use and Agrisolar Practices

By Heidi Kolbeck-Urlacher, Center for Rural Affairs
April 2023

CENTER *for* RURAL AFFAIRS

CONTENTS

INTRODUCTION

As demand for clean energy increases, solar deployment is expected to rise. Because utility-scale solar requires considerable land use, many state and local governments are prudently discussing the impact future solar development will have on agricultural lands. The practice of dual-use solar, which refers to allowing two uses to be accomplished in the same space, can

address concerns about solar on agricultural land.[1]

Agrisolar, also called agrivoltaics, is the co-location of agriculture and solar within the landscape. It includes solar co-located with crops, grazing, beekeeping, pollinator habitat, aquaculture, and farm or dairy processing. In addition to photovoltaics, it also includes concentrated solar installations.[2] The practice of combining agriculture and solar energy systems can provide numerous economic and environmental benefits. This includes improving economic viability for landowners and agricultural entities, providing beneficial ecological services, and expanding siting

1 Marieb, Dugan. "Dual-use Solar in the Pacific Northwest: A Way Forward." Renewable Northwest, 2019. Accessed March 2023.
2 Personal communication, Stacie Peterson, Energy Program Director, National Center for Appropriate Technology, March 2023.

opportunities for solar deployment.[3]

The purpose of this report is to provide decision makers and others an overview of policy approaches to combining solar with agriculture and offer considerations on how regulations can facilitate dual-use.

First, we will look at land use and solar, examining the impact expected by the rapid increase of solar development in the near future, and the varying level of responses occurring around clean energy siting regulations and guidance. Next, we will explore the types of dual-use applications and the benefits associated with them, and then move into an overview of policy mechanisms at the federal, state, and local levels that facilitate dual-use. Lastly, we will take a closer look at how local governments have the most impact on solar development, and offer considerations for decision-makers who are interested in creating ordinances or incentives around dual-use.

LAND USE AND SOLAR

How Much Land Will Be Needed?

As the U.S. moves toward setting ambitious decarbonization goals, solar energy is forecasted to grow considerably. Based on solar deployment scenarios by the U.S. Department of Energy (DOE), ground-based solar technologies may require a land area equivalent to 0.5% of the contiguous U.S. However, it is estimated that this requirement could be met using less than 10% of already disturbed or contaminated lands.[4]

By county, it does not appear that current or planned solar projects would require significant land allocation as a proportion of local area. In an analysis of all counties in the contiguous U.S., the Great Plains Institute found that existing solar development comprises on average 0.04% of land per county and that if all proposed solar projects were built, development would average 0.22% of land per county. As of 2021, no county in the U.S. had more than 4% of total county area in solar development. In contrast, cultivated lands comprise up to 75% of the total county area in much of the central Midwest.[5]

Some state and local governments have created restrictions around using farmland for solar development. However, clean energy development does not appear to pose an immediate threat to the availability of farmland. As of 2022, Iowa had 30.6 million acres of farmland, about 17.5 million of which meets the U.S. Department of Agriculture's (USDA) definition of "prime."[6,7] If all of the 2,290 MW of proposed solar projects in Iowa were sited on prime farmland, it would use only 0.11% of prime farmland in the state.[8]
According to Minnesota Solar Pathways, powering 70% of Minnesota's electrical load by 2050 would require adding 22 gigawatts of solar,

3 Macknick, Jordan, et al. "The 5 Cs of Agrivoltaic Success Factors in the United States: Lessons From the InSPIRE Research Study." National Renewable Energy Laboratory, 2022. Accessed March 2023.

4 "Solar Futures Study Fact Sheet." U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy, September 2021. Accessed March 2023.
5 Wyatt, Jessi, and Maggie Kristian. "The True Land Footprint of Solar Energy." Great Plains Institute for Sustainable Development, Sept. 14, 2021. Accessed March 2023.
6 "Prime Farmland Definition." Natural Resources Conservation Service, March 2015. Accessed March 2023.
7 "Iowa Solar and Agriculture Fact Sheet." Clean Grid Alliance. Accessed March 2023.
8 Ibid.

which would use 220,000 acres of land. Even if all of this solar were to be sited exclusively on prime farmland, it would still only use 1.32% of prime farmland in the state.[9]

Alternatives to Land-use Restrictions

Even though the land needed for solar development is proportionally low, many state and local governments have enacted or are considering enacting restrictions on clean energy development on farmland. In Iowa, some counties have considered using Corn Suitability Ratings (CSR) to restrict development,[10] [11] and state legislators have introduced bills prohibiting solar development on farmland.[12] [13] [14]

In Minnesota, the Public Utilities Commission's administrative rules restrict large electric generation plants from being located on prime farmland.[15] In Midwest states where a large percentage of the land qualifies as farmland, blanket restrictions such as these can severely impact opportunities for clean energy development.

However, some organizations concerned about the land use impacts of clean energy development have developed siting guidance that mitigates impacts to sensitive areas. For example, the American Farmland Trust, an organization dedicated to the preservation of farmland, has created a series of Smart Solar principles, which they believe meet three goals: accelerate solar energy development, strengthen farm viability, and safeguard land well-suited for farming and ranching.[16]

These principles include:[17]

Prioritize solar siting on buildings and land not well suited for farming

Including buildings, irrigation ditches, brownfields or other marginal lands.

Safeguard the ability for land to be used for agriculture

If developed on farm or ranch land, policies and practices should protect soil health, especially during construction and decommissioning.

Grow agrivoltaics for agricultural production and solar energy

Agrivoltaics sustain agricultural production under/between the solar panels.

Promote equity and farm viability

Farmers and underserved communities should benefit from solar development and should be included in stakeholder engagement processes.

9 "Minnesota Solar and Agriculture," Clean Grid Alliance. Accessed March 2023.
10 Whiskeyman, Danny, "Scott County Board of Supervisors approves new solar ordinance," KWQC, Sept. 20, 2022. Accessed March 2023.
11 Klotzbach, John, "County Considering Wind Turbine Ordinance Changes," Independence Bulletin Journal, Sept. 6, 2022. Accessed March 2023.
12 "Senate Study Bill 1077," Iowa Legislature, Jan. 24, 2023. Accessed March 2023.
13 "Senate File 2327," Iowa Legislature, Jan. 26, 2022. Accessed March 2023.
14 "Senate File 2321," Iowa Legislature, Feb. 17, 2022. Accessed March 2023.
15 "Minnesota Administrative Rules," Minnesota Legislature, Sept. 18, 2009. Accessed March 2023.
16 Sallet, Lori, "Growing Renewable Energy While Strengthening Farm Viability and Safeguarding Healthy Soil," American Farmland Trust, Sept. 22, 2022. Accessed March 2023.
17 Ibid.

This type of siting guidance offers a more nuanced approach to clean energy development. By taking a wider array of factors into consideration, including economic impacts and dual usage, this approach demonstrates that clean energy siting does not require an either/or mindset.

Through thoughtful planning, local decision makers can craft policies that respect the property rights of local landowners and allow them to take advantage of opportunities to diversify their income, while at the same time encouraging dual-use practices that preserve the agricultural values of the local community.

TYPES OF DUAL-USE

There are several types of dual-use practices that can be combined with solar energy sites including cultivating different types of crops such as vegetables and berries, utilizing livestock grazing for managing vegetation, beekeeping, and planting native vegetation and pollinator habitat. These practices can create environmental and economic benefits such as new revenue streams for local farmers, increased pollinators, wildlife habitat, enhanced soil health, reduced erosion, and carbon storage. These projects are not mutually exclusive, however, and multiple activities can occur simultaneously, or at different times of the year.[18]

Crops

A variety of agricultural crops can be grown in co-location with solar installations, including fruit, vegetables, and berries. Any crops that are successful in a region are likely to be suitable for co-location with solar projects. Crops can be grown under the panels, between rows, or outside the perimeter of the installation. Panel height, spacing, water access, equipment needs, and whether the system is fixed or tracking, all will play a role in the success of integrating specific types of crop production into a solar installation. Research is ongoing to better understand the performance and feasibility of co-locating crops with solar energy systems.[19] [20]

Iowa State University recently announced it will kick off a $1.8 million, four-year research project on dual-use and food crop production.[21] Similar food crop-focused research is ongoing through the Sustainably Colocating Agricultural and Photovoltaic Electricity Systems (SCAPES) projects at University of Illinois Urbana-Champaign, University of Arizona, Colorado State University, Auburn University, and

18 Macknick, Jordan, et al. "The 5 Cs of Agrivoltaic Success Factors in the United States: Lessons From the InSPIRE Research Study," National Renewable Energy Laboratory, 2022. Accessed March 2023.
19 "Suitable Agricultural Activities for Low-Impact Solar Development," InSPIRE, Aug. 11, 2022. Accessed March 2023.
20 Macknick, Jordan, et al. "The 5 Cs of Agrivoltaic Success Factors in the United States: Lessons From the InSPIRE Research Study," National Renewable Energy Laboratory, 2022. Accessed March 2023.
21 "ISU researchers to study growing crops in solar farms footprint," Iowa State University, Feb. 15, 2023. Accessed March 2023.

University of Chicago. [22]

Outside of food crops, researchers are also looking into whether more traditional row crops can be co-located with solar installations. For example, Purdue University is conducting field trials combining traditional crops like corn and soy with raised solar panels.[23]

Grazing

Solar grazing is the utilization of livestock, usually sheep, to manage vegetation at solar sites. It takes the place of traditional mowing and offers both environmental and financial benefits. For project developers, contracting with local farmers to use solar grazing as a management tool can reduce operations and maintenance costs. Solar grazing can offer local livestock owners additional pasture opportunities and the opportunity to be paid for a valuable service, increasing income to their business and adding to the economy of the rural communities where these projects are usually located.[24]

Beekeeping

Solar beekeeping is the practice of placing beehives on or near solar sites that have been planted in native vegetation or other pollinator habitats. Solar beekeeping can offer new revenue streams for local beekeepers, as well as the opportunity to gain resiliency from a diverse source of pollen for honey production.

Additionally, the landowner sees a positive impact from improved soil health, and nearby farmers profit from pollination services.[25] Pollinators are critical to crop production, with the USDA estimating that wild and managed bees together add $15 billion in crop value each year.[26] An Argonne National Laboratory case study found that the value of pollinator habitat on U.S. lands designated as proposed or potential solar sites is between $1.5 billion and $3.2 billion.[27]

Native Vegetation and Pollinator-Friendly Solar

Sites with native or naturalized, non-invasive, flowering vegetation are commonly referred to as "pollinator-friendly solar sites." Pollinator-friendly solar project sites offer habitat for honey bees, native bees, and other species of pollinators, all of which can positively benefit local agricultural production. Using native or pollinator-friendly vegetation provides numerous benefits, including reduced erosion, improved water quality and soil health, and increased habitat for wildlife. It can also reduce long-term operation and maintenance costs for project developers and site managers.[28]

Determining the appropriate types of dual-use projects most likely to be successful at a specific site can be daunting. However, research is ongoing to understand the components needed for successful deployment and operation of agrisolar projects. From 2015 to 2021, the Innovative Solar Practices Integrated with Rural Economies and Ecosystems (InSPIRE) project studied field research sites and identified five key elements that enable success. These elements were explored in the report *"The 5 C's of Agrivoltaic Success Factors in the United States: Lessons from the InSPIRE Research Study."* They include:[29]

Climate, soil, and environmental conditions
The ambient conditions and factors of the specific location that are beyond the control of the solar owners, solar operators, agrivoltaic practitioners, and researchers.

Configurations, solar technologies, and designs
The choice of solar technology, the site layout, and other infrastructure that can affect light availability and solar generation.

Crop selection and cultivation methods, seed and vegetation designs, and management approaches
The methods, vegetation, and agricultural approaches used for agrivoltaic activities and research.

Compatibility and flexibility
The compatibility of the solar technology design and configuration with the competing needs of the solar owners, solar operators, agricultural practitioners, and researchers.

Collaboration and partnerships
Understandings and agreements made across stakeholders and sectors to support agrivoltaic installations and research, including community engagement, permitting, and legal agreements.

POLICY APPROACHES TO DUAL-USE

Policies at the federal, state, and local levels of government can influence the implementation of dual-use solar. These policies interact, but overall, local land-use policies have been shown to be the most significant catalyst or inhibitor of agrisolar development.[30]

We will be looking at a variety of policy approaches at each level of government, including tax incentives, land use laws, renewable portfolio standards, and others.

22. Harwood, Lori. "UArizona Partners on $10M USDA Grant to Expand Research on Growing Crops Under Solar Panels." University of Arizona, Oct. 6, 2021. Accessed March 2023.
23. Bowman, Sarah, et al. "Can solar panels and row crops coexist on farmland across the skeptical Corn Belt?" Indy Star, Sept. 13, 2022. Accessed March 2023.
24. "Fact Sheet: Making the Case for Solar Grazing." Center for Rural Affairs, Dec. 20, 2021. Accessed March 2023.
25. "Fact Sheet: Making the Case for Solar Beekeeping." Center for Rural Affairs, Dec. 22, 2022. Accessed March 2023.
26. Marieb, Dugan. "Dual-use Solar in the Pacific Northwest: A Way Forward." Renewable Northwest, 2019. Accessed March 2023.
27. "Case Study: Economics of Pollinator Habitats at Solar Facilities." Argonne National Laboratory. Accessed March 2023.
28. Smith, Cody. "Amplifying Clean Energy with Conservation, Part One: Pollinator-Friendly Solar." Center for Rural Affairs, October 2020. Accessed March 2023.
29. Macknick, Jordan, et al. "The 5 Cs of Agrivoltaic Success Factors in the United States: Lessons From the InSPIRE Research Study." National Renewable Energy Laboratory, 2022. Accessed March 2023.
30. Pascaris, Alexis S. "Examining existing policy to inform a comprehensive legal framework for agrivoltaics in the U.S." Energy Policy, December 2021. Accessed March 2023.

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Federal

Because land use decisions are typically made at the local level, the role of federal policy in encouraging or discouraging dual-use applications is limited. However, two primary incentives exist for solar development—the Business Energy Investment Tax Credit (ITC) and USDA's Rural Energy for America Program (REAP). Additionally, federal investments in dual-use can help bolster the practice.

Tax incentives

The ITC is the sole corporate tax credit available for solar. The tax credit does not include any restrictions that would disallow solar on specific locations, making it acceptable for combination with dual-use.[31]

Land-use laws

Authority over land use in the U.S. is held by state and local governments.[32]

Portfolio standards

Renewable portfolio standards are policies that require electricity suppliers to provide customers with a stated amount of electricity from renewable sources. Although the idea of a federal renewable portfolio standard has been proposed, no such policy currently exists.[33]

Other

REAP grants and loan guarantees offer financial assistance to agricultural producers and small businesses for energy improvements or investments. This can include construction of solar energy systems and does not present conflicts with dual-use integration.[34]

In 2022, DOE announced an $8 million investment in agrivoltaic research projects. The

Foundational Agrivoltaic Research for Megawatt Scale-funding program is aimed at developing best practices, seeking replicable models, providing new economic opportunities, and reducing land-use conflicts.[35] In 2022, USDA's Partnerships for Climate Smart Commodities awarded the University of Arizona $4.7 million[36] and the University of Texas Rio Grande Valley $2.2 million[37] for agrivoltaic research projects.

State

State policy approaches to dual-use include tax and other financial incentives, state-level land-use laws, renewable portfolio standards, and pollinator scorecards. State-level policies interact with local decision making in ways that can either enable or restrict local governments from enacting certain practices or policies.

Tax incentives

States can incentivize solar dual-use practices through land use taxes. If landowners are able to integrate solar development into their farming operation without a land-use tax change, they may be more receptive to the development. For example, Rhode Island has amended its Farm,

31 Ibid.
32 Ibid.
33 "Renewable energy explained: Portfolio standards," U.S. Energy Information Administration, November 30, 2022. Accessed March 2023.
34 Pascaris, Alexis S. "Examining existing policy to inform a comprehensive legal framework for agrivoltaics in the U.S." Energy Policy, December 2021. Accessed March 2023.

35 "DOE Announces $8 Million to Integrate Solar Energy Production with Farming," U.S. Department of Energy, Dec. 8, 2022. Accessed March 2023.
36 "Media Advisory: USDA awards over $4.7M to support and promote 'climate-smart' food production," University of Arizona, Dec. 19, 2022. Accessed March 2023.
37 Gonzalez, Maria. "UTRGV receives $2.2M grant for 'Climate-Smart' Commodities project," University of Texas Rio Grande Valley, Dec. 12, 2022. Accessed March 2023.

Policy Approaches for Dual-use and AgriSolar Practices

Forest, and Open Space Land law to exempt landowners from a land-use change tax if they are integrating a dual-use renewable energy generation system, which is defined as a wind or solar system that allows agricultural practices to continue around it under normal practices.[38] [39]

Similarly, in 2021, New Jersey enacted a Dual-Use Solar Law, which provides an incentive for keeping land at solar sites in agricultural production. The law established a pilot program allowing unpreserved farmland used for dual-use solar projects to be eligible for farmland assessment under certain conditions.[40]

The AgriSolar Clearinghouse maintains an interactive map detailing dual-use financial incentives throughout the United States, including potential funding sources, assistance programs, utility incentives, and tax breaks. It can be found at: agrisolarclearinghouse.org/financial-information-map.

Land-use laws

State-level land use laws can significantly impact where solar development can happen. For example, Illinois' Agricultural Areas Conservation & Protection Act creates land areas where only agricultural production is allowed.[41]

As dual-use has evolved, debates about whether implementation of these practices at solar sites should qualify as agricultural land use are ongoing. One practice states can employ to help facilitate dual-use at solar sites is to review land use planning goals and definitions of solar generation, farmland, and farm uses to ensure they do not preclude dual-use solar.[42]

Some states have created statewide siting standards to regulate clean energy development. For example, in early 2023, lawmakers in Illinois passed House Bill 4412, which dictates statewide setbacks for wind and solar development.[43] Alternative approaches, such as the creation of state-specific best practices, model ordinances, or voluntary siting matrices offer ways to preserve local control while also providing helpful guidelines for local decision makers.[44] [45]

38 "Rules and Regulations for Enforcement of the Farm, Forest, and Open Space Act," Rhode Island Department of State. Accessed March 2023.
39 Marleb, Dugan. "Dual-use Solar in the Pacific Northwest: A Way Forward," Renewable Northwest, 2019. Accessed March 2023.
40 "Chapter 170," New Jersey Legislature, 2021. Accessed March 2023.

41 Guarino, Jessica, and Tyler Swanson. "The Illinois Agrivoltaics Regulatory and Policy Guide Analyzes State and Local Laws," AgriSolar Clearinghouse, Feb. 1, 2023. Accessed March 2023.
42 Marleb, Dugan. "Dual-use Solar in the Pacific Northwest: A Way Forward," Renewable Northwest, 2019. Accessed March 2023.
43 Moore, Brenden. "New Illinois state energy project standards welcomed by some, resisted by others," The Pantagraph, February 11, 2023. Accessed March 2023.
44 Marleb, Dugan. "Dual-use Solar in the Pacific Northwest: A Way Forward," Renewable Northwest, 2019. Accessed March 2023.
45 Mouw, Lindsay. "Exploring Siting Guidance: Agriculture Siting Matrices Inform Renewable Energy Siting," Center for Rural Affairs, July 2022. Accessed March 2023.

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Portfolio standards

As of 2021, 31 states and the District of Columbia had adopted renewable portfolio standards or clean energy goals.[46] Within these standards, "carve out" provisions can be used to encourage the adoption of certain technologies, such as solar and dual-use. As of 2021, 21 states had solar carve-out provisions in their renewable portfolio standards. Massachusetts' SMART program is one example of such a renewable portfolio standard that also incorporates incentives for dual-use.[47]

Other

Under the Massachusetts Department of Energy's Solar Massachusetts Renewable Target (SMART) program, specific kinds of dual-use solar systems, known as Agricultural Solar Tariff Generation Units (ASTGU), can qualify for financial incentives. To qualify, the land under the solar system must be in continuous agricultural production. The SMART program offers a base cents-per-kilowatt-hour compensation rate for new solar arrays. Systems using these practices that qualify as an ASTGU receive an additional 6 cents per kilowatt-hour to the base rate.[48] [49] [50]

Many states across the U.S. have created policies or programs to encourage or require implementation of pollinator habitat at solar

sites. These initiatives can vary widely in their structure and implementation. One tool is a pollinator scorecard, which provides a model to score pollinator-friendly practices. This score can be used to gauge if a site meets state or local requirements, to designate a site as pollinator-friendly, or to determine if a site qualifies for other types of incentives.[51]

For example, Minnesota state code (§216B.1642)[52] authorizes the Board of Soil and Water Resources to establish statewide guidance for solar project developers aiming for recognition under the Habitat Friendly Solar Program. The statute reads, "...an owner of a solar site implementing solar site management practices may claim that the site provides benefits to gamebirds, songbirds, and pollinators only if the site adheres to guidance set forth by the pollinator plan provided by the Board of Water and Soil Resources."[53] [54]

Local

Local land-use policy is the key leverage point

46 Bowers, Richard. "Five states updated or adopted new clean energy standards in 2021." U.S. Energy Information Administration, February 1, 2022. Accessed March 2023.
47 Pascaris, Alexis S. "Examining existing policy to inform a comprehensive legal framework for agrivoltaics in the U.S." Energy Policy, December 2021. Accessed March 2023.
48 "Dual-Use: Agriculture and Solar Photovoltaics." University of Massachusetts Amherst. Accessed March 2023.
49 "Guideline Regarding the Definition of Agricultural Solar Tariff Generation Units." Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs, Department of Energy Resources, Department of Agricultural Resources, April 26, 2018. Accessed March 2023.
50 "SMART Program Incentives for Solar Arrays." University of Massachusetts Amherst. Accessed March 2023.
51 "Pollinator-Friendly Solar Scorecards." Fresh Energy. Accessed March 2023.
52 "2019 Minnesota Statutes." Office of the Revisor of Statutes, Minnesota Legislature. Accessed March 2023.
53 "Minnesota Habitat Friendly Solar Program." Minnesota Board of Water and Soil Resources, 2019. Accessed March 2023.
54 Smith, Cody. "Amplifying Clean Energy with Conservation, Part One: Pollinator-Friendly Solar." October 2020. Accessed March 2023.

for enabling development on land suitable for combining agriculture and solar energy production.[55] This is because local governments usually have the most influence over land use, including the ability to regulate zoning and develop siting ordinances that dictate how and where development can occur. Tax incentives and renewable portfolio standards are seen more in state-level policy.

Tax incentives

Local governments have the ability to create tax incentives, though these are more common in state-level policy.

Land-use laws

Land-use laws are the primary lever for local governments to facilitate dual-use. However, despite rapid expansion of solar energy development, many local governments have not addressed siting in their ordinances. In a review of local-level policies in Illinois, researchers found that many counties had no solar siting ordinance on the books, and the counties that did represented drastically different approaches to zoning and land-use policy.[56] As of 2020, only 19% of zoning ordinances in Michigan addressed utility-scale solar siting.[57] When counties lack an ordinance, it can create uncertainty for decision makers and developers, who won't know if the land use is permitted or prohibited.[58]

Solar siting often depends on the county's comprehensive land-use plans and resulting zoning and siting ordinances. When developing ordinances, local decision makers often use the county's land-use planning goals to help guide the process. For example, in Buchanan County, Iowa, county supervisors cited language in their comprehensive land-use plan about preserving agricultural lands with highly productive soils to propose a restriction on clean energy development on lands with high CSR.[59] Expressing similar concern, Scott County, Iowa passed an ordinance restricting solar development on lands with high CSR.[60] [61]

Conversely, some counties have identified renewable energy development as a priority within their comprehensive land-use plan. Linn County, Iowa's comprehensive plan contains a section on renewable energy, which identifies an objective to "encourage development of local alternative and renewable energy resources through identification and removal of regulatory

55 Pascaris, Alexis S. "Examining existing policy to inform a comprehensive legal framework for agrivoltaics in the U.S." Energy Policy, December 2021. Accessed March 2023.
56 Guarino, Jessica, and Tyler Swanson. "The Illinois Agrivoltaics Regulatory and Policy Guide Analyzes State and Local Laws." AgriSolar Clearinghouse, Feb. 1, 2023. Accessed March 2023.
57 Pascaris, Alexis S. "Examining existing policy to inform a comprehensive legal framework for agrivoltaics in the U.S." Energy Policy, December 2021. Accessed March 2023.
58 Ibid.
59 Klotzbach, John. "County Considering Wind Turbine Ordinance Changes." Independence Bulletin Journal, Sept. 6, 2022. Accessed March 2023.
60 "Scott County Ordinance NO. 22 -04." Scott County, Iowa, Sept. 15, 2022. Accessed March 2023.
61 Whiskeyman, Danny. "Scott County Board of Supervisors approves new solar ordinance." KWQC, Sept. 20, 2022. Accessed March 2023.

barriers."[62]

Additionally, local governments can adopt siting ordinances that dictate specific dual-use management practices at solar sites. For example, ordinances can require sites to be planted in native vegetation or pollinator habitat, or to be maintained by livestock grazing.

Portfolio standards

Both municipalities and utilities have the ability to set their own renewable electricity goals.

Other

Community agrisolar projects can improve local buy-in by providing an opportunity for community members to become shareholders.[63]

CONSIDERATIONS FOR LOCAL DECISION MAKERS: HOW ORDINANCES CAN FACILITATE DUAL-USE

Decision makers who want to facilitate the combination of clean energy development and agriculture should consider the following topics when engaging in the ordinance development or amendment process:

Land-use Planning

Comprehensive land-use plans are commonly used by counties to help guide development. These plans reflect the values and vision of the community and, in rural areas, they often contain language relating to the preservation of agricultural heritage and farmland. The way this language is interpreted varies widely between counties, and some decision makers may have difficulty interpreting how language around agricultural resource protection relates to dual-use.[64]

Implementation of dual-use practices can provide an alternative to an either/or mindset relating to agriculture and clean energy development, as they allow land to stay in agricultural use. Combining livestock grazing, crop production, and other endeavors with solar sites preserves the agricultural roots of rural communities while also allowing landowners and counties to take advantage of the environmental and economic benefits of clean energy development.

Including renewable-energy development within the county's comprehensive plan can ensure the economic benefits of this development are taken into consideration when ordinances are created or amended in the future. Clean energy can benefit counties in the form of increased tax revenues, lease payments to local landowners, and job creation. Combining this development with dual-use can offer increased environmental benefits and provide new revenue streams for local farmers.

Zoning and Siting Regulations

Local decision makers can ensure that development is done in a way that meets the needs of the community by engaging in a proactive ordinance development process. By taking the time to create an ordinance before development has been proposed, decision makers can ensure there is time to receive

62 "Linn County Comprehensive Plan: Volume 1." Linn County, Iowa, July 19, 2013. Accessed March 2023.
63 Brunswick, Sarah, and Danika Marzillier. "The New Solar Farms: Growing a Fertile Policy Environment for Agrivoltaics." Minnesota Journal of Law, Science & Technology, March 4, 2023. Accessed March 2023.

64 Marieb, Dugan. "Dual-use Solar in the Pacific Northwest: A Way Forward." Renewable Northwest, 2019. Accessed March 2023.

community input and feedback on proposed language. Additionally, considerations can be made about setting additional land use expectations, such as dual use.

Counties wanting to enable dual-use integration should consider zoning schemes that allow for mixed land usage. This could include overlay districts, which would allow a special permit for solar in certain zones, or allowing development when certain land use standards are met, such placing a certain percentage of land into pollinator habitat.[65]

Siting regulations should be carefully crafted to ensure they don't restrict dual-use. For example, setting restrictions on panel height or developing overly prescriptive vegetation management requirements can limit dual-use opportunities.

Definitions

When creating definitions within zoning and siting regulations, local governments can ensure they do not preclude dual-use solar. This could include refining definitions for solar generation, farmland, and farm uses to ensure compatibility with desired dual-use practices.[66]

It is also important to determine wich applications and practices will be considered dual-use. For example, in Oregon, a rule was adopted allowing for dual-use practices on high-value soils. However, the rule only specifies agrivoltaics and grazing, meaning pollinator habitats or other conservation dual-use do not qualify.[67]

Interaction of Dual-use Goals

When creating policies, it is especially important to carefully consider how the dual-usage goals interact. Certain requirements may unintentionally restrict beneficial practices. For example, native vegetation or pollinator-friendly habitat requirements may unintentionally limit grazing opportunities if plants on the site are not suitable. In the same vein, to meet pollinator requirements vegetation must be allowed to bloom to ensure it is actually benefiting pollinators, requiring grazing schedules be modified to accommodate bloom times.[68]

65 Pascaris, Alexis S. "Examining existing policy to inform a comprehensive legal framework for agrivoltaics in the U.S." Energy Policy, December 2021. Accessed March 2023.
66 Marieb, Dugan. "Dual-use Solar in the Pacific Northwest: A Way Forward." Renewable Northwest, 2019. Accessed March 2023.
67 Ibid.

It is wise to consider that 100% of land may not be able to be integrated into dual-use. Setting overly strict guidance could deter development if prescriptions are not feasible. Instead, requiring a percentage of land to be used for dual-use purposes introduces a level of flexibility while ensuring that the original intent of the usage policy is preserved.

Site Construction, Decommissioning, and Restoration

Although not directly related to dual-use, local governments can use ordinances to minimize land impacts during the construction and decommissioning of solar systems.

Solar projects generally have minimal impact on land quality, and land can be returned to farming at the end of the project's life cycle, if desired. However, being clear about how land will be

68 "Fact Sheet: Making the Case for Solar Grazing." Center for Rural Affairs, Dec. 20, 2021. Accessed March 2023.

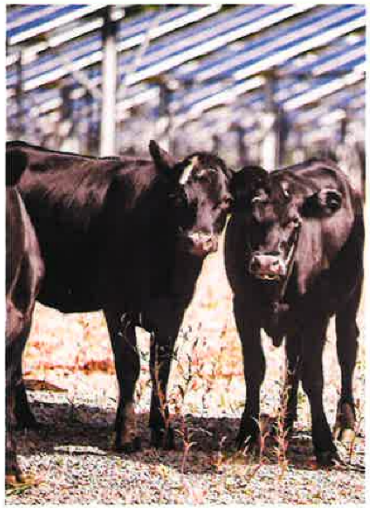
managed during construction as well as once a project is decommissioned can help protect land quality. Local governments can set requirements for construction, vegetation management, and decommissioning that spell out the expectations and obligations. This can also include requiring financial guarantees to ensure funds are available for decommissioning purposes and that local governments are not responsible for costs.[69]

KEY TAKE-AWAYS

Solar development is expected to rise significantly in the coming years. Although deployment models reflect that will require a large amount of land, it is expected it will require 0.5% of land in the contiguous U.S. and, in many cases, can be placed on already disturbed or marginal lands. Even if all proposed projects in Minnesota and Iowa were sited on prime farmland, it would only represent 1.32% and 0.11% of all prime land in those states, respectively.

Clean energy and agriculture do not require an either/or approach. Through thoughtful planning, local decision makers can craft policies that respect the property rights of local landowners and allow them to take advantage of opportunities to diversify their income, while at the same time encouraging dual-use and agrisolar practices that preserve the agricultural values of the local community.

Dual-use and agrisolar practices can include cultivating crops, utilizing livestock grazing, beekeeping, and planting native vegetation and pollinator habitat. These practices can create a variety of environmental and economic benefits, such as new revenue streams for local farmers, increased



pollinators, wildlife habitat, and soil health, reduced erosion, and carbon storage.

Policies exist at the federal, state, and local levels of government that can influence the implementation of dual-use solar and agrivoltiacs. These policies interact but overall, local land-use policies have the most significant role in impacting solar and agrivoltaic development.

By engaging in a proactive ordinance development process, local decision makers can ensure that development is done in a way that meets the needs of their community. Creating an ordinance in advance of development ensures there is time to receive community input and feedback on the proposed language.

69. Kolbeck-Urlacher, Heidi. "Decommissioning Solar Energy Systems Resource Guide." Center for Rural Affairs, June 2022. Accessed March 2023.

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FACT SHEET:

MAKING THE CASE FOR SOLAR GRAZING

As solar projects across the nation continue to expand, solar grazing has emerged as a valuable tool. Using livestock to manage vegetation at solar sites can enhance site value by keeping land in agricultural use, providing new income streams for local farmers, and adding environmental benefits such as decreased erosion and enhanced soil health.

"Agrivoltaics" is a term used to describe combining agriculture with renewable energy. Other types of agrivoltaics include producing hay, berries, vegetables, and honey at solar sites.[1]

ECONOMICS

Solar grazing is the utilization of livestock, usually sheep, to manage vegetation at solar sites. It takes the place of traditional mowing, offering numerous environmental and financial benefits and meeting clean energy and agricultural goals simultaneously. For project developers, contracting with local farmers to use solar grazing as a management tool can reduce operations and maintenance costs. A 2018 Cornell University study found that managing solar site vegetation with sheep grazing required two and half times less labor, making it less expensive than traditional landscaping.[2] Meanwhile, solar grazing provides livestock owners with additional pasture opportunities and the chance to be paid for a valuable service, increasing income to their business and adding to the economy of the rural communities where these projects are usually located.

ENVIRONMENTAL BENEFITS

Solar grazing can also add environmental benefits to a project site. Introducing livestock onto the landscape and partnering them with native vegetation can improve soil health and reduce runoff. The deep, complex root systems of native vegetation help retain water, reduce topsoil loss, and provide wildlife and pollinator habitat.[3] Sites with native vegetation can have three and one-half times more pollinators than sites without.[4] This vegetation provides habitat for bees and other pollinators, as well as ground nesting birds including sage grouse, pheasants, and quail. Pollinator plantings can coexist with solar grazing with careful planning and management, such as developing a rotational grazing plan that accommodates vegetation bloom periods.[5]

Sources

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2 Kochendoerfer, Nikola, et al. "The agricultural, economic and environmental potential of co-locating utility scale solar with grazing sheep." David R. Atkinson Center for a Sustainable Future, Cornell University, 2019, solargrazing.org/wp-content/uploads/2021/02/Atkinson-Center-Full-Report.pdf. Accessed November 2021.

3 Dreves, Harrison. "Beneath Solar Panels, the Seeds of Opportunity Sprout: Low-Impact Development of Solar Installations Could be Win-Win-Win for Food, Water, and Renewable Energy." National Renewable Energy Laboratory, 2019, nrel.gov/news/features/2019/beneath-solar-panels-the-seeds-of-opportunity-sprout.html. Accessed November 2021.

4 Schulte, Lisa A., et al. "Prairie strips improve biodiversity and the delivery of multiple ecosystem services from corn–soybean croplands." Proceedings of the National Academy of Sciences of the United States of America, Oct. 17, 2017, pnas.org/content/114/42/11247. Accessed November 2021.

5 "Solar Grazing FAQ." American Solar Grazing Association, solargrazing.org/faq. Accessed November 2021.

PLANNING

Including solar grazing as a goal in the beginning stages of project planning will allow developers to tailor sites for optimal grazing management. Solar grazing is most successful when deployed as part of a strategic, rotational grazing plan.

Photo courtesy of Minnesota Native Landscapes

STEP 1

Goal setting

Developers should identify their project goals and build a site plan that reflects the solar grazing co-usage goals. Other beneficial practices, such as pollinator or wildlife habitat and establishment of native vegetation, should be considered, but weighing how these goals can complement or impede each other is important.

STEP 2

Determine site conditions

Developers should develop a timeline for site establishment. Introduction of regular livestock grazing should be withheld until native vegetation at the site is fully established—between one and three years. Flash grazing during this period can be used for weed control. Consulting with local experts is key when selecting a seed mix for the site that is regionally appropriate and suitable for livestock grazing. Other factors that should be considered include site size, accessibility of the site, electricity and water access, and fencing. Although wildlife fencing provides benefits to sites with native plantings, it is not suited for grazing sites due to the gaps at the bottom.[6]

STEP 3

Select livestock species and determine population

Sheep are the most widely used and best-suited livestock for solar grazing.[7] They are smaller than cattle and are not likely to damage equipment. Cattle have been successfully used in solar sites, but panel height becomes a necessary consideration.[8] Determining the number of animals used during grazing management will depend on available forage and the length of the grazing period.

STEP 4

Establish a robust rotational grazing and vegetation management plan for the site

Creating a rotational grazing plan is key to ensuring proper management of vegetation and for the health of grazing animals. Consult with local grazing experts to create a goal-oriented, site-specific plan. Temporary fencing may be employed for "mob" or rotational grazing. Sheep should be moved at least once a week to allow recovery of grazed plants and should not return to a previously grazed paddock for at least six weeks.[9]

Sources, continued

6 Personal communication, Audrey Lounax, Grazing Manager, Minnesota Native Landscapes, October 2021.

7 "What is Solar Grazing?" American Solar Grazing Association, solargrazing.org/what-is-solar-grazing. Accessed November 2021.

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9 Frenay, Erica. "Solar Grazing: Livestock as Landscapers at Utility-Scale Solar Arrays." Cornell Small Farm Program, July 20, 2020, smallfarms.cornell.edu/2020/07/solar-grazing-livestock-as-landscapers-at-utility-scale-solar-arrays. Accessed November 2021.

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CONSIDERATIONS

Developers and farmers must work together to develop contracts that serve the needs of both parties. Longer-term contracts allow farmers to make investments in best practices. Site managers should ensure fencing, gates, and water access are maintained.[10] Carrying proper insurance and having clear contracts that spell out who is allowed at the site is important for the safety of the animals, equipment, and people.

SOLAR GRAZING AND SEED MIXES

Seed mixes should be regionally appropriate and site-specific. Consult with local experts to develop a location-specific mix. Many seed mixes can support both pollinators and livestock. If pollinator habitat is a goal, carefully timing grazing schedules is necessary to accommodate bloom times.

POLICIES

Policymakers can develop zoning and tax policies that incentivize beneficial practices, such as solar grazing. It is important to recognize that vegetation management goals may differ from site to site. Ordinances that include native vegetation and/or pollinator-friendly rules should not be so strict that they reduce opportunities for other beneficial practices, such as grazing.

- In 2021, New Jersey enacted a "Dual-Use Solar Law" which provides an incentive for keeping land at solar sites in agricultural production. S3484 established a pilot program allowing unpreserved farmland used for dual-use solar projects to be eligible for farmland assessment under certain conditions.[11]
- Under the Massachusetts Department of Energy's Solar Massachusetts Renewable Target (SMART) program, specific kinds of dual-use solar systems, known as "Agricultural Solar Tariff Generation Units," can qualify for financial incentives. To qualify, the land under the solar system must be in continuous agricultural production.[12]

Sources, continued

10 "Recommendations." American Solar Grazing Association, solargrazing.org/recommendations. Accessed November 2021.

11 "Chapter 170." New Jersey Legislature, 2021, njleg.state.nj.us/2020/Bills/PL21/170_.PDF. Accessed November 2021.

12 "Dual Use: Agriculture and Solar Photovoltaics." University of Massachusetts Amherst, Center for Agriculture, Food, and the Environment, May 2018, ag.umass.edu/clean-energy/fact-sheets/dual-use-agriculture-solar-photovoltaics. Accessed November 2021.

FACT SHEET: ENVIRONMENTAL IMPACTS OF RENEWABLE ENERGY— WIND AND SOLAR

Renewables have been the fastest growing energy source since 2017 when costs reached a key milestone. Costs dropped enough to make wind and solar the cheapest form of conventional energy.[1] Rural communities often carry this infrastructure. This fact sheet looks at the environmental impacts of wind and solar development.

WIND

Bird and bat species are a top concern for protection from wind turbines.

Especially key protected, threatened, or endangered species: Indiana bat, northern long-eared bat, little brown bat, tri-colored bat, and bald eagles.

Wind developers are now performing acoustic surveys and radio tracking of threatened species to understand migration, mating, and nesting habits.

- Each developer must file for an Incidental Take Permit with the nearest U.S. Fish & Wildlife Service Ecological Services Office, which sets a limit to the amount of damage by wind turbines to vulnerable species.

That application includes a Habitat Conservation Plan detailing how the developer will not only avoid damaging, but protect vulnerable species.[2]

- These plans are part of complying with the Endangered Species Act.[3]
- Operating wind farms must conduct baseline bird and bat fatality monitoring in compliance with state and federal law.

Turbines are checked weekly for bird and bat fatalities.

- Investing in habitat conservation and considering the nesting and migration patterns are also options to meet requirements.

1 "Levelized Cost of Energy and Levelized Cost of Storage 2018." Lazard, Nov. 8, 2018, lazard.com/perspective/levelized-cost-of-energy-and-levelized-cost-of-storage-2018/. Accessed December 2018.
2 "Habitat Conservation Plan Handbook." U.S. Fish & Wildlife Service, Jan. 18, 2018, fws.gov/endangered/what-we-do/hcp_handbook-chapters.html. Accessed December 2018.
3 "Habitat Conservation Plans: Section 10 of the Endangered Species Act." U.S. Fish & Wildlife Service, Aug. 29, 2018, fws.gov/midwest/endangered/permits/hcp/hcp_wofactsheet.html. Accessed December 2018.

SOLAR

- Land used for utility scale solar projects can cause habitat loss.
  - Pollinator-friendly solar sites can combine habitat for pollinators with solar arrays, and has been supported through state policy in Maryland, Minnesota, New York, and Illinois.[4,5]
- Three states—Connecticut,[6] North Carolina,[7] and Washington[8]—have passed policies restricting siting solar projects on agricultural land through either state legislation or county ordinances.
  - As an alternative, low-impact solar and co-location of solar and agriculture is a growing area of research with three categories of design:
    1. Solar-centric
    2. Vegetation-centric
    3. Co-location[9]

Solar developers have found that combining solar generation with pollinator habitat or grazing land can reduce operations and maintenance costs.[10]

4 "Conservation: (525 ILCS55/1) Pollinator Friendly Solar Site Act." Illinois General Assembly, Aug. 21, 2018, ilga.gov/legislation/ilcs/ilcs3.asp?ActID=3900&ChapterID=44. Accessed December 2018.
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9 Mow, Benjamin. "Solar Sheep and Voltaic Veggies: Uniting Solar Power and Agriculture." U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy-National Renewable Energy Laboratory, June 6, 2018, nrel.gov/state-local-tribal/blog/posts/solar-sheep-and-voltaic-veggies-uniting-solar-power-and-agriculture.html. Accessed December 2018.
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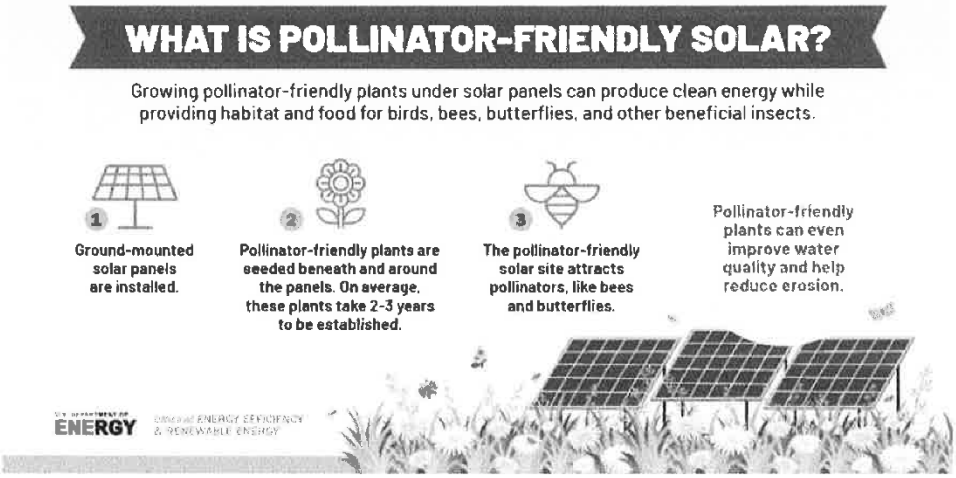
Solar Energy Technologies Office

Buzzing Around Solar: Pollinator Habitat Under Solar Arrays

JUNE 21, 2022

By: Michele Boyd, Program Manager, Strategic Analysis and Institutional Support



Pollinators—such as bees, butterflies, and other insects—are critical to the success of about 35 percent of global food crop production. In order to thrive, pollinators must have a suitable habitat. Establishing pollinator-friendly plants under and around ground-mounted solar arrays has the potential to provide this critical habitat and benefit both the pollinators and nearby agriculture. But a number of important questions remain about the impacts of pollinator-friendly solar and how to implement it at a large scale.

The U.S. Department of Energy Solar Energy Technologies Office (SETO) is working to better understand the economic, ecological, and performance impacts of co-locating pollinator habitat and solar arrays. This research is part of our broader agrivoltaics research, which studies how solar and agriculture can co-locate. Some of that research includes:

- Seed mixes and stormwater management in Georgia: A pollinator-friendly solar farm on former U.S. President Jimmy Carter's land is one of five solar sites being used to study stormwater infiltration and runoff at solar farms. They are testing three different seed mixes, including the

industry-standard grass, a low-diversity pollinator mix, and a high-diversity planting pollinator mix.

Black-eyed Susan flowers are blooming at sunrise at the Carter Farms solar site.

Jill Stuckey

- Ecological and performance impact studies in the Midwest: SETO funded a project led by the University of Illinois to investigate solar co-located with pollinator plantings at large-scale installations, with teams of researchers working at seven separate sites in the Midwest. From their findings, they will develop a pollinator planting manual, cost-benefit calculator, native seed mix selection tool, and pollinator assessment tool. Together, these tools will address questions on project cost, return on investment, logistical needs, and site- or project-specific constraints.

National Institute of Food and Agriculture
UNITED STATES DEPARTMENT OF AGRICULTURE

Protecting Pollinators Critical to Food Production

June 10, 2022

NIFA AUTHORS

Margaret Lawrence, Writer-Editor

Pollinators help ensure the world eats. Scientists estimate that about 75% of the world's flowering plants and about 35% of the world's food crops depend on animal pollinators to produce.

While more than 3,500 species of native bees help increase crop yields, pollinators include many more species than just bees. Flowers can be pollinated by both insects and animals - such as bees, wasps, moths, flies, butterflies, birds and even small mammals such as bats.

Despite their importance, many pollinators are declining in numbers, posing a threat not only to the world's ecosystems but to global food security as well. To help address overall pollinator decline, USDA's National Institute of Food and Agriculture (NIFA) partners with Land-grant Universities (LGUs), U.S. government laboratories, and private and nonprofit organizations to support research, education, and extension programs advancing pollinator health.

Since 2020, NIFA has awarded $15.98 million via more than 40 competitive grants including Agriculture and Food Research Initiative grants as well as non-AFRI grants. Additionally, NIFA capacity funding to Land-grant Institutions supported 28 additional research and Extension projects.

Multi-State Project Reaping Rewards

NIFA's Multi-State Research Fund also provides crucial support to projects that incorporate multiple institutions tackling vital projects. One such grant brought together the **University of California**, **Cornell University**, **Cornell Cooperative Extension**, **Delaware Cooperative Extension**, **University of Illinois**, **Louisiana State University**, **University of Massachusetts**, **Michigan State University**, **University of Minnesota**, **Mississippi State University**, **University of Nebraska**, **University of New Hampshire**, **North Carolina Cooperative Extension**, **Pennsylvania State University**, **Purdue University**, **Rutgers University, University of Vermont**, and **Virginia Tech.** Their goal—harness chemical ecology to address agricultural pest and pollinator challenges. To reduce reliance on pesticides, scientists explored ways to harness natural plant defenses, such as emitting chemicals that slow insect feeding, inhibit infections, call beneficial insects to their aid or warn other plants.

Received from Christopher Widman, 11-27-23 - Woodbury County Zoning Commission Meeting

To: Woodbury County Zoning Commision

Questions Submitted at Nov 27, 2023 meeting

1. Does the county have a map showing where the signed solar easements are located in the county? If so, can you provide this map to the public with a listing of parcels and owners?

2. Can the Solar Utilities within Ag Preservation Land designate a setback from a residence to a one mile radius? Studies have shown that property values within 0.5 miles of solar farms are negatively impacted by solar farms (See attached article or link) (link: Do Solar Farms Lower Property Values? A New Study Has Some Answers - Inside Climate News)

3. If the county grants an overlay within Ag Preservation Land and does not designate the setbacks greater than 0.5 miles, does the county think there is precedent to win a legal case brought from landowners within 0.5 miles of the solar farms who believe their land values are decreased due to the solar farm? Please provide a listing of legal cases that show legal precedent has been made in other counties.

4. Per the packet provided at the meeting today, it appears that the majority of the people who have spoken at prior meetings in favor of the solar projects on Ag Preservation land have signed easements with solar companies or utility companies. (See attached listing of landowners and parcels that have signed easement contracts.) It would appear those people are primarily promoting private interest rather than the general welfare of the county. If the Woodbury County Zoning Commission makes the changes to allow an overlay that would allow these landowners with existing easement contracts to build solar utilities on the Ag Preservation Land, does the county believe they can show that the changes were made within a comprehensive land use plan and promotes the general welfare of the county? If the county begins making changes to include more parcels from the landowners with easements, it could be seen as promoting private interest rather than the general welfare of the county.

5. In the packet provided it discusses the possibility of using the original Corn Suitability Rating (CSR) Vs the Corn Suitability Rating 2 (CSR2). The county assesses taxes based on CSR2 not CSR. When the county began using CSR2 to assess property taxes, property owners in the river bottom tried to argue that it was not a suitable rating for the land. However, the county and state disagreed and stated that CSR2 was a suitable rating for Ag Land. If the commission decides to use a CSR rating instead of a CSR2 rating, please provide evidence as to why they believe the old rating is better than the new rating? If they believe CSR values are more correct than CSR2, should the commission petition the Treasurer's Office to change the property valuations from CSR2 back to the old CSR valuation that was used over 10 years ago?

Christopher Widman
1866 220th Street
Bronson, IA 51007

Clean Energy

Do Solar Farms Lower Property Values? A New Study Has Some Answers

Researchers looked at sale prices of 1.8 million homes near utility-scale solar plants in six states—the largest analysis ever done on this subject.

By Dan Gearino
March 15, 2023

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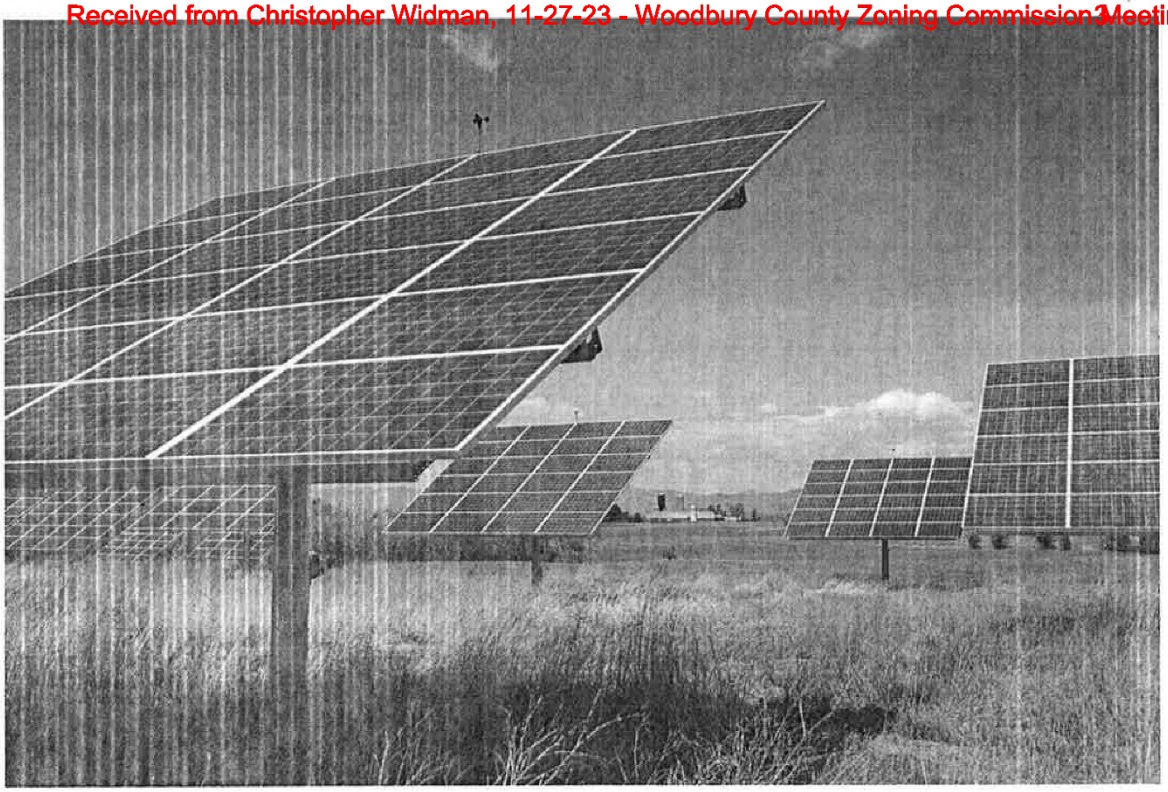


Solar tracker panels follow the sun's path on May 17, 2014 on a Champlain Valley dairy farm near West Haven, Vermont. Credit: Robert Nickelsberg/Getty Images

A new study finds that houses within a half-mile of a utility-scale solar farm have resale prices that are, on average, 1.5 percent less than houses that are just a little farther away.

The research from Lawrence Berkeley National Laboratory helps to refute some of the assertions of solar opponents who stoke resistance to projects with talk of huge drops in property values. But it also drives a hole through the argument made by people in the solar industry who say there is no clear connection between solar and a drop in values.

The authors analyzed 1.8 million home sales near solar farms in six states and found diminished property values in Minnesota (4 percent), North Carolina (5.8 percent) and New

were within their margins of error, which means the price effects were too close to zero to be meaningful. The paper was published in the journal Energy Policy.

The authors accounted for differences in property features, inflation and other factors in order to isolate the effect of proximity to solar.

Ben Hoen, a co-author and research scientist at the Lawrence Berkeley lab, said the numbers are clear but additional research is needed to understand what's happening on the local level to lead to these price effects.

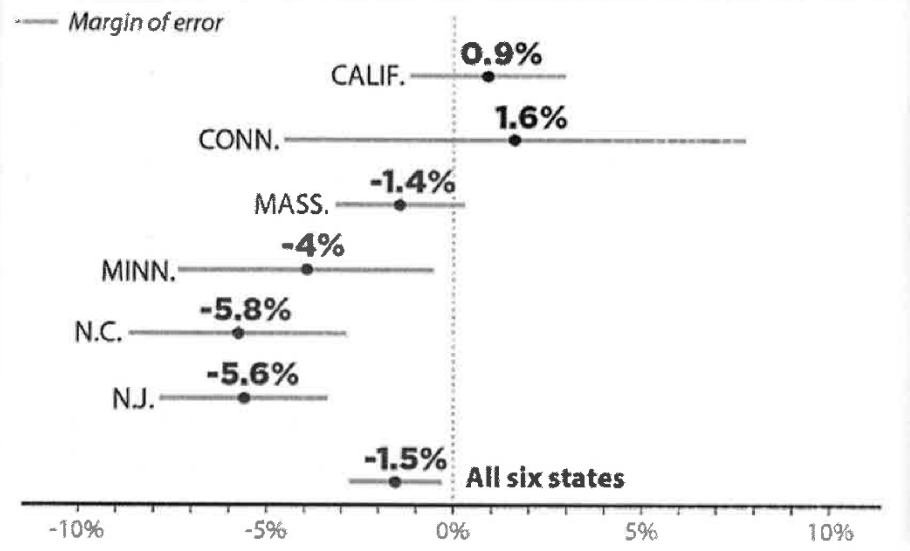
"We have a sense of the 'what,' but we don't know the 'why,'" he said.

Solar's Effect on Home Resale Prices

A new study looked at resale values of houses near utility-scale solar plants and found the properties closest to a solar project sell for slightly less than properties that are a little farther away. The research covered six states, only three of which (Minnesota, North Carolina and New Jersey) showed pricing effects outside of the study's margin of error.

HOME RESALE VALUES

Price difference between half-mile and 2-to-4 mile proximity of utility-scale solar plant



For example, he doesn't have a thorough explanation for why the price differences are higher in some states than others.

The researchers chose this group of states because they were, except for Connecticut, the top five in the country for the number of solar installations of at least 1 megawatt as of 2019. They included Connecticut because it is an example of a state with a high population density near solar projects.

Hoen emphasized that the results show a period in time, with transactions that occurred from 2003 to 2020, and may not reflect prices right now.

Also, he noted that the paper's analysis doesn't take into account any of the financial benefits of solar for landowners and communities, which may include payments from the developer and a decrease in local taxes.

The study is being released at a time of rapid expansion in the number and size of solar projects, which is a key part of the country's push to reduce the emissions that contribute to climate change.

The scale of growth in solar development has been met with an intensifying resistance in local communities where some people argue that the projects are ugly and pose a threat to property values and human health. Solar opponents amplify these concerns on social media.

Of all the arguments against solar, the idea that it will hurt property values has been among the most potent, based on prior reporting by Inside Climate News about the local debates. At public hearings and in comments filed with regulators, some residents talk about how they fear reductions of 40 percent or more.

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Our #1 newsletter delivers the week's climate and energy news -- our original stories and top headlines from around the web.

☐ Get ICN Weekly

Inside Clean Energy
Thursdays

Dan Gearino's habit-forming weekly take on how to understand the energy transformation reshaping our world.

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Asked if he saw anything in his data to support these claims, Hoen said there is "no evidence that an effect that large exists."

Jeffrey Jacquet, an Ohio State University professor who has written about conflicts over renewable energy projects, said the new paper is impressive in its depth and shows the need to ask more questions about the benefits and drawbacks of

"I think the takeaway is that the effect of renewables on property values is small on average, but it is not zero, and we need to correct for that negative impact," he said.

Before this latest study, the largest one done in the United States was in 2020 by researchers at the University of Rhode Island who looked at about 400,000 real-estate transactions in Rhode Island and Massachusetts. They found that the value of houses within one mile of a solar project decreased by an average of 1.7 percent following construction of the project.

The two studies each show a small decrease in values of properties near solar projects, although Hoen cautioned against comparisons because the two are different in their geographic scope and the number of transactions reviewed.

The Solar Industry Reacts

Clean energy advocates and the solar industry may be pleased that the study finds no large negative effect on property values, but they also are wary of the core finding that there is a measurable, albeit small, effect.

"There is nothing revelatory in this study—the results are not definitive and only cover a narrow data set," said Jason Ryan, a spokesman for the American Clean Power Association, a trade group, in a statement. "The report, which found no evidence of adverse impacts on property values in half the states studied, is largely consistent with many prior studies finding that solar projects don't adversely affect property values. Appraisal data from across the country also show similar conclusions."

property appraiser in Raleigh, North Carolina. He has spent about 15 years analyzing property values near solar projects. He often works on behalf of solar companies in regulatory cases before state and local regulatory agencies.

"You can't really measure things that small in real estate from an appraisal standpoint," he said.

Among the many problems with drawing conclusions from such a small difference is that there are many factors at play, including the desirability of the house and the features of the land, he said. The presence of a solar project is one of those factors, and it's difficult to say how much weight it has.

In his experience, solar projects do not lead to a pattern of a negative effect on the values of nearby properties.

Kirkland is far from alone in coming to this conclusion. In Chisago County, Minnesota, which has more solar projects than any other county in the state, officials have been monitoring real-estate transactions to try to detect any changes in resale prices as a result of solar development. They haven't found any negative effects, either in 2017 after the construction of the state's largest solar array, or as recently as December, according to the county assessor's

Hoen said that a 1.5 percent difference may not be significant for an appraiser looking at a small number of transactions, but it is significant in a statistical analysis like the one in the paper.

And, even if there are many factors at play, he is confident that proximity to solar is a strong factor explaining the price difference.

He is eager to ask follow-up questions in additional studies to get an idea of what solar-related factors are contributing to negative effects of pricing. For example, he wonders if an increase in local controversy surrounding a project leads to larger decreases in property values.

"Unpacking these types of mechanisms will take further study," he said.

Share this article

Dan Gearino

Clean Energy Reporter, Midwest, National Environment Reporting Network

Dan Gearino covers the midwestern United States, part of ICN's National Environment Reporting Network. His coverage deals with the business side of the clean-energy transition and he writes ICN's Inside Clean Energy newsletter. He came to ICN in 2018 after a nine-year tenure at The Columbus Dispatch, where he covered the business of energy. Before that, he covered politics and business in Iowa and in New Hampshire. He grew up in Warren County, Iowa, just south of Des Moines, and lives in Columbus

@DanGearino dan.gearino@insideclimatenews.org

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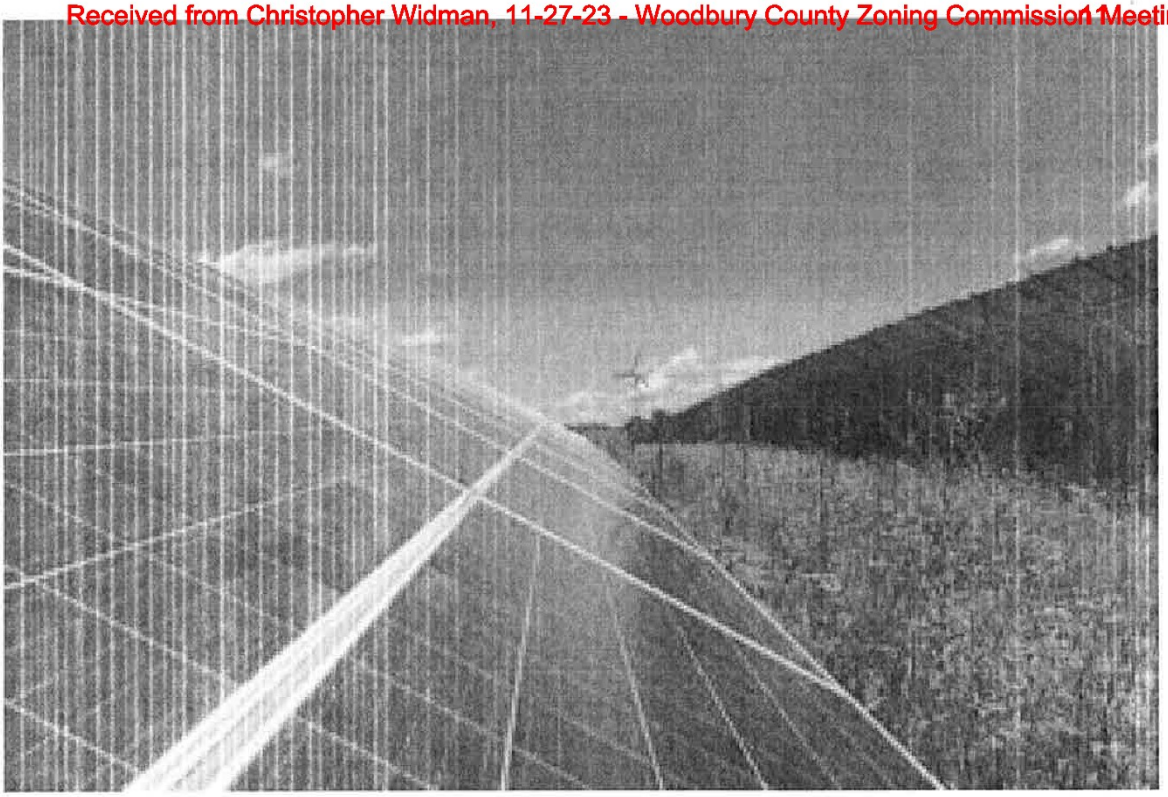
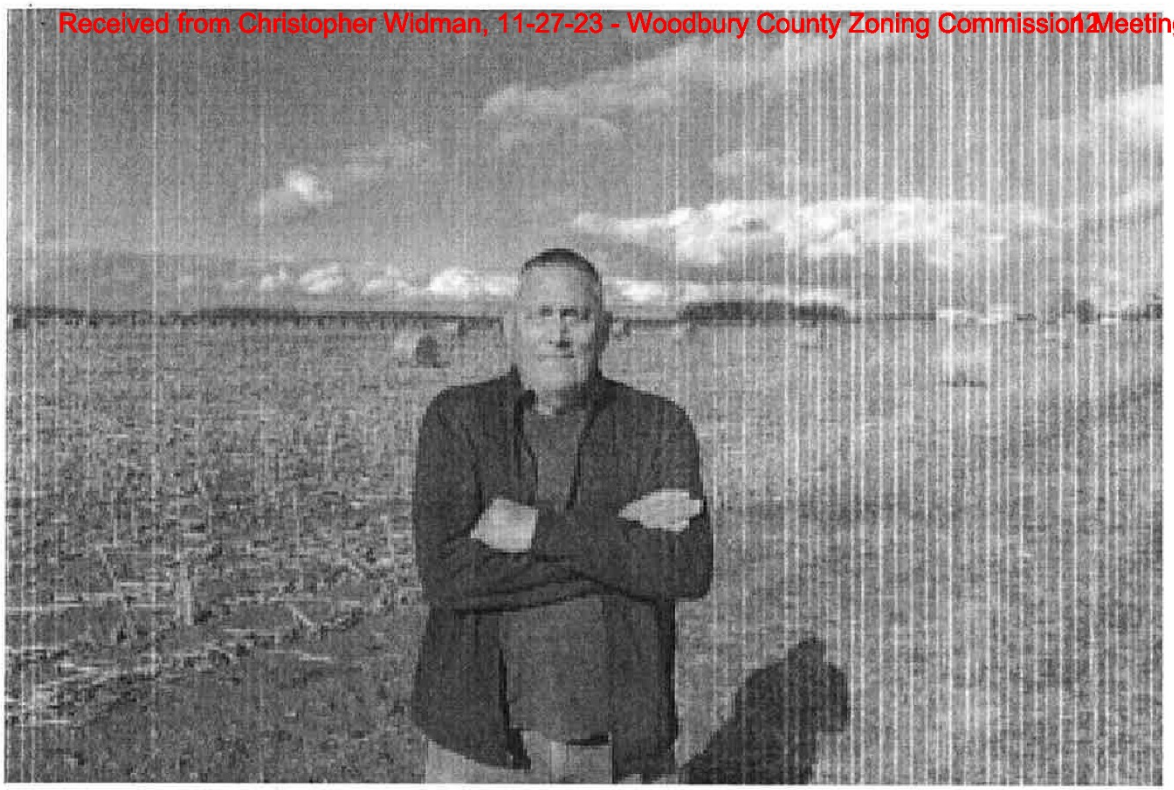


Community Solar Is About to Get a Surge in Federal Funding. So What Is Community Solar?

By Dan Gearino



In the End, Solar Power Opponents Prevail in Williamsport, Ohio

By Dan Gearino

One Farmer Set Off a Solar Energy Boom in Rural Minnesota; 10 Years Later, Here's How It Worked Out

By Dan Gearino

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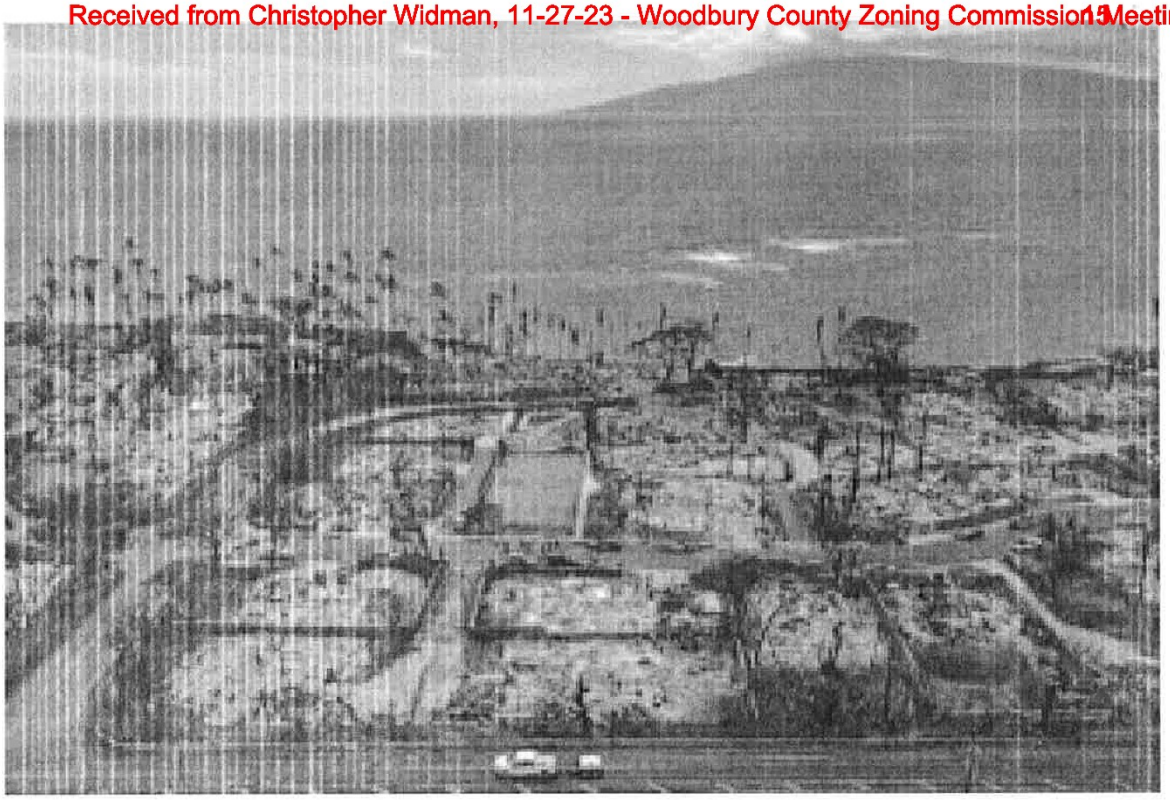
By Wyatt Myskow



US Regions Will Suffer a Stunning Variety of Climate-Caused Disasters, Report Finds

By Nicholas Kusnetz, Lee Hedgepeth, Amy Green, Phil McKenna, Dylan Baddour, Aydali Campa, Wyatt Myskow, Marianne Lavelle and Kristoffer Tigue

New Research Makes it Harder to Kick The Climate Can Down the Road from COP28

By Bob Berwyn

Clean Energy

What Happened to the Great Lakes Offshore Wind Boom?

Offshore wind projects cropped up all over the Great Lakes region in the early 2010s. By the end of the decade, all but one were gone. Developers, though still drawn to the lakes' powerful winds, have been reluctant to return.

By Nicole Pollack

A New Solar Water Heating System Goes Online as Its Developer Enters the US Market

As New York Officials Push Clean Hydrogen Project, Indigenous Nation Sees a Threat to Its Land

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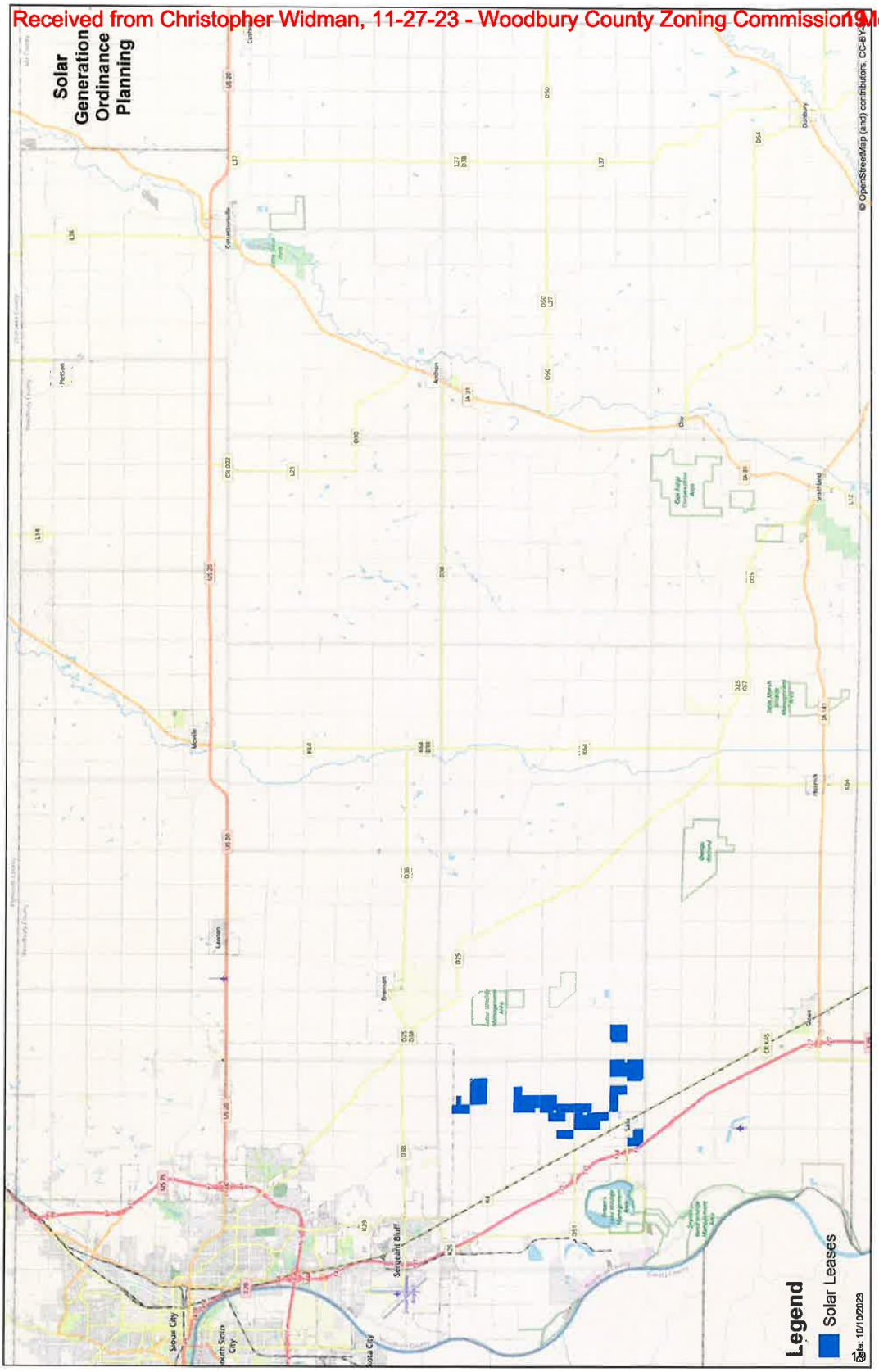

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	Gregory Jochum	874631200003	40
	Gregory Jochum	874631200004	40
	Gregory Jochum	874631200006	37.16
9654	Leo Jochum	874714400001	39
	Leo Jochum	874714400002	40
	Leo Jochum	874714400004	29
	Leo Jochum	874714400005	39
	Leo Jochum	874702400001	19.5
	Leo Jochum	874702400002	19.5
	Leo Jochum	874702400003	38
	Leo Jochum	874702400005	20
	Leo Jochum	844702400006	39
	Leo Jochum	874702400042	19.53
	Leo Jochum	874734452001	34.39
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	Leo Jochum	874723200002	38.26
	Leo Jochum	874723200001	37.27
	Leo Jochum	874723200004	40
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	Leo Jochum	874711200001	38
	Leo Jochum	874711200003	39
	Leo Jochum	874711200005	19.5
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	Gregory Jochum	874726100002	38
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	Gregory Jochum	874726100004	33.99
	Gregory Jochum	874726300003	19.5
	Gregory Jochum	874726300004	19.5
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9655	Stephen Jochum	874712100006	17.9
	Stephen Jochum	874712100008	20
9656	William Jochum	874723400003	38
	William Jochum	874726200001	38
	William Jochum	874726200003	39
9651	Bradley Jochum	874712100003	40
	Bradley Jochum	874712100001	39
9661	Ronald Wood	874736100001	39
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9657	Russell Peterson	874722400005	19.5
	Russell Peterson	874722400002	20
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	Wagner Farm Enterprises	874736200002	38
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	Anthony Harpenau	874736400003	37.58
	Anthony Harpenau	874736400004	36.62
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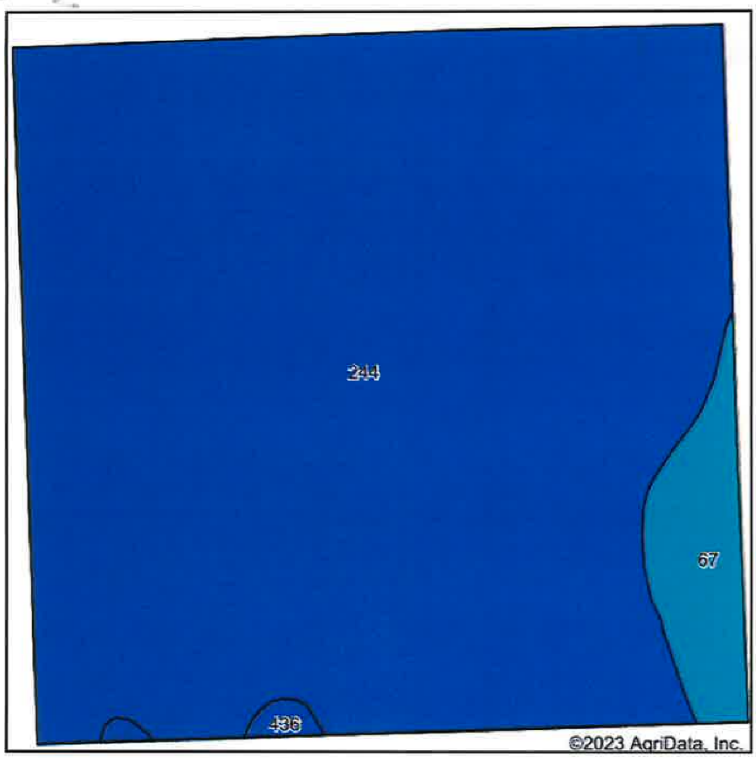
Soils Map



Soils data provided by USDA and NRCS.

State: **Iowa**
County: **Woodbury**
Location: **5-86N-46W**
Township: **Sloan**
Acres: **153.5**
Date: **11/27/2023**

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N W E S

Area Symbol: IA193, Soil Area Version: 33

Code	Soil Description	Acres	Percent of field	CSR2 Legend	Non-Irr Class *c	CSR2**	CSR	*n NCCPI Soybeans
244	Blend silty clay, 0 to 2 percent slopes, rarely flooded	144.57	94.2%		IIIw	81	47	52
67	Woodbury silty clay, 0 to 2 percent slopes, rarely flooded	8.00	5.2%		IIIw	74	51	52
436	Lakeport silty clay loam, 0 to 2 percent slopes, rarely flooded	0.93	0.6%		Iw	89	74	71
				Weighted Average	**2.99**	**80.7**	**47.4**	***n 52.1**

**IA has updated the CSR values for each county to CSR2.
*n: The aggregation method is "Weighted Average using all components"
*c: Using Capabilities Class Dominant Condition Aggregation Method
Soils data provided by USDA and NRCS.

The CSR established an index rating soil map units (SMU) on their potential crop productivity. A CSR rating is based on the inherent properties of each SMU, average weather, and the frequency of use of the soil for row-crop production (Equation 1). The rating also assumes a SMU is adequately managed, artificially drained where required, SMUs located on lower landscapes are not frequently flooded, and there is no land leveling or terracing. Corn suitability ratings can range from 100 for SMUs that have no physical limitations for continuous row cropping to as low as 5 for SMUs with severe limitations for row cropping.

Equation 1

CSR = S - E - B ± W - C - D - SG - P - DSM - PM - MP (modified from Fenton et al., 1971)

S = slope
E = erosion
B = biosequence
W = wetness
C = calcareous soils
D = depth phase
SG = sandy or gravelly soils
P = precipitation factors
DSM = deposition and special soil modifiers
PM = parent material
MP = muck and peaty soils

Since the establishment of the CSR in 1971, the science for calculating CSR for a SMU became more robust as the knowledge base of soil properties was significantly enhanced and expanded. Another change since the establishment of the CSR in 1971 was the soil classification system in use at that time has since been replaced with the current classification system. With the change in soil classification systems, there are currently 500 soil series recognized in Iowa. That is 150 additional soils recognized than when the CSR was first established in 1971.

As the knowledge of soil's increased and more SMUs were recognized, the CSR calculation became more expert driven. In 2013, ISU introduced a new method for calculating CSR values called the Corn Suitability Rating 2 (CSR2) (Equation 2). The CSR2 method provided an index with ratings comparable to CSR, but was more consistent and transparent. This provided interested individuals the ability to calculate a CSR2 value from parameters that can be clearly understood and used.

Equation 2

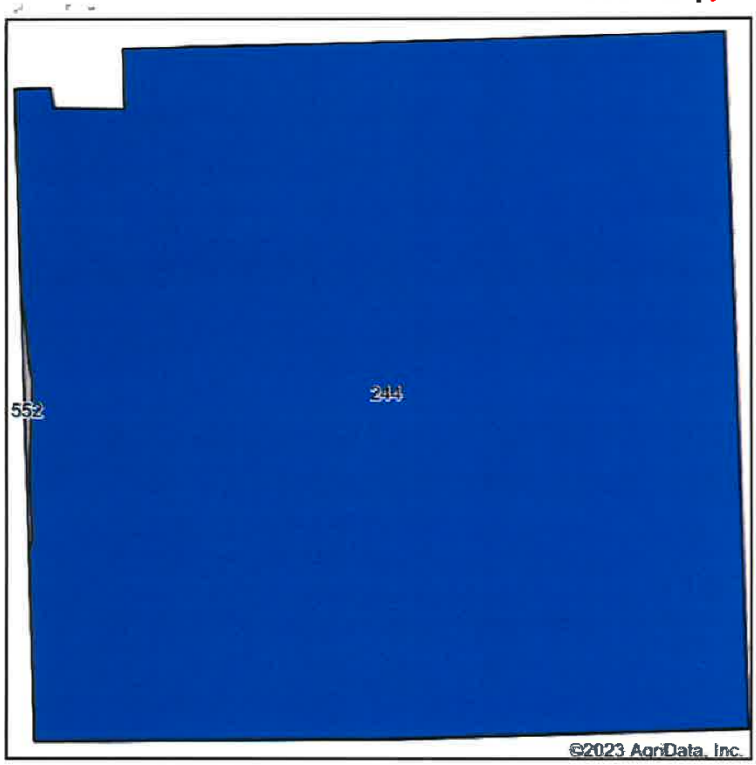
CSR2 = S - M - W - F - D ± EJ (Burras et al., 2015)

S = taxonomic subgroup class of the series of the soil map unit (MU)
M = family particle size class
W = available water holding capacity (AWC) of the series
F = field condition of a particular MU
- Slope
- Flooding
- Ponding
- Erosion class
- Topsoil thickness

D = soil depth and tolerable rate of soil erosion
EJ = expert judgement correction factor
- Normally used with parent materials with very high bulk density and/or are usually clayey or sandy

Similar to the original CSR, the CSR2 assumes a SMU is adequately managed, artificially drained where required, and there is no land leveling or terracing. A major difference between the CSR and the CSR2 is the CSR included a rainfall correction factor where the CSR2 does not.

Soils Map



Soils data provided by USDA and NRCS.

State: **Iowa**
County: **Woodbury**
Location: **31-87N-46W**
Township: **Grange**
Acres: **153.97**
Date: **11/27/2023**

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N W E S

Area Symbol: IA193, Soil Area Version: 33

Code	Soil Description	Acres	Percent of field	CSR2 Legend	Non-Irr Class *c	Irr Class *c	CSR2**	CSR	*n NCCPI Soybeans
244	Blend silty clay, 0 to 2 percent slopes, rarely flooded	153.62	99.8%		IIIw		81	47	52
552	Owego silty clay, 0 to 2 percent slopes, rarely flooded	0.35	0.2%		IIIw	IIIw	67	42	51
				Weighted Average	**3.00**	***-**	**81**	**47**	***n 52**

**IA has updated the CSR values for each county to CSR2.
*n: The aggregation method is "Weighted Average using all components"
*c: Using Capabilities Class Dominant Condition Aggregation Method
*- Irr Class weighted average cannot be calculated on the current soils data due to missing data.
Soils data provided by USDA and NRCS.

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Equation 1

CSR = S - E - B ± W - C - D - SG - P - DSM - PM - MP (modified from Fenton et al., 1971)

S = slope
E = erosion
B = biosequence
W = wetness
C = calcareous soils
D = depth phase
SG = sandy or gravelly soils
P = precipitation factors
DSM = deposition and special soil modifiers
PM = parent material
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M = family particle size class
W = available water holding capacity (AWC) of the series
F = field condition of a particular MU
- Slope
- Flooding
- Ponding
- Erosion class
- Topsoil thickness

D = soil depth and tolerable rate of soil erosion
EJ = expert judgement correction factor
- Normally used with parent materials with very high bulk density and/or are usually clayey or sandy

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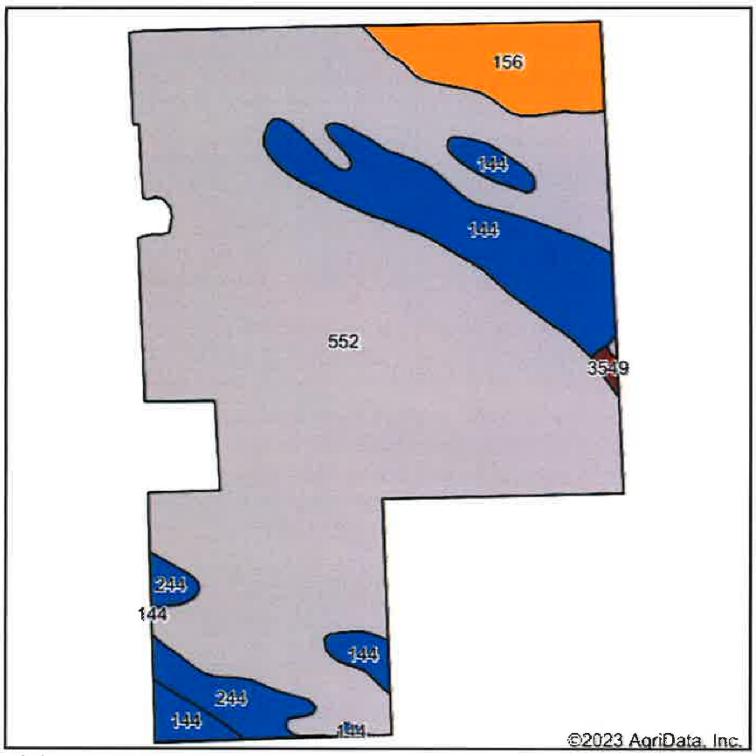
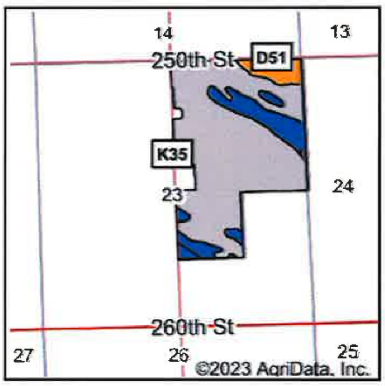
Soils Map



Soils data provided by USDA and NRCS.



State: **Iowa**
County: **Woodbury**
Location: **23-87N-47W**
Township: **Liberty**
Acres: **187.71**
Date: **11/27/2023**

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N W E S

Area Symbol: IA193, Soil Area Version: 33									
Code	Soil Description	Acres	Percent of field	CSR2 Legend	Non-Irr Class *c	Irr Class *c	CSR2**	CSR	*n NCCPI Soybeans
552	Owego silty clay, 0 to 2 percent slopes, rarely flooded	146.95	78.3%		IIIw	IIIw	67	42	51
144	Blake silty clay loam, 0 to 2 percent slopes, rarely flooded	23.10	12.3%		Iw	Iw	91	70	74
156	Albaton silty clay, 0 to 2 percent slopes, rarely flooded	11.21	6.0%		IIIw		58	51	49
244	Blend silty clay, 0 to 2 percent slopes, rarely flooded	5.99	3.2%		IIIw		81	47	52
3549	Modale complex, 0 to 2 percent slopes, rarely flooded	0.46	0.2%		Iw	Iw	77	63	57
				Weighted Average	**2.75**	*-	**69.9**	**46.2**	***n 53.8**

**IA has updated the CSR values for each county to CSR2.
*n: The aggregation method is "Weighted Average using all components"
*c: Using Capabilities Class Dominant Condition Aggregation Method
*- Irr Class weighted average cannot be calculated on the current soils data due to missing data.
Soils data provided by USDA and NRCS.

The CSR established an index rating soil map units (SMU) on their potential crop productivity. A CSR rating is based on the inherent properties of each SMU, average weather, and the frequency of use of the soil for row-crop production (Equation 1). The rating also assumes a SMU is adequately managed, artificially drained where required, SMUs located on lower landscapes are not frequently flooded, and there is no land leveling or terracing. Corn suitability ratings can range from 100 for SMUs that have no physical limitations for continuous row cropping to as low as 5 for SMUs with severe limitations for row cropping.

Equation 1

CSR = S - E - B ± W - C - D - SG - P - DSM - PM - MP (modified from Fenton et al., 1971)

S = slope
E = erosion
B = biosequence
W = wetness
C = calcareous soils
D = depth phase
SG = sandy or gravelly soils
P = precipitation factors
DSM = deposition and special soil modifiers
PM = parent material
MP = muck and peaty soils

Since the establishment of the CSR in 1971, the science for calculating CSR for a SMU became more robust as the knowledge base of soil properties was significantly enhanced and expanded. Another change since the establishment of the CSR in 1971 was the soil classification system in use at that time has since been replaced with the current classification system. With the change in soil classification systems, there are currently 500 soil series recognized in Iowa. That is 150 additional soils recognized than when the CSR was first established in 1971.

As the knowledge of soil's increased and more SMUs were recognized, the CSR calculation became more expert driven. In 2013, ISU introduced a new method for calculating CSR values called the Corn Suitability Rating 2 (CSR2) (Equation 2). The CSR2 method provided an index with ratings comparable to CSR, but was more consistent and transparent. This provided interested individuals the ability to calculate a CSR2 value from parameters that can be clearly understood and used.

Equation 2

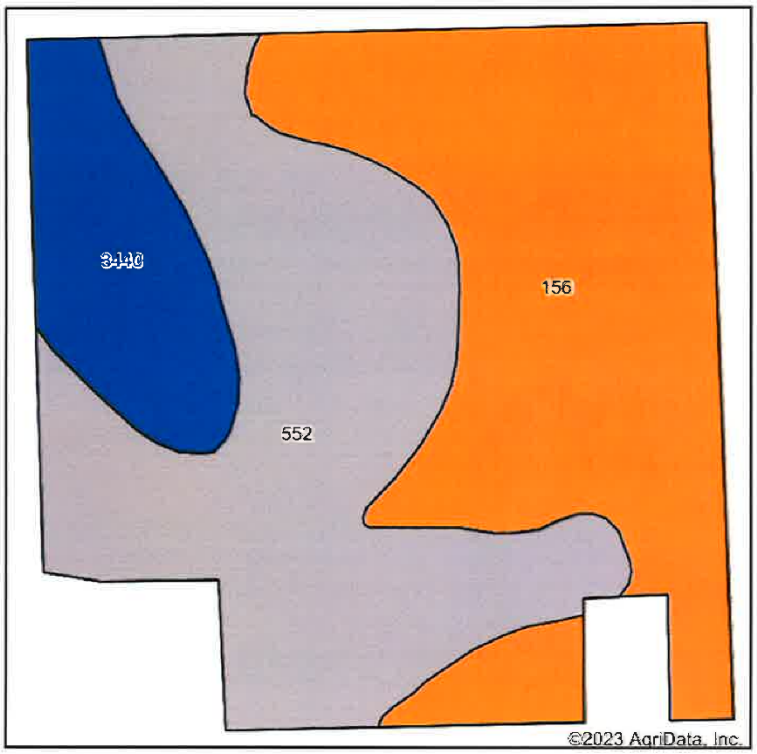
CSR2 = S - M - W - F - D ± EJ (Burras et al., 2015)

S = taxonomic subgroup class of the series of the soil map unit (MU)
M = family particle size class
W = available water holding capacity (AWC) of the series
F = field condition of a particular MU
- Slope
- Flooding
- Ponding
- Erosion class
- Topsoil thickness

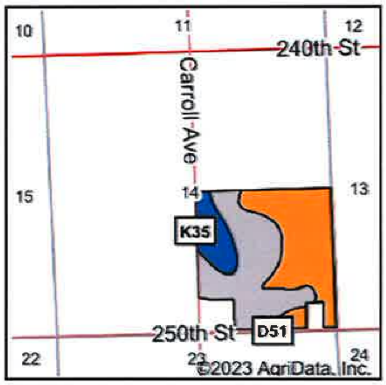
D = soil depth and tolerable rate of soil erosion
EJ = expert judgement correction factor
- Normally used with parent materials with very high bulk density and/or are usually clayey or sandy

Similar to the original CSR, the CSR2 assumes a SMU is adequately managed, artificially drained where required, and there is no land leveling or terracing. A major difference between the CSR and the CSR2 is the CSR included a rainfall correction factor where the CSR2 does not.

Soils Map



Soils data provided by USDA and NRCS.



State: **Iowa**
County: **Woodbury**
Location: **14-87N-47W**
Township: **Liberty**
Acres: **140.07**
Date: **11/27/2023**

Maps Provided By: surety CUSTOMIZED ONLINE MAPPING
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Area Symbol: IA193, Soil Area Version: 33									
Code	Soil Description	Acres	Percent of field	CSR2 Legend	Non-Irr Class *c	Irr Class *c	CSR2**	CSR	*n NCCPI Soybeans
156	Albaton silty clay, 0 to 2 percent slopes, rarely flooded	61.74	44.1%		IIIw		58	51	49
552	Owego silty clay, 0 to 2 percent slopes, rarely flooded	60.39	43.1%		IIIw	IIIw	67	42	51
3440	Blencoe-Woodbury silty clays, 0 to 2 percent slopes, rarely flooded	17.94	12.8%		IIw		84	63	55
				Weighted Average	**2.87**	***-**	**65.2**	**48.7**	***n 50.6**

**IA has updated the CSR values for each county to CSR2.
*n: The aggregation method is "Weighted Average using all components"
*c: Using Capabilities Class Dominant Condition Aggregation Method
*- Irr Class weighted average cannot be calculated on the current soils data due to missing data.
Soils data provided by USDA and NRCS.

The CSR established an index rating soil map units (SMU) on their potential crop productivity. A CSR rating is based on the inherent properties of each SMU, average weather, and the frequency of use of the soil for row-crop production (Equation 1). The rating also assumes a SMU is adequately managed, artificially drained where required, SMUs located on lower landscapes are not frequently flooded, and there is no land leveling or terracing. Corn suitability ratings can range from 100 for SMUs that have no physical limitations for continuous row cropping to as low as 5 for SMUs with severe limitations for row cropping.

Equation 1

CSR = S - E - B ± W - C - D - SG - P - DSM - PM - MP (modified from Fenton et al., 1971)

S = slope
E = erosion
B = biosequence
W = wetness
C = calcareous soils
D = depth phase
SG = sandy or gravelly soils
P = precipitation factors
DSM = deposition and special soil modifiers
PM = parent material
MP = muck and peaty soils

Since the establishment of the CSR in 1971, the science for calculating CSR for a SMU became more robust as the knowledge base of soil properties was significantly enhanced and expanded. Another change since the establishment of the CSR in 1971 was the soil classification system in use at that time has since been replaced with the current classification system. With the change in soil classification systems, there are currently 500 soil series recognized in Iowa. That is 150 additional soils recognized than when the CSR was first established in 1971.

As the knowledge of soil's increased and more SMUs were recognized, the CSR calculation became more expert driven. In 2013, ISU introduced a new method for calculating CSR values called the Corn Suitability Rating 2 (CSR2) (Equation 2). The CSR2 method provided an index with ratings comparable to CSR, but was more consistent and transparent. This provided interested individuals the ability to calculate a CSR2 value from parameters that can be clearly understood and used.

Equation 2

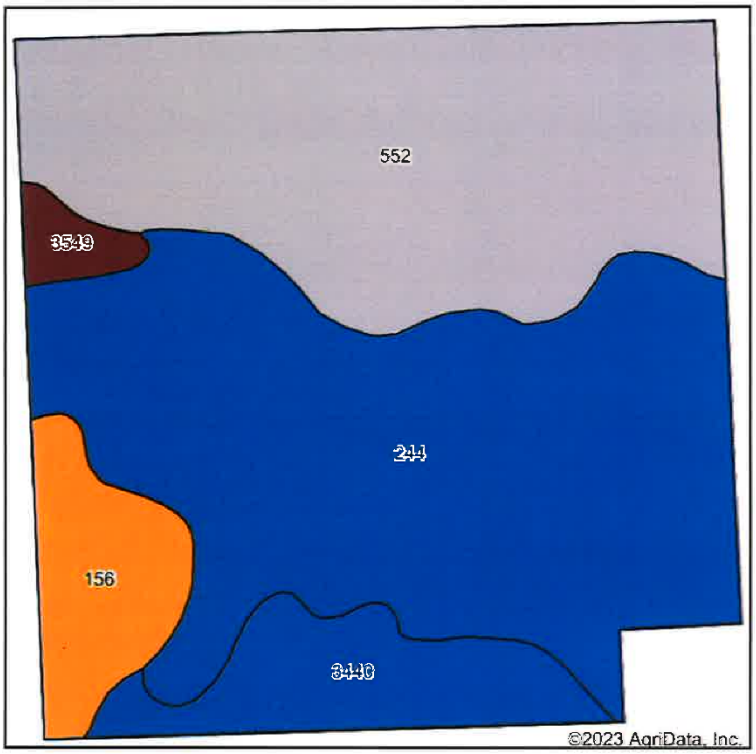
CSR2 = S - M - W - F - D ± EJ (Burras et al., 2015)

S = taxonomic subgroup class of the series of the soil map unit (MU)
M = family particle size class
W = available water holding capacity (AWC) of the series
F = field condition of a particular MU
- Slope
- Flooding
- Ponding
- Erosion class
- Topsoil thickness

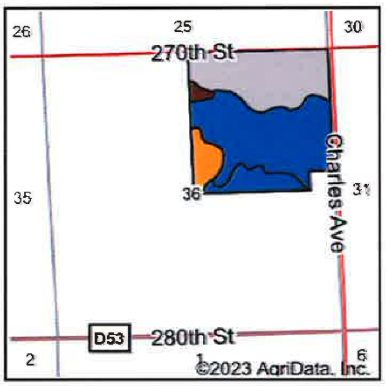
D = soil depth and tolerable rate of soil erosion
EJ = expert judgement correction factor
- Normally used with parent materials with very high bulk density and/or are usually clayey or sandy

Similar to the original CSR, the CSR2 assumes a SMU is adequately managed, artificially drained where required, and there is no land leveling or terracing. A major difference between the CSR and the CSR2 is the CSR included a rainfall correction factor where the CSR2 does not.

Soil Map



Soils data provided by USDA and NRCS.



State: **Iowa**
County: **Woodbury**
Location: **36-87N-47W**
Township: **Liberty**
Acres: **152.17**
Date: **11/27/2023**

Maps Provided By: surety CUSTOMIZED ONLINE MAPPING © AgriData, Inc. 2023 www.AgriDataInc.com

N W E S

Area Symbol: IA193, Soil Area Version: 33

Code	Soil Description	Acres	Percent of field	CSR2 Legend	Non-Irr Class *c	Irr Class *c	CSR2**	CSR	*n NCCPI Soybeans
244	Blend silty clay, 0 to 2 percent slopes, rarely flooded	71.47	47.0%		IIIw		81	47	52
552	Owego silty clay, 0 to 2 percent slopes, rarely flooded	54.10	35.6%		IIIw	IIIw	67	42	51
3440	Blencoe-Woodbury silty clays, 0 to 2 percent slopes, rarely flooded	13.35	8.8%		IIw		84	63	55
156	Albaton silty clay, 0 to 2 percent slopes, rarely flooded	10.72	7.0%		IIIw		58	51	49
3549	Modale complex, 0 to 2 percent slopes, rarely flooded	2.53	1.7%		Iw	Iw	77	63	57
				Weighted Average	**2.88**	***-**	**74.6**	**47.2**	***n 51.8**

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