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FARMING SOLAR ON THE MARGINS

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ABSTRACT

Knowledge of climate change is not new, but solutions have proven elusive. In the United States, governments at all levels are pushing for fundamental policy changes. Many of these initiatives fall at the intersection of climate and energy policy; they endeavor to replace fossil-based energy with zero-carbon sources such as solar and wind energy. These initiatives are unlikely to make significant progress, however, unless they address the land use controversies that have long slowed efforts to expand green energy. And to do that successfully, they must navigate the political and economic realities at the intersection of land, climate, and energy policy.

Building out large amounts of zero-carbon energy will require extensive land use changes—millions of acres of land for new generation and its supporting transmission lines. Such a broad land use change will face significant, and potentially fatal, opposition under the current approach, which tends to forge ahead without common ground. Indeed, conservative rural voters and even progressive "green" communities have already blocked the siting (location) of many renewable energy projects.

Forming new coalitions by capitalizing on areas of shared opportunity will be crucial to making the large-scale land use changes necessary for a climate solution. As explored here, a promising area lies within agriculture. Farmers—many of them on the conservative side of the political spectrum—hold vast amounts of land, including marginal land that lacks prime agricultural soils. They also already benefit from substantial government subsidies to help them address volatile commodity prices and extreme weather events (which are becoming more common due to climate change). Land, in turn, is exactly the asset that solar developers need.

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This Article reframes the key obstacles to climate policy and argues for a solution to the current climate policy impasse. We propose that the next Farm Bill should use the billions of dollars in subsidies that keep marginal farmland out of production to support solar energy production on these lands. Although there is no silver bullet to the "massive problem" of climate change, matching solar farms with millions of acres of land could be a substantial and positive step forward.

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INTRODUCTION

Political polarization within the United States has made bipartisan programs increasingly rare in recent years, not least in the area of climate change. Blue states push for aggressive climate policies that often find little traction in rural, agricultural states that are an increasingly deep shade of red.[1]

Even without the seemingly insurmountable political schism, efforts to address the climate crisis are challenging because they rest at the intersection of climate, energy, and land use policy.[2] Reducing carbon emissions requires electrifying most energy uses and building massive quantities of new zero-carbon electricity generation and transmission lines.[3] This effort, in turn, will

[1] *See* Kim Parker, Juliana Menasce Horowitz, Anna Brown, Richard Fry, D'Vera Cohn & Ruth Igielnik, *Urban, Suburban and Rural Residents' Views on Key Social and Political Issues*, PEW RSCH. CTR. (May 22, 2018), https://www.pewresearch.org/social-trends/2018/05/22/urban-suburban-and-rural-residents-views-on-key-social-and-political-issues/ [https://perma.cc/96N3-SYH3] (noting rural conservative and urban progressive connections); *see also* Richard C. Schragger, *The Attack on American Cities*, 96 TEX. L. REV. 1163, 1167 (2018) (concluding that in 2016, "Clinton won the popular vote on the votes of urban citizens; Trump won the presidency on the votes of everyone else," and providing numbers to support this statement). There are, of course, important exceptions to this observation. *See Texas: State Profile and Energy Estimates*, U.S. ENERGY INFO. ADMIN., https://www.eia.gov/state/analysis.php?sid=TX [https://perma.cc/Y9WT-2E8N] (last updated May 19, 2022) (noting Texas accounted for roughly fourteen percent of total U.S. electricity generation from all renewable sources in 2021). Texas is also the leading producer of wind energy in the United States. *Id.* We discuss many of these exceptions in this Article, observing that many farmers support renewable energy. *See infra* note 15. But there is growing conservative opposition to renewables, as evidenced by statements such as those of Agricultural Commissioner of Texas Sid Miller, who wrote after a large Texas electricity blackout in 2021 (primarily caused by reliance on non-winterized natural gas infrastructure): "We should never build another wind turbine in Texas." Erin Douglas & Ross Ramsey, *No, Frozen Wind Turbines Aren't the Main Culprit for Texas' Power Outages*, TEX. TRIB. (Feb. 17, 2021), https://www.texastribune.org/2021/02/16/texas-wind-turbines-frozen/ [https://perma.cc/9GLF-Y4QT]. In a separate post, Miller wrote: "So much for the unsightly and unproductive, energy-robbing Obama Monuments. At least they show us where idiots live." *Id.*

[2] Danielle Stokes is one of the pioneers in recognizing this type of interconnection, emphasizing "the intersections of property law, environmental law, and legal geography" in the climate space. Danielle Stokes, *Renewable Energy Federalism*, 106 MINN. L. REV. 1757, 1760 (2022) (footnotes omitted) (arguing for careful consideration of federalism's role in energy industry).

[3] There are many greenhouse gases, which are gases that, when emitted into the earth's atmosphere, capture heat and prevent it from leaving the atmosphere. U.S. ENV'T PROT. AGENCY, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990-2019, at ES-3 (2021), https://www.epa.gov/sites/default/files/2021-04/documents/us-ghg-inventory-2021-main-text.pdf?VersionId=uuA7i8WoMDBOc0M4ln8WVXMgn1GkujvD [https://perma.cc/2QV9-LW7A]. The bulk of carbon emissions come from energy use—electric power generation, vehicles, buildings, and industry. *Id.* at ES-5, -7, -11. To substantially reduce carbon emissions, vehicles, buildings, and industry must electrify their energy use, converting vehicles, heating, and industrial power sources to electricity or "green" (carbon-free) fuels. *See* Michael B. Gerrard, *Legal Pathways for a Massive Increase in Utility-Scale Renewable*

demand land use changes in many parts of the United States, particularly in rural, conservative areas.[4] Beyond the resistance of conservative voters to initiatives aimed directly at climate change, voters of all stripes—progressive and conservative—are notoriously wary of land use changes such as new power generation and transmission lines, including when the generation involves "clean" renewable energy.[5]

Generation Capacity, 47 ENV'T L. REP. 10591, 10592 (2017) (discussing how infrastructure needs to electrify "passenger transportation and space and water heating"). Likewise, fossil fuel-fired power plants must switch to zero-carbon fuels such as renewable energy (e.g., hydroelectric, geothermal, solar, wind, biomass, or ocean power) or nuclear power. *See id.* at 10606. For further discussion of additional renewable energy facilities needed to achieve deep decarbonization, see *id.* at 10592 (noting all deep decarbonization scenarios "call for the construction of a massive number of new central station renewable energy facilities, mostly wind and solar—many times higher than the amount of such construction ever previously achieved"); and NAT'L ACADS. OF SCIS., ENG'G, & MED., ACCELERATING DECARBONIZATION OF THE U.S. ENERGY SYSTEM 4 (2021), https://nap.nationalacademies.org/read/25932/chapter/1 [https://perma.cc/A937-KM8S] (noting transitioning to net-zero energy in United States would reduce global greenhouse gas emissions by about ten percent).

[4] *See* THOMAS L. DANIELS & HANNAH WAGNER, REGULATING UTILITY-SCALE SOLAR PROJECTS ON AGRICULTURAL LAND 1 (2022), https://kleinmanenergy.upenn.edu/wp-content/uploads/2022/08/KCEP-Regulating-Utility-Scale-Solar-Projects.pdf [https://perma.cc/B6B3-T79C] ("To reach President Biden's goal of 100% renewable electricity by 2035, the United States will need to build thousands of utility-scale solar projects covering millions of acres . . . . [and r]ural areas and agricultural land present attractive sites for utility-scale solar . . . ."); Casey L. Cirner, *Harvesting the Sun on Maryland Farmland: Local Zoning Restrictions for Solar Fields*, MD. BAR J., Nov. 2018, at 18, 20 (noting ideal location for utility-scale solar projects is same land that is ideal for farms).

[5] *See* Zimmerman v. Bd. of Cnty. Comm'rs, 264 P.3d 989, 1010 (Kan. 2011) (affirming validity of commercial wind ban); SAMANTHA GROSS, BROOKINGS INST., RENEWABLES, LAND USE, AND LOCAL OPPOSITION IN THE UNITED STATES 9-11 (2020), https://www.brookings.edu/wp-content/uploads/2020/01/FP_20200113_renewables_land_use_local_opposition_gross.pdf [https://perma.cc/P9QA-UNFE] (noting homeowners' concerns with renewable energy projects that may affect their property values or surrounding ecosystem); Alison Knezevich, *Proposed Solar Energy Developments Draw Opposition over Loss of Farmland*, WASH. POST (Jan. 19, 2019, 6:16 PM), https://www.washingtonpost.com/local/proposed-solar-energy-developments-draw-opposition-over-loss-of-farmland/2019/01/19/f2f6acfa-1b72-11e9-8813-cb9dec761e73_story.html (noting conflict between farmers and solar developers that arose after Baltimore County, Maryland, promulgated rules to govern community solar projects); Sammy Roth, *California's San Bernadino County Slams the Brakes on Big Solar Projects*, L.A. TIMES (Feb. 28, 2019, 4:35 PM), https://www.latimes.com/business/la-fi-san-bernardino-solar-renewable-energy-20190228-story.html (describing county-wide ban on utility-scale solar and wind projects); Opinion, *CMP Corridor Project Will Benefit Maine Economy and Families*, BANGOR DAILY NEWS (Sept. 9, 2021), https://bangordailynews.com/2021/09/09/opinion/opinion-contributor/cmp-corridor-project-will-benefit-maine-economy-and-families/ (describing benefits offered by transmission line company). *See generally* PEGGY KIRK HALL, WHITNEY MORGAN & JESSE RICHARDSON, LAND USE CONFLICTS BETWEEN WIND AND SOLAR RENEWABLE ENERGY AND AGRICULTURAL USES 12 (2022), https://nationalaglawcenter.org/wp-content/uploads//assets/articles/Wind-Solar-Land-Use.pdf [https://perma.cc/UZX3-SYBM] (noting overlap between prime farmland and prime sites for solar energy).

There is, however, the potential for significant, mutual benefit to break this impasse. Many residents in rural areas are working to preserve their agricultural heritage and rural identity while maintaining economic viability.[6] The federal government provides billions of dollars in subsidies each year to help farmers grapple with volatile commodity prices and to keep 20 to 30 million acres of farmland out of production ("fallow").[7] At the same time, blue and purple states with large urban areas and progressive municipalities are enacting climate measures that call for one hundred percent zero-carbon energy generation within a relatively short time frame.[8] These policies will require as much as 10 million acres of rural land for renewable energy production—particularly for thousands of new utility-scale solar farms—and billions of dollars in infrastructural investments.[9] Much of this land will be farmland.[10] In short, farmers have land and subsidies but need a steadier source of income.[11] Renewable energy developers, in turn, need land and more subsidies if we are to achieve a rapid

[6] *But cf.* William S. Eubanks II, *A Rotten System: Subsidizing Environmental Degradation and Poor Public Health with Our Nation's Tax Dollars*, 28 STAN. ENV'T L.J. 213, 261-62 (2009) (describing Agriculture Improvement Act ("Farm Bill") programs that have incentivized problematic cultivating practices resulting in "worthless" cropland).

[7] Press Release, Farm Serv. Agency, U.S. Dep't of Agric., USDA Accepts 2.8 Million Acres for the Conservation Reserve Program (Aug. 23, 2021) [hereinafter Press Release, USDA Accepts 2.8 Million Acres], https://www.fsa.usda.gov/news-room/news-releases/2021/usda-accepts-28-million-acres-for-the-conservation-reserve-program [https://perma.cc/669M-GPQW] (noting 4-million-acre enrollment deficit below total acreage target for Conservation Reserve Program ("CRP") enrollment and noting total acreage enrollment cap for CRP was 25 million acres in 2021, and will expand to 27 million acres by 2023).

[8] *See, e.g.*, Press Release, C40 Cities, More than 100 American Cities Make Historic Pledge To Accelerate Net-Zero Emissions, Deliver Action Needed To Meet National Climate Goals (Oct. 25, 2021), https://www.c40.org/news/american-cities-net-zero-climate-goals/ [https://perma.cc/4PZE-4YRK] (signing pledge to cut carbon emissions in half by 2030 and reach net-zero emissions by 2050).

[9] *See infra* notes 12, 52-63 and accompanying text (describing massive amounts of land and money required to build solar panels and replace legacy energy infrastructure).

[10] In 2017, farmers and ranchers owned 900 million acres, or forty percent, of all U.S. land. *See* NAT'L AGRIC. STAT. SERV., U.S. DEP'T OF AGRIC., 2017 CENSUS OF AGRICULTURE HIGHLIGHTS—FARMS AND FARMLAND 1 (2019), https://www.nass.usda.gov/Publications/Highlights/2019/2017Census_Farms_Farmland.pdf [https://perma.cc/U6DX-LVNZ]. In North Carolina, which has experienced a solar boom, sixty-three percent of solar farms are located on agricultural land. *See* Scott Curtis, Randall Etheridge, Praveen Malali, Ariane L. Peralta & Faete Filho, *Planning for Future Solar Farm Development in North Carolina: A Geographic Food-Energy-Water Approach*, 60 SE. GEOGRAPHER 48, 55 (2020). Other lands will also be important for the massive renewable energy build-out—particularly public lands. *See* Gerrard, *supra* note 3, at 10594-95.

[11] *See supra* notes 7-10 and accompanying text (describing fluctuating price of commodities as well as weather and climate patterns as factors in farmers' unstable income).

transition to zero-carbon energy.[12] Agricultural land already hosts, and will continue to host, much of the new renewable energy development.[13]

The land-hungry nature of renewable energy is typically painted in negative terms.[14] But for the solar boom transforming many parts of rural America, the land-energy nexus is a benefit in some respects, and can be even more beneficial with closer attention to this nexus and better land-energy regulation.[15] Lower-quality or marginal farmland can once again be put to productive use by hosting solar panels, supplying essential climate mitigation while preserving agricultural livelihoods, and using the land beneath the panels for ecological or other purposes.[16] Solar leases on farms can provide a steady source of income that

[12] Wind and solar energy are the least expensive forms of new energy generation, without considering levelized tax credits. U.S. ENERGY INFO. ADMIN., LEVELIZED COSTS OF NEW GENERATION RESOURCES IN THE *ANNUAL ENERGY OUTLOOK 2022*, at 8 tbl.1a (2022) [hereinafter LEVELIZED COSTS], https://www.eia.gov/outlooks/aeo/pdf/electricity_generation.pdf [https://perma.cc/67KU-6L2Y] (indicating total system levelized cost of electricity and levelized cost of storage for standalone solar and onshore wind are $36.09 and $37.80 per megawatt hour, respectively). But replacing extensive fossil fuel-fired infrastructure that has remaining useful life will be expensive. *See* Geoffrey Heal, *The Cost of a Carbon-Free Electricity System in the U.S.* 7-8 (Nat'l Bureau of Econ. Rsch., Working Paper No. 26084, 2019) (estimating that replacing all fossil fuel-fired U.S. generation with wind and solar generation by 2050 would cost $23 billion to $55 billion annually).

[13] *See, e.g.*, Curtis et al., *supra* note 10, at 48 (using North Carolina as case study of agricultural land adapted for utility-scale solar power).

[14] *See, e.g.*, Sara C. Bronin, *Curbing Energy Sprawl with Microgrids*, 43 CONN. L. REV. 547, 549 (2010) (describing impacts on wildlife habitats and landscapes as consequences of vast land consumption required to site energy generation facilities in future); Uma Outka, *The Energy-Land Use Nexus*, 27 J. LAND USE & ENV'T L. 245, 253-54 (2012) (noting negative impact of all forms of energy development on land and other resources such as wildlife); Anne M. Trainor, Robert I. McDonald & Joseph Fargione, *Energy Sprawl Is the Largest Driver of Land Use Change in United States*, PLOS ONE, Sept. 2016, at 1, 9 (highlighting renewable energy's larger direct footprint as measured by land use per unit of energy and as compared to extractive resources).

[15] *See Sustainability*, AM. FARM BUREAU FED'N, https://www.fb.org/land/sustainability-in-ag [https://perma.cc/GE4K-6BYM] (last visited Feb. 10, 2023) (supporting farmers' initiatives to incorporate renewable energy onto farms). Agricultural support for renewable energy has also grown in other countries. *See, e.g.*, WILSON HAMBRICK, ARNE JUNGJOHANN, AMANDA CHIU & HILARY FLYNN, BEYOND BIOFUELS: RENEWABLE ENERGY OPPORTUNITIES FOR U.S. FARMERS 15 (2010) (noting Federation of German Farmers aggressively advocates for renewable energy). There are, however, valid objections to the renewable industrialization of rural areas—objections that can be addressed through effective policy design. *See, e.g.*, Dayna Nadine Scott & Adrian A. Smith, *"Sacrifice Zones" in the Green Energy Economy: Toward an Environmental Justice Framework*, 62 MCGILL L.J. 861, 882 (2017) (noting one farmer's "philosophical objection to using solar generation on crop land"); Barton H. Thompson Jr., *EcoFarming: A Realistic Vision for the Future of Agriculture?*, 1 U.C. IRVINE L. REV. 1167, 1195 (2011) (noting potential displacement of valuable crops because of "sizable" "footprint for large-scale solar").

[16] *See* JORDAN MACKNICK, BRENDA BEATTY & GRAHAM HILL, NAT'L RENEWABLE ENERGY LAB'Y, OVERVIEW OF OPPORTUNITIES FOR CO-LOCATION OF SOLAR ENERGY TECHNOLOGIES AND VEGETATION 1 (2013), https://www.nrel.gov/docs/fy14osti/60240.pdf [https://perma.cc

helps to offset volatile commodity prices.[17] As Cornell researchers put it, "Leasing land for solar development can be more profitable, per acre, than producing almost any crop."[18] Even solar panels on productive farmland can, if designed properly, enhance certain crops and livestock through "agrivoltaics" and preserve land for potential use by future generations of farmers.[19]

This is not to say that solar energy is welcomed by rural communities. Indeed, quite the contrary is true.[20] Residents in many rural areas have forcefully opposed utility-scale solar farms, objecting to the industrialization of previously agricultural communities and the displacement of prime agricultural soils, among other concerns.[21] In some cases, solar energy has pitted farmers against their rural neighbors, with farmers often welcoming lease income and nearby landowners objecting to the impacts of solar energy.[22] But raw economics and a growing set of policies pushing the United States toward solar suggest that a solar boom is coming to rural America regardless of rural America's views on

/45FG-G5L4] (noting instances "where solar facilities are co-located with agricultural operations or have native vegetation growing beneath the panels"). The lower-quality or marginal farmlands that this Article focuses on are lands within the federal government's CRP, on which farmers receive money to not grow crops. For the lands included, see 16 U.S.C. § 3831(b).

[17] MACKNICK ET AL., *supra* note 16, at 12 (explaining benefits of adapting solar technology to farmland, including providing alternative revenue during periods of depressed agricultural productivity or commodity prices).

[18] TRAVIS GROUT & JENNIFER IFFT, APPROACHES TO BALANCING SOLAR EXPANSION AND FARMLAND PRESERVATION: A COMPARISON ACROSS SELECTED STATES 1 (2018), https://dyson.cornell.edu/wp-content/uploads/sites/5/2019/02/Cornell-Dyson-eb1804.pdf [https://perma.cc/2EPE-RC9Z].

[19] *See* Greg A. Barron-Gafford, Mitchell A. Pavao-Zuckerman, Rebecca L. Minor, Leland F. Sutter, Isaiah Barnett-Moreno, Daniel T. Blackett, Moses Thompson, Kirk Dimond, Andrea K. Gerlak, Gary P. Nabhan & Jordan E. Macknick, *Agrivoltaics Provide Mutual Benefits Across the Food-Energy-Water Nexus in Drylands*, NATURE SUSTAINABILITY, Sept. 2019, at 1, 1 (noting photovoltaic panels reduced plant drought stress); Axel Weselek, Andrea Ehmann, Sabine Zikeli, Iris Lewandowski, Stephan Schindele & Petra Högy, *Agrophotovoltaic Systems: Applications, Challenges, and Opportunities. A Review*, AGRONOMY SUSTAINABLE DEV., June 2019, at 1, 2-3 (finding agrophotovoltaic systems can increase land productivity by up to seventy percent and increase water productivity). Agrivoltaic opportunities are not universal, however. For example, there is not always regional livestock, such as sheep and turkeys, that can be raised beneath solar panels, and some crops cannot grow beneath solar panels. *See, e.g.*, DANIELS & WAGNER, *supra* note 4, at 2 ("[S]ome landowners have continued to graze small livestock such as sheep, create pollinator space, or raise vegetables amid the solar panels. Growing extensive row crops, however, such as corn or wheat, is not possible.").

[20] *See* Hannah J. Wiseman, *Localizing the Green Energy Revolution*, 70 EMORY L.J. ONLINE 59, 77 n.84 (2021) (describing rural opposition and bans on large-scale energy development based on its aesthetic impact and disruption of wildlife).

[21] *See id.*

[22] *See id.* at 75 n.73 (noting split between farmers who welcome renewable energy as lease income and rural residents who are concerned that such projects will displace productive land and transform communities).

this matter.[23] A boom that occurred in a more conscientious way—cognizant of community concerns, prioritizing the preservation of prime agricultural land for agriculture, and conducted in a manner that environmentally enhanced rather than damaged land—could be, when balanced against other impacts, a good thing for rural communities.

This Article argues for a reframing of climate policy in a way that captures the opportunities presented by the land-energy nexus. Without addressing climate, energy, and land use law as an inseparable challenge *and* opportunity, and without finding the political common ground for new energy development, ambitious initiatives to rapidly move the United States toward net-zero carbon emissions will fall flat.[24] The tendency of policymakers and scholars alike is to champion ambitious climate initiatives while expanding the current chasm in U.S. politics—emphasizing the disastrous impacts of climate change and the imperative of reducing emissions.[25] Engaging political realities and redesigning some aspects of land use law at the national level is a better path to achieve emission reduction goals.

To beneficially merge climate, land, and energy policy, Congress should revise the Agriculture Improvement Act ("Farm Bill") to prioritize subsidization of marginal farmland that hosts solar energy development.[26] The most recent

[23] *See, e.g.*, Inflation Reduction Act, H.R. 5376, 117th Cong. §§ 45Y, 48E (2022) (creating new tax credits for solar energy and other "clean energy" credits that last longer than previous credits set to expire).

[24] This Article builds on critical work that pioneered this nexus. *See, e.g.*, Patricia E. Salkin & Ashira Pelman Ostrow, *Cooperative Federalism and Wind: A New Framework for Achieving Sustainability*, 37 HOFSTRA L. REV. 1049, 1054 (2009) (urging for cooperative federalism approach to wind siting policy as adopted in Telecommunications Act of 1996, in which there is enhanced federal review of local government cell phone tower siting decisions, and local governments may not bar cell phone towers entirely); Stokes, *supra* note 2, at 1815-16 (proposing "collaborative federalism regime" to maximize efficiency and consistency in siting process). Sara Bronin jump-started the land-energy conversation in the legal literature by emphasizing the land-hungry nature of renewable energy, and Uma Outka expanded upon Bronin's work. *See* Bronin, *supra* note 14, at 553 (emphasizing phenomenon of "energy sprawl" resulting from development of energy infrastructure); Outka, *supra* note 14, at 246-55 (noting how land use policy, such as suburban sprawl, affects energy use and how energy generation choices affect U.S. land use).

[25] *See, e.g.*, David Hodas, *Imagining the Unimaginable: Reducing U.S. Greenhouse Gas Emissions by Forty Percent*, 26 VA. ENV'T L.J. 271, 273-74 (2008) (arguing United States must reduce its greenhouse gas emissions and there are ways of doing so without damaging the economy); Henry Shue, *Climate Hope: Implementing the Exit Strategy*, 13 CHI. J. INT'L L. 381, 387 (2013) ("The third great revolution must . . . be the creation of *both* an escape route from fossil fuel energy *and* a path to the most rapid possible transition to alternative sources of energy in order to preserve the ecological preconditions for sustainable development.").

[26] Agriculture Improvement Act of 2018, Pub. L. No. 115-334, 132 Stat. 4490 (codified in scattered sections of 7 U.S.C.). "Farm Bill" is the shortened term often used to describe the Agriculture Improvement Act, which was originally the Agricultural Adjustment Act of 1933. *History of the United States Farm Bill*, LIBR. OF CONG., https://www.loc.gov/ghe/cascade/index.html?appid=1821e70c01de48ae899a7ff708d6ad8b&bookmark=What%20is%20the%

Farm Bill expires in 2023, presenting a window of opportunity to put marginal lands to two productive uses: (1) environmental conservation, and (2) renewable energy development, which is currently rapidly expanding.[27] With careful design to ensure farm-compatible renewables, this policy could keep farmers in business—even increasing their income—while supporting the land-intensive renewable energy at the heart of climate solutions.[28] Numerous other land use changes will also be required, including revisions to public land rules that would better enable renewable energy development on the vast public lands in the sunny West.[29] We focus here, however, on the agricultural component, a key piece in the land use puzzle that will support utility-scale solar projects. We define utility-scale projects as those with the capacity to produce one or more megawatt ("MW") of energy and typically requiring five to ten acres of land per MW of generating capacity.[30]

20Farm%20Bil (last visited Feb. 10, 2023). The conservation farm bills of the 1980s and 1990s had somewhat similar goals to those of the modern CRP, which aims to reduce planting on marginal lands. *See, e.g.*, Eubanks II, *supra* note 6, at 242-43 (describing "Sodbuster" program and formation of CRP). Congress has already taken tepid steps toward the more sweeping energy-oriented approach that we propose here. *See* John N. Moore & Kale Van Bruggen, *Agriculture's Fate Under Climate Change: Economic and Environmental Imperatives for Action*, 86 CHI.-KENT L. REV. 87, 96 (2011) (describing "first ever" farm bill that recognized "increasingly critical role of farmers and agriculture in supplying renewable energy for the nation"). For proposals to amend portions of the Farm Bill to encourage renewable energy development, see Jared Wiesner, *A Grassroots Vehicle for Sustainable Energy: The Conservation Reserve Program & Renewable Energy*, 31 WM. & MARY ENV'T L. & POL'Y. REV. 571, 597-99 (2007) (arguing for amendments to CRP to encourage production of switchgrass and other biomass on marginal farmland).

27 *See Solar Power Will Account for Nearly Half of New U.S. Electric Generating Capacity in 2022*, U.S. ENERGY INFO. ADMIN. (Jan. 10, 2022) [hereinafter *Solar Power*], https://www.eia.gov/todayinenergy/detail.php?id=50818 [https://perma.cc/6LPW-3N7V] (projecting solar energy additions to U.S. electric grid to account for forty-six percent of all new generation additions in 2022, followed by natural gas capacity additions at twenty-one percent).

28 For a discussion of the value that renewable energy provides to struggling farmers, who might otherwise have to sell their land, see Paul Goeringer, *Solar Energy Development Provides Opportunity and Drawbacks to Maryland Agricultural Landowners*, MD. BAR J., Spring 2019, at 44, 45 (observing "[c]urrent low commodity prices may make lease offers from solar developers attractive to many farmers and landlords"); and Gene Kelly & Michelle Piasecki, *The Impossible Search for Perfect Land: Siting Renewable Generation Projects in New York State*, 30 ENV'T L. N.Y. 167, 171 (2019) (quoting New York farmer: "We got a choice: plant corn and lose $300 an acre or do nothing and get $1,500 an acre"). For an examination of the conflicts between renewable energy and agriculture and the need to carefully select lands for solar energy, see Jessica Owley & Amy Wilson Morris, *The New Agriculture: From Food Farms to Solar Farms*, 44 COLUM. J. ENV'T L. 409, 469 (2019) (describing challenges associated with "least conflict assessments," designed to reduce environmental conflict resulting from solar siting).

29 *See, e.g.*, Gerrard, *supra* note 3, at 10595.

30 *See* SEAN ONG, CLINTON CAMPBELL, PAUL DENHOLM, ROBERT MARGOLIS & GARVIN HEATH, NAT'L RENEWABLE ENERGY LAB'Y, LAND-USE REQUIREMENTS FOR SOLAR POWER

This Article explores the physical (land-based) and political opportunities that could generate meaningful, essential changes in twenty-first century climate-energy policy in the United States despite deep political antagonism. Part I argues for a reframing of the policy approach to climate change—addressing opportunities at the intersection of climate, energy, and land use law. Part II then analyzes the benefits and costs of the extensive land use change that will be required for a large renewable energy build-out. Next, Part III explores key design modifications for agricultural policy. These changes will help to ensure politically feasible, responsible renewable energy development that could help to achieve climate mandates, improve farmers' wellbeing, address neighboring residents' concerns, and enhance the environmental value of rural land.

I. THE CRITICAL INTERSECTION OF CLIMATE, ENERGY, AND LAND USE LAW

A central obstacle to achieving the current targets of federal, state, and local policies to transition toward net-zero carbon emissions is policymakers' failure to treat climate law and land use law as inseparable.[31] Policymakers, climate advocates, and scholars have long recognized the climate-energy nexus: the central solution to U.S. climate change policy is to reduce carbon emissions from electric generation and transportation—the largest climate culprits.[32] A growing body of scholarship emphasizes the connection between energy generation and land use, but this scholarship typically views the land-energy connection as an impediment to progress rather than an opportunity.[33]

PLANTS IN THE UNITED STATES, at iv n.2 (2013), https://www.nrel.gov/docs/fy13osti/56290.pdf [https://perma.cc/J7TP-J49Z] (defining utility-scale solar as involving more than one megawatt of generation capacity); *Land Use & Solar Development*, SOLAR ENERGY INDUS. ASS'N, https://www.seia.org/initiatives/land-use-solar-development [https://perma.cc/8D3V-5S2F] (last visited Feb. 10, 2023) ("Depending on the specific technology, a utility-scale solar power plant may require between 5 and 10 acres per megawatt (MW) of generating capacity."); *Most U.S. Utility-Scale Solar Photovoltaic Power Plants Are 5 Megawatts or Smaller*, U.S. ENERGY INFO. ADMIN. (Feb. 7, 2019), https://www.eia.gov/todayinenergy/detail.php?id=38272 [https://perma.cc/LEY8-8EMT] ("EIA considers utility-scale generating facilities to be those where total generation capacity is one megawatt (MW) or greater."); *Utility-Scale Solar*, SOLAR ENERGY INDUS. ASS'N, https://www.seia.org/initiatives/utility-scale-solar-power [https://perma.cc/RGB9-PBPX] (last visited Feb. 10, 2023) (describing nearly 10,000 U.S. solar projects greater than one MW currently in operation or development).

31 *See* Outka, *supra* note 14, at 246 (highlighting underexplored nexus between energy and land use).

32 U.S. ENV'T PROT. AGENCY, *supra* note 3, at ES-26 to -27 (showing that energy use by residences, buildings, and transportation, as well as energy generation, made up ninety percent of U.S. greenhouse gas emissions in 2019).

33 *See* Bronin, *supra* note 14, at 549 ("[S]ignificant investment in energy infrastructure will lead to widespread fragmentation and damage to natural ecosystems and wildlife and bird habitats."). *But see* Outka, *supra* note 14, at 255-56 (noting benefits of "reusing land *for* or *from* energy production" by building on previously used or contaminated lands and exploring other ways to positively integrate land and energy).

To achieve real progress on the climate front, climate policy must embrace the land-energy nexus as one that presents unusual benefits from a political economy perspective, bridging the typically insurmountable divide between conservative and progressive values. This political common ground rests most clearly within the physical and policy space of agriculture, as explored in this Part.

In analyzing the strong links between agriculture and renewable energy, this Article focuses primarily on solar development. Solar energy generation is the fastest-growing form of renewable energy in the United States and is often more feasible than wind energy development, attracting somewhat less opposition from neighbors in the process of siting (locating) and permitting projects.[34] Additionally, we focus on generation, rather than transmission, because the literature on modifying policy to enable a wholesale transformation of the electric transmission grid is vast.[35] Although much remains to be done on the policy side to expand transmission to support renewables,[36] the primary gaps in the literature remain in the generation space.[37]

Finally, we focus on utility-scale solar because it is the most economically feasible form of solar energy.[38] Distributed solar—often built on rooftops, and typically providing electricity both to on-site facilities and the grid—is the optimal type of solar energy from a land use perspective because it does not displace other potentially more valuable land uses such as agriculture or

[34] *See* Wiseman, *supra* note 20, at 77 n.84 (describing residents' specific opposition to wind farms); *Solar Power*, *supra* note 27.

[35] *See, e.g.*, Alexandra B. Klass, *Transmission, Distribution, and Storage: Grid Integration*, *in* LEGAL PATHWAYS TO DEEP DECARBONIZATION IN THE UNITED STATES 527, 527 (Michael B. Gerrard & John C. Dernbach eds., 2019); Alexandra Klass, Joshua Macey, Shelley Welton & Hannah Wiseman, *Grid Reliability Through Clean Energy*, 74 STAN. L. REV. 969 *passim* (2022) (exploring many policy options for nationally interconnected grid); Alexandra B. Klass & Elizabeth J. Wilson, *Interstate Transmission Challenges for Renewable Energy: A Federalism Mismatch*, 65 VAND. L. REV. 1801, 1857-73 (2012) (proposing new approach in U.S. transmission grid system to address new sources of renewable energy); Edward N. Krapels, *Triple Jeopardy: How ISOs, RTOs and Incumbent Utilities Are Killing Interregional Transmission*, ELEC. J., May 2018, at 47, 50 (arguing for new cost allocation scheme for new transmission line construction).

[36] It is important to note, however, that some utility-scale solar on farmland will be limited if it is located too far from existing transmission substations. A key consideration in siting solar is proximity to transmission lines and substations that step up (increase) the voltage from generation sites such as solar farms to send it through transmission lines. DANIELS & WAGNER, *supra* note 4, at 2 ("Developers generally want land located within two miles of an electrical substation and within 1,000 feet of three-phase power (alternating current).").

[37] These gaps are slowly being filled, particularly with respect to proposals for the allocation of authority over renewable generation siting. *See* Stokes, *supra* note 2, at 1815 (arguing for greater collaboration between local and federal government in siting process); Salkin & Ostrow, *supra* note 24, at 1091-97 (applying lessons from Telecommunications Act of 1995 to federal wind siting policy).

[38] *See infra* notes 40, 61 and accompanying text (pointing out cost difference between utility-scale solar and residential rooftop solar).

ecological protection.[39] But distributed solar is still more expensive than utility-scale solar—more than 200 percent more expensive by some metrics—because it requires individual, roof-by-roof installations and maintenance and lacks other economies of scale associated with utility-scale solar.[40]

A. *Climate-Energy Policy: A Cause in Need of Land and Subsidies*

To achieve net-zero carbon emissions or something close to it—a goal that many scientists believe is critical to slowing the potentially cataclysmic effects of climate change—the U.S. energy landscape must change dramatically.[41] Solar and wind energy are now some of the least expensive forms of new energy generation and thus dominate new U.S. capital investments in this sector.[42] But achieving net-zero emissions will require the replacement of existing, fossil fuel-fired generation with zero-carbon generation.[43] This widespread replacement will be expensive, particularly for younger fossil fuel-fired power plants with a long remaining useful life. And to achieve large levels of utility-scale renewable energy generation, a massive new network of transmission lines will be required.[44] Many of the sunniest and windiest parts of the United States are far from load centers, and renewable energy is more reliable when it is interconnected with a large network of wires.[45] If the wind stops blowing or the

[39] *See* Wiseman, *supra* note 20, at 66 (noting reduction of infrastructure replacement costs required for transition to renewables with distributed solar); *see also* Bronin, *supra* note 14, at 549 n.5.

[40] *See Levelized Cost of Energy, Levelized Cost of Storage, and Levelized Cost of Hydrogen*, LAZARD (Oct. 28, 2021), https://www.lazard.com/perspective/levelized-cost-of-energy-levelized-cost-of-storage-and-levelized-cost-of-hydrogen/ [https://perma.cc/H5YH-W7MF] (showing utility-scale solar PV energy as costing $28 to $41 per MW hour and residential rooftop solar PV as costing $147 to $221 per MW hour). *But see* Ryan Thomas Trahan, *Regulating Toward (in)Security in the U.S. Electricity System*, 12 TEX. J. OIL GAS & ENERGY L. 1, 15 & n.67 (2017) (contending existing studies fail to incorporate costs of transmission and distribution facilities into projected costs of energy projects, resulting in failure to "more fully understand the actual cost of electricity in the context of available delivery alternatives").

[41] *See, e.g.*, James H. Williams, Ryan A. Jones, Ben Haley, Gabe Kwok, Jeremy Hargreaves, Jamil Farbes & Margaret S. Torn, *Carbon-Neutral Pathways for the United States*, AGU ADVANCES, Mar. 2021, at 1, 1 ("The Intergovernmental Panel on Climate Change (IPCC) Special Report on Global Warming of 1.5°C points to the need for carbon neutrality by mid-century.").

[42] LEVELIZED COSTS, *supra* note 12, at 17 tbl.A1a (providing comparison of economic competitiveness of different sources of new energy generation in United States).

[43] Williams et al., *supra* note 41, at 6-7 (describing pillars of deep decarbonization, including replacing fossil fuels with wind, solar, and biomass).

[44] Richard Piwko, Dale Osborn, Robert Gramlich, Gary Jordan, David Hawkins & Kevin Porter, *Wind Energy Delivery Issues*, IEEE POWER & ENERGY MAG., Nov./Dec. 2005, at 47, 47-48.

[45] *See id.*; *see also* Patrick R. Brown & Audun Botterud, *The Value of Inter-Regional Coordination and Transmission in Decarbonizing the US Electricity System*, 5 JOULE 115, 130 (2021) (noting benefits of expanding grid coordination).

sun stops shining in some parts of the country, utilities connected to this large network can often draw from renewable energy generated in another part of the country.[46] The overall effort of achieving net-zero U.S. carbon emissions—including widespread replacement of fossil fuel-fired generation, construction of new transmission lines, and electrification of many fossil fuel technologies, among other changes—will cost around "$1.7 trillion over the 2020-2050 period, using a 2% societal discount rate."[47]

Paralleling the large financial commitment necessary for an expansive renewable energy build-out is the need for a vast amount of land—particularly for building solar and wind generation and associated transmission lines. All forms of U.S. energy development projected through 2040 will require additional land area greater than the size of Texas, increasing at a pace that "is more than double the historic rate of urban and residential development."[48] While urban and residential land use change was previously the largest driver of land use conversion, land use for energy now holds that position.[49] Land use for renewable energy generation is only a portion of this energy land use picture, but it is an important one.

Wind and solar farms use more land than natural gas-fired generation, which is currently the predominant source of U.S. electricity, even accounting for the land involved in drilling or mining for fossil fuels.[50] For electricity produced with natural gas from shale wells, the most common source of natural gas, the direct land use footprint is 0.12 to 0.48 square kilometers used per terawatt-hour of electricity produced.[51] Compare this to 0.34 to 1.37 square kilometers per terawatt-hour for onshore wind energy, and a much larger 12.30 to 16.97 square kilometers of land use per terawatt-hour of solar photovoltaic ("PV") electricity

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[46] *See* VICTOR DIAKOV, THE VALUE OF GEOGRAPHIC DIVERSITY OF WIND AND SOLAR: STOCHASTIC GEOMETRY APPROACH 2-3 (2012), https://www.nrel.gov/docs/fy12osti/54707.pdf [https://perma.cc/PA7M-NQJ8] (describing how combination of solar and wind from different locations better matches load (demand) than solar or wind alone); Tomás Guozden, Juan Pablo Carbajal, Emilio Bianchi & Andrés Solarte, *Optimized Balance Between Electricity Load and Wind-Solar Energy Production*, FRONTIERS ENERGY RSCH., Feb. 2020, at 1, 2 ("It is well-known that a wider geographical distribution of wind farms reduce their overall variability.").

[47] Williams et al., *supra* note 41, at 10.

[48] Trainor et al., *supra* note 14, at 1.

[49] *Id.* at 11 ("In total, energy sprawl is causing land use change at rates higher than other major drivers, making it the largest driver of land use change in the United States.").

[50] *Id.* at 9 tbl.2 (listing area of direct land use footprint for different types of energy generation, including renewables and fossil fuels); *Electricity Explained: Electricity in the United States*, U.S. ENERGY INFO. ADMIN., https://www.eia.gov/energyexplained/electricity/electricity-in-the-us.php [https://perma.cc/N4TX-NQU5] (last updated July 15, 2022) (showing natural gas provided thirty-eight percent of U.S. electricity generation in 2021, more than any other individual source).

[51] Trainor et al., *supra* note 14, at 9 tbl.2.

produced.[52] However, this difference between the renewable energy and fossil fuel land use footprints narrows as time passes and additional land is needed to drill new wells, whereas existing solar and wind farms continue producing without the need for expansion.[53] Additionally, recent studies based on aerial photos of solar farms suggest that solar requires more land than initially estimated.[54] Indeed, many of the models of pathways toward a zero-carbon United States include scenarios that vary based on the amount of land available for onshore renewable energy, recognizing that this will be a key limiting factor.[55] Part of the reason for the large land area needed is that solar panels are not energy dense, with most commercial panels converting only between fifteen percent and twenty percent of sunlight into electricity.[56] More efficient solar panels would occupy less space.

This is not to say that solar energy will cover or consume a large amount of U.S. land from a whole-country perspective. The National Renewable Energy Laboratory ("NREL") observes that supplying all U.S. electricity needs (as measured by 2004 energy use) with solar PV generation would require 0.4 percent of the land area in the United States—roughly 10 million acres.[57] And in an observation particularly apt for the energy-agricultural links discussed in this Article, NREL observed in 2004 that "the federal government idles 30 million acres of farmland every year—or three times the area needed to generate all our electricity from sunlight."[58] Even if electricity use were to triple from 2004 levels—which it will (and more) if we electrify most vehicles, building heating, cooking appliances, and industrial processes—the land taken out of production through the Conservation Reserve Program ("CRP") would provide

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[52] *Id.*; *see also* ONG ET AL., *supra* note 30, at 17 (concluding solar PV generation requires 3.6 acres per gigawatt-hour per year).

[53] *See* Trainor et al., *supra* note 14, at 10 (detailing number of production years for which shale wells have same land use impact as onshore wind (6.9) and solar PV (78.5)).

[54] *See* Dirk-Jan van de Ven, Iñigo Capellan-Peréz, Iñaki Arto, Ignacio Cazcarro, Carlos de Castro, Pralit Patel & Mikel Gonzalez-Eguino, *The Potential Land Requirements and Related Land Use Change Emissions of Solar Energy*, 11 SCI. REPS. 1, 1 (2021) (citations omitted) (explaining high land use of bioenergy and other renewable energy sources also increases land competition for cropland and forests).

[55] *See* Williams et al., *supra* note 41, at 7 (modeling "low land" alternate pathway that involves "limiting the land area available for siting wind and solar"); Brown & Botterud, *supra* note 45, at 115-17 (noting authors "develop supply curves of available land area for PV and wind development, excluding water bodies, national parks, urban areas, mountain ranges, and Native American territories" (citations omitted)).

[56] CTR. FOR SUSTAINABLE SYS., UNIV. OF MICH, PHOTOVOLTAIC ENERGY 1 (2022), https://css.umich.edu/sites/default/files/2022-09/Photovoltaic%20Energy_CSS07-08.pdf [https://perma.cc/3DSG-NNQL] (noting some cells have efficiencies closer to fifty percent).

[57] NAT'L RENEWABLE ENERGY LAB'Y, U.S. DEP'T OF ENERGY, PV FAQS: HOW MUCH LAND WILL PV NEED TO SUPPLY OUR ELECTRICITY? 1 (2004), https://www.nrel.gov/docs/fy04osti/35097.pdf [https://perma.cc/H2SR-UFHE].

[58] *Id.*

the acreage needed to serve this demand through solar PV generation.[59] NREL also observes that in the alternative, we would need to place solar panels on only seven percent of existing infrastructure, such as buildings and parking lots, to cover all 2004 electricity needs.[60] But distributed solar is more expensive than utility-scale solar, making the use of land for large solar farms a more feasible option.[61]

Other reports suggest similar land needs. For example, an MIT study estimates that solar panels evenly distributed around the United States could power all U.S. electricity demand as of 2015 using "only about 0.4% of the land area of the continental United States," which is half the acreage that is currently used to produce ethanol from corn.[62] Alternatively, placing more solar panels in the sunniest parts of the country and building transmission lines to connect those panels to population centers would require less acreage.[63] Another study concludes that achieving an eighty percent reduction from 1990 greenhouse gas emissions through the construction of utility-scale solar projects would require approximately 14,285 square kilometers, or around 3.5 million acres of land—an area "roughly the area of the state of Connecticut."[64] Regardless of the exact numbers, it is clear that substantial acreage must be committed to renewable energy for intensive U.S. decarbonization.

The land requirements for renewable energy do not stop at the point of generation. The physical location of future renewable energy generation requires

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[59] *See* Williams et al., *supra* note 41, at 10 (noting electricity demand triples from 2021 level of use with extensive electrification conversions, including electric vehicles, heat pumps, and production of hydrogen gas (using renewably produced electricity) for industrial processes).

[60] NAT'L RENEWABLE ENERGY LAB'Y, *supra* note 57, at 1.

[61] *See supra* note 40 and accompanying text; *Levelized Cost of Energy, Levelized Cost of Storage, and Levelized Cost of Hydrogen*, *supra* note 40 (showing that, on levelized cost basis, excluding all subsidies provided to different energy forms, utility-scale solar PV costs between $28 and $41 per megawatt-hour of electricity as compared to $67 to $180 per megawatt hour for commercial rooftop solar and $147 to $221 per MW hour for residential rooftop solar).

[62] RICHARD SCHMALENSEE, VLADIMIR BULOVIĆ, ROBERT ARMSTRONG, CARLOS BATTLE, PATRICK BROWN, JOHN DEUTCH, HENRY JACOBY, ROBERT JAFFE, JOEL JEAN, RAANAN MILLER, FRANCIS O'SULLIVAN, JOHN PARSONS, JOSÉ IGNACIO PÉREZ-ARRIAGA, NAVID SEIFKAR, ROBERT STONER, CLAUDIO VERGARA, MASS. INST. OF TECH., THE FUTURE OF SOLAR ENERGY 4 (2015), https://energy.mit.edu/wp-content/uploads/2015/05/MITEI-The-Future-of-Solar-Energy.pdf [https://perma.cc/2V9A-3AG6]. A more precise calculation of the total land area of the continental United States is 1.9 billion acres, and 0.4 percent of 1.9 billion is 7.6 million acres. *See* Dave Merrill & Lauren Leatherby, *Here's How America Uses Its Land*, BLOOMBERG (July 31, 2018), https://www.bloomberg.com/graphics/2018-us-land-use/?leadSource=uverify%20wall [https://perma.cc/34ZP-LTU8].

[63] SCHMALENSEE ET AL., *supra* note 62, at 4.

[64] Rebecca R. Hernandez, Madison K. Hoffacker, Michelle L. Murphy-Mariscal, Grace C. Wu & Michael F. Allen, *Solar Energy Development Impacts on Land Cover Change and Protected Areas*, 112 PROCS. NAT'L ACAD. SCIS. U.S. 13579, 13579 (2015); *Correction*, 113 PROCS. NAT'L ACAD. SCIS. U.S. E1768, E1768 (2016).

an extensive expansion of the transmission grid—adding 200,000 to 400,000 more miles of transmission lines.[65] Building large amounts of offshore wind could alleviate some of this build-out, as 40% of the U.S. population lives in coastal counties.[66] But offshore wind is currently at least double the price of onshore wind and solar energy.[67]

Farmland—particularly the marginal farmland that the U.S. government currently pays farmers to keep out of production—will be a key supporting factor for the large renewable energy build-out needed to mitigate climate change. Shifting existing farm subsidies to these lands would also help lower some of the financial barriers to this large build-out, many of which are "soft costs," including the costs of siting and permitting renewable generation.[68] The siting of solar farms on marginal farmland would likely be a boon to farmers, as explored below, because it would provide lease payments for otherwise unproductive land.[69] This, in turn, would lessen farmer opposition to proposed solar leases, and it would make for easier permitting given the already degraded nature of the land.

B. *Agricultural Policy: Subsidies and Land in Need of a Cause*

While zero-carbon energy sources, such as electricity from solar PV energy, demand large quantities of land and investment, U.S. farms offer millions of acres of currently unused, subsidized land.[70] Many of these acres are fallow because the federal government, through the CRP, pays farmers to avoid

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[65] DAN SHREVE & WADE SCHAUER, DEEP DECARBONISATION REQUIRES DEEP POCKETS: TRILLIONS REQUIRED TO MAKE THE TRANSITION 6 (2019) (naming transmission expansion as operational challenge for achieving complete renewable energy reliance); Wiseman, *supra* note 20, at 61-62 (discussing this report).

[66] *See Economics and Demographics*, NOAA OFF. FOR COASTAL MGMT., https://coast.noaa.gov/states/fast-facts/economics-and-demographics.html [https://perma.cc/S8LZ-BZ69] (last updated Feb. 16, 2023); *Renewable Energy on the Outer Continental Shelf*, BUREAU OF OCEAN ENERGY MGMT., https://www.boem.gov/renewable-energy/renewable-energy-program-overview [https://perma.cc/UMQ6-SCDQ] (last visited Feb. 10, 2023) ("Offshore wind is an abundant domestic energy resource that is located close to major coastal load centers.").

[67] LEVELIZED COSTS, *supra* note 12, at 22.

[68] The National Renewable Energy Laboratory ("NREL") classifies land acquisition as an operating expenditure (soft cost) rather than capital cost because most solar developers lease rather than purchase land. DAVID FELDMAN, VIGNESH RAMASAMY, RAN FU, ASHWIN RAMDAS, JAL DESAI & ROBERT MARGOLIS, U.S. SOLAR PHOTOVOLTAIC SYSTEM AND ENERGY STORAGE COST BENCHMARK: Q1 2020, at 46 (2021), https://www.nrel.gov/docs/fy21osti/77324.pdf [https://perma.cc/Z58B-5J38].

[69] *See infra* note 89 and accompanying text.

[70] Press Release, Farm Serv. Agency, U.S. Dep't of Agric., USDA Accepts More than 3.1 Million Acres in Grassland CRP Signup (July 12, 2022), https://www.fsa.usda.gov/news-room/news-releases/2022/usda-accepts-more-than-3-1-million-acres-in-grassland-crp-signup [https://perma.cc/XY9T-3AGM] (noting that "about 5.6 million acres are entering CRP in 2023").

growing crops in order to improve wildlife habitat, reduce soil erosion, or achieve similar conservation goals.[71] The most recent Farm Bill, enacted in 2018, allocates between $1.9 and $2.1 billion annually to the program through 2023.[72] In 2021 alone, farmers enrolled 5.3 million new acres in the program,[73] and annual total CRP acreage is between 20 and 30 million acres.[74] One of the states with the most newly-enrolled acreage is New Mexico,[75] which also happens to boast some of the most consistent solar radiation in the United States—an important factor supporting new solar construction.[76]

The U.S. Department of Agriculture ("USDA") already directly subsidizes some solar activity, although not nearly on the scale that CRP support would provide.[77] But these subsidies, too, would further support the development of solar PV generation on CRP lands. For example, under the Farm Bill, the USDA provides guaranteed grants and loans for solar development on farms,[78] and

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[71] *See Conservation Reserve Program: About the Conservation Reserve Program (CRP)*, U.S. DEP'T OF AGRIC.: FARM SERV. AGENCY [hereinafter *About the CRP*], https://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-program/ [https://perma.cc/7PNH-WR6L] (last visited Feb. 10, 2023) ("In exchange for a yearly rental payment, farmers enrolled in the program agree to remove environmentally sensitive land from agricultural production and plant species that will improve environmental health and quality.").

[72] *See* CONG. BUDGET OFF., USDA'S MANDATORY FARM PROGRAMS—CBO'S JANUARY 2019 BASELINE 26 (2019), https://www.cbo.gov/system/files?file=2019-01/51317-2019-01-usda.pdf [https://perma.cc/ZP6T-TSSZ]; *see also* Agriculture Improvement Act of 2018, Pub. L. No. 115-334, 132 Stat. 4490 (codified in scattered sections of 7 U.S.C.).

[73] Press Release, Farm Serv. Agency, U.S. Dep't of Agric., USDA Accepts More than 2.5 Million Acres in Grassland CRP Signup, Double Last Year's Signup (Sept. 10, 2021) [hereinafter Press Release, USDA Accepts More than 2.5 Million Acres], https://www.fsa.usda.gov/news-room/news-releases/2021/usda-accepts-more-than-2-5-million-acres-in-grassland-crp-signup-double-last-years-signup [https://perma.cc/68NS-V7LT].

[74] *See* Press Release, USDA Accepts 2.8 Million Acres, *supra* note 7.

[75] *See* Press Release, USDA Accepts More than 2.5 Million Acres, *supra* note 73.

[76] Billy J. Roberts, *Global Horizontal Solar Irradiance, National Solar Radiation Database Physical Model*, NAT'L RENEWABLE ENERGY LAB'Y (Feb. 22, 2018), https://www.nrel.gov/gis/assets/images/solar-annual-ghi-2018-usa-scale-01.jpg [https://perma.cc/8WTT-KMH7] (showing highest levels of annual average daily total solar resource in southern New Mexico and also relatively high levels in remainder of state).

[77] *See, e.g.*, *Energy Programs*, U.S. DEP'T OF AGRIC.: RURAL DEV., https://www.rd.usda.gov/programs-services/energy-programs [https://perma.cc/D5TV-KZUT] (last visited Feb. 10, 2023) (detailing programs to install renewable energy sources, including solar panels, in rural areas).

[78] *Rural Energy for America Program Renewable Energy Systems & Energy Efficiency Improvement Guaranteed Loans & Grants*, RURAL DEV., U.S. DEP'T OF AGRIC.: RURAL DEV. [hereinafter *Rural Energy*], https://www.rd.usda.gov/programs-services/energy-programs/rural-energy-america-program-renewable-energy-systems-energy-efficiency-improvement-guaranteed-loans [https://perma.cc/3W89-JBL9] (last visited Feb. 10, 2023) (describing guaranteed financing for "[s]mall and large solar generation," among other renewable energy sources, on farms).

some of the grants under the Farm Bill's Federal-State Marketing Improvement Program have gone to projects such as those supporting sheep grazing under solar panels.[79]

Beyond some existing subsidies, solar development has numerous nonclimate benefits that attract support from many farmers. These include providing a financial lifeline to struggling farmers and preserving land that may otherwise have been converted to housing developments.[80] In addition to providing income on marginal lands—such as those subsidized to remain fallow under the CRP—solar development can allow for productive farming beneath and around solar panels, and the entire farm need not be converted to solar.[81] High-quality soils can remain crop land, and farmers can continue to raise livestock near, or in the case of sheep, alongside and beneath solar panels.[82]

In short, agricultural policy already has what renewable energy needs the most—available land and continued financial support under the CRP and other Farm Bill subsidies. The USDA already provides nontrivial financial support for renewable energy generation on farms.[83] But addressing the climate-energy-land

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[79] U.S. DEP'T OF AGRIC., FISCAL YEAR 2021 DESCRIPTION OF FUNDED PROJECTS 1 (2021), https://www.ams.usda.gov/sites/default/files/media/FSMIPFY21DescriptionofFundedProjects.pdf [https://perma.cc/N4FE-3JHW] (detailing projects in Pennsylvania, New York, and New England states with goal of disseminating outcomes to sheep farmers nationwide).

[80] For a longer list of benefits, see *Farmer's Guide to Going Solar*, U.S. DEP'T OF ENERGY: OFF. OF ENERGY EFFICIENCY & RENEWABLE ENERGY, https://www.energy.gov/eere/solar/farmers-guide-going-solar [https://perma.cc/HRZ6-ARXL] (last visited Feb. 10, 2023) (noting, among others, "nutrient and land recharge of degraded lands," "[i]ncreased ability to install high-value, shade-resistant crops for new markets," and "[p]otential to extend growing seasons").

[81] *See id.* (noting ability to grow shade-resistant crops and cobenefits of sheep and solar, with sheep controlling growth around solar panels and also supporting "local shepherds").

[82] Renewable energy can also supply on-farm energy, often for a lower price than grid-provided energy. This advantage has been recognized both within the United States and globally. Internationally, the World Bank supports development projects that provide renewable water pumping equipment and other renewable-powered equipment to farmers. Mehrin Ahmed Mahbub, *Solar Irrigation Pumps: A New Way of Agriculture in Bangladesh*, WORLD BANK BLOGS (Mar. 29, 2016), https://blogs.worldbank.org/endpovertyinsouthasia/solar-irrigation-pumps-new-way-agriculture-bangladesh [https://perma.cc/EP26-CCTN] (describing project supported by World Bank to provide solar pumps to farmers in Bangladesh).

[83] *See* Press Release, U.S. Dep't of Agric., USDA Invests $464 Million in Renewable Energy Infrastructure To Help Rural Communities, Businesses and Ag Producers Build Back Better (Sept. 9, 2021), https://www.usda.gov/media/press-releases/2021/09/09/usda-invests-464-million-renewable-energy-infrastructure-help-rural [https://perma.cc/9A83-HCFA] (describing specific projects financed by program); *Rural Energy*, *supra* note 78 (describing eligibility for renewable energy systems grants under Rural Energy for America program); *see also* KELSI BRACMORT, CONG. RSCH. SERV., R45943, THE FARM BILL ENERGY TITLE: AN OVERVIEW AND FUNDING HISTORY 1 (2021), https://www.everycrsreport.com/files/2021-10-28_R45943_5c16d6399f18be33dcaddbdbfb96637d74636ce3.pdf [https://perma.cc/YCZ3-8QNP] (describing all energy initiatives under farm bills and observing that most of them are for biofuels).

connection would require only relatively small amendments to the CRP (and potentially the Farm Bill, which enables the CRP) that would prioritize proposed CRP projects that allowed solar development on fallow lands.[84]

The USDA could maintain the existing criteria, which require eligible applicants to keep certain environmentally sensitive lands out of agricultural production and plant vegetative cover or implement other practices to reduce erosion or enhance wildlife habitat.[85] The added criterion would be a prioritization of applicants who allowed solar development on their land—likely by submitting a signed lease. Continuing to subsidize agricultural nonproduction and prioritizing subsidies for farmers who allowed solar development on CRP land could decrease siting costs for utility-scale solar developers. Part III further explores how the federal government should operationalize this policy change to incentivize the siting of solar on marginal farmlands.

C. *A Pareto-Efficient Merger of Energy and Agriculture?*

Shifting CRP funding toward solar development and providing the land and some of the investment that solar energy developers need could be a Pareto efficient solution, in which no one person could be made better off through further shifting of funds, without making someone else worse off. This, of course, is all dependent on how one views funding baselines. If we take the use of federal funds to pay farmers *not* to farm as the baseline, then using these funds to keep land uncultivated *and* support solar energy development appears to make many parties better off. The public at large receives the environmental benefits of fewer air pollutants and, eventually, fewer climate impacts, albeit with the land use and water quality impacts of solar energy that would have to be closely monitored—particularly if the solar projects were built on fragile/erodible land.[86] The federal government's funding would support the creation of solar construction jobs on lands that would otherwise remain unused.[87] Farmers would receive some subsidy from the CRP—taking into account the lease money received from the solar developer—and the CRP money would support the types of environmental protection measures that solar developers might otherwise not invest in, such as planting crops to reduce erosion.[88] These lease payments are

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[84] See *infra* Part III for a discussion of the extent to which both the Farm Bill and CRP regulations might need to be modified to prioritize solar development on CRP lands.

[85] *See* FARM SERV. AGENCY, U.S. DEP'T OF AGRIC., CONSERVATION RESERVE PROGRAM: 56TH GENERAL ENROLLMENT PERIOD ENVIRONMENTAL BENEFITS INDEX (EBI) 2-3 (2021), https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/FactSheets/2020/crp-56th-ebi-fact-sheet-12-31-2020.pdf [https://perma.cc/MN8X-Q7PE] (describing practices for which applicants for CRP receive points).

[86] *See infra* Part II (discussing impacts of solar energy on environment).

[87] *See, e.g.*, Roth, *supra* note 5 (detailing how union workers advocated for California lawmakers to allow renewable energy development in county to create jobs).

[88] *See* HALL ET AL., *supra* note 5, at 13 (describing state regulatory efforts to protect quality soil during renewable energy construction).

key to keeping many farmers in business, which is a central goal of the Farm Bill.[89]

Ultimately, supporting solar energy generation on farmland is a key mechanism for keeping a growing number of farms in business. A solar lease is a steady source of income—typically distributed over twenty or twenty-five years—that helps to smooth out the ongoing volatility of commodity prices, which is not entirely addressed by government price supports or crop insurance payments.[90]

II. FINDING OPPORTUNITY IN THE LAND-ENERGY NEXUS

The land-intensive nature of renewable resources such as solar PV energy is a topic of much commentary, typically with a negative bent. Solar PV energy, on a unit-per-unit basis, uses more land than its natural gas-fired competitor.[91] And powering all of the United States with solar PV panels will require something on the order of 10 million acres of land and thousands of miles of new transmission lines, as explored in Part I.[92] The land use changes associated with the renewable energy revolution required for transition to net-zero energy in the United States will be far from negligible, impacting wildlife habitat, water quality, farms, and aesthetics. This Part acknowledges and analyzes these impacts yet also focuses on the positive attributes of solar PV energy in all of these spheres, pinpointing areas where typically divided stakeholders may find unusual common ground to support solar energy.

A. *Solar Energy and the Environment: A Complex Tale*

Climate policy relies centrally on the rapid build-out of renewable energy because this will reduce carbon emissions.[93] In turn, reduced carbon emissions will gradually mitigate some of the worst environmental impacts of climate change—including, for example, massive habitat destruction from wildfires and pests, and higher extinction rates for plants and animals due to habitat and

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[89] RENÉE JOHNSON & JIM MONKE, CONG. RSCH. SERV., RS22131, WHAT IS THE FARM BILL? 1 (2022), https://sgp.fas.org/crs/misc/RS22131.pdf [https://perma.cc/8X2R-AEYV] (“Historically, farm bills focused on farm commodity program support for a handful of staple commodities . . . .”).

[90] *See* GROUT & IFFT, *supra* note 18, at 1 (noting benefits farmers will receive from solar leases due to revenue stream acting as hedge against “volatile commodity prices and unpredictable production”).

[91] *See supra* notes 51-52 and accompanying text.

[92] *See supra* Part I (highlighting vast amount of land needed to meet U.S. solar power needs).

[93] *See* Jeffrey Thaler, *Fiddling as the World Floods and Burns: How Climate Change Urgently Requires a Paradigm Shift in the Permitting of Renewable Energy Projects*, 42 ENV’T L. 1101, 1103-05 (2012) (emphasizing urgent need for faster permitting processes for renewable energy projects to reduce carbon emissions); J.B. Ruhl & James Salzman, *What Happens When the Green New Deal Meets the Old Green Laws?*, 44 VT. L. REV. 693, 700 (2020).

temperature changes, among others.[94] But renewable energy also has direct, non-climate-related impacts on the environment. Many scholars focused on the cataclysmic aspects of climate change correctly observe that these direct impacts, such as the physical impact of solar and wind farms on wildlife habitats, are negligible in comparison to the environmental catastrophe of climate change.[95] These scholars accordingly suggest that the direct impacts of renewable energy on the environment should not be the central concern in a rapid approval process for renewable energy development.[96] But these impacts are nonetheless relevant in determining how much streamlining of renewable energy siting and permitting should occur as part of a larger decarbonization effort. And within each of these areas, solar development can produce opportunities for enhancing the environmental performance of land.

1. Habitat Fragmentation and Other Wildlife Impacts

Due to the land-intensive nature of solar and wind energy, these types of developments can substantially break up wildlife habitat—not only current habitat, but also land areas that will be important as wildlife migrates northward and to higher topographies resulting from intensifying climate change.[97] Fragmentation of habitat can break up animals' breeding and feeding areas as well as migration routes.[98] Solar and wind farms can be optimally located and designed to minimize these impacts, but this requires careful planning. For example, planners can coordinate approvals of solar and wind farms within a particular geographic area such that these farms provide a continuous line of open space, with no fencing or physical infrastructure, allowing wildlife to pass through the farms.[99] Planners can also use mapping tools that identify current and future areas that will be essential for hosting plant and animal species as

[94] *See* Thaler, *supra* note 93, at 1107-08 (emphasizing threat of climate change on wildlife and ecosystems).

[95] *See* Peter Berrill, Anders Arvesen, Yvonne Scholz, Hans Christian Gils & Edgar G. Hertwich, *Environmental Impacts of High Penetration Renewable Energy Scenarios for Europe*, ENV'T RSCH. LETTERS, Jan. 2016, at 1, 5 (2016) ("Climate change impacts reduce considerably with increasing inputs of renewable energy.").

[96] *See, e.g.*, Thaler, *supra* note 93, at 1104 (advocating for paradigm shift away from burdensome laws and regulations governing renewable energy); Ruhl & Salzman, *supra* note 94, at 700 (arguing new environmental laws must be passed for Green New Deal to accomplish its initiatives in time).

[97] *Resilient Land Mapping Tool*, NATURE CONSERVANCY, https://maps.tnc.org/resilientland/ (last visited Feb. 10, 2023) (allowing identification of the areas that will be critical for climate flow).

[98] *See* Hernandez et al., *supra* note 64, at 13580 (describing ecological consequences of habitat fragmentation due to solar energy development).

[99] *See* THE NATURE CONSERVANCY IN N.C., PRINCIPLES OF LOW IMPACT SOLAR SITING AND DESIGN 4 (2019), https://www.nature.org/content/dam/tnc/nature/en/documents/ED_TNCNCPrinciplesofSolarSitingandDesignJan2019.pdf [https://perma.cc/2QZP-QE34] (recommending wildlife-friendly fencing or unfenced corridors when building solar facility).

they gradually migrate due to climate change, and steer renewable energy development away from these "resilient" lands.[100]

Other habitat-related impacts on wildlife are more difficult to address. For example, some bird species react negatively to any form of infrastructure within their habitat, be it a fence post or a wind tower. Wind farms in the West and Midwest have already negatively impacted endangered wildlife such as the sage grouse and prairie chicken, largely due to interruption of their breeding routines.[101]

2. Enhancement of Land and Wildlife Habitat

Although renewable energy, like most forms of infrastructure development, has negative environmental impacts, it can also enhance the environmental value of land. Particularly when solar farms are sited on degraded lands, solar development—when designed properly, such as minimally grading the site and planting vegetation that prevents soil erosion and benefits pollinators and other wildlife—can improve water quality, carbon sequestration, biodiversity, and pollinator habitat as compared to the previous site condition.[102] Furthermore, solar developers can add "supplemental habitat features" such as bird perches, nesting boxes, and similar boxes for bats and bees.[103] A 2021 study found that planting and managing native grassland under utility-scale solar farms in the Midwest would result in a "3-fold increase in pollinator supply" as compared to maintaining the land as farmland.[104]

Achieving these benefits in practice can be quite difficult, however, if they are not mandated within a local zoning ordinance. Rural local governments generally lack these zoning ordinances as they tend to be underfunded and sometimes lack the expertise and resources to write and enforce these ordinances.[105] Additional USDA funds provided to farmers above and beyond lease payments, with a requirement that a minimum amount of environment-improving activity occur, could be a key driver of habitat-enhancing solar development, if implemented carefully.

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[100] *See Resilient Land Mapping Tool*, *supra* note 97.

[101] Virginia L. Winder, Lance B. McNew, Andrew J. Gregory, Lyla M. Hunt, Samantha M. Wisely & Brett K. Sandercock, *Effects of Wind Energy Development on Survival of Female Greater Prairie-Chickens*, 51 J. APPLIED ECOLOGY 395, 402-03 (2014) (noting some species of birds may be more sensitive to energy development than others and encouraging species-specific responses).

[102] THE NATURE CONSERVANCY IN N.C., *supra* note 99, at 5.

[103] *Id.* at 8 (recommending solar developers provide supplemental wildlife habitat features to encourage wildlife to live near solar site).

[104] Leroy J. Walston, Yudi Li, Heidi M. Hartmann, Jordan Macknick, Aaron Hanson, Chris Nootenboom, Eric Lonsdorf & Jessica Hellmann, *Modeling the Ecosystem Services of Native Vegetation Management Practices at Solar Energy Facilities in the Midwestern United States*, ECOSYSTEM SERVS., Dec. 2020, at 1, 7 (2021).

[105] *See* Stokes, *supra* note 2, at 1772-74 (describing rural county's failure to include solar facilities in zoning ordinance due to limited resources).

3. Stormwater Pollution

Wind and solar farms produce few air or water pollutants, aside from the pollutants produced in the manufacturing and disposal of solar and wind equipment.[106] However, depending on their location and design, these farms can cause soil to erode from sites and wash into surface water during precipitation events.[107] This stormwater pollution, or runoff, can negatively impact surface waters, blocking light filtration and adding sediment to the bottoms of water bodies.[108]

Some renewable energy sites produce minimal stormwater pollution because they are not bulldozed or graded prior to development. Rather, solar panels are simply built on the existing landscape.[109] Sites that require grading or that are on hilly terrain tend to produce more stormwater runoff.[110] Regardless, all utility-scale renewable energy farms must comply with federal Clean Water Act standards for stormwater pollution, which require erosion-reducing measures.[111]

If designed properly, as with wildlife habitat, solar farms can reduce stormwater pollution rather than causing or exacerbating it. Particularly if solar farms are built on erodible lands that would otherwise be used for growing crops such as corn, and these farms are built without grading and with the addition of erosion-reducing vegetative cover, net benefits can result.[112]

A key consideration in allowing solar on CRP lands would be to prohibit, or allow only with stringent limitations, solar development on lands in the program with steep slopes from which soil can easily erode and pollute water.[113] While solar projects with limited stormwater runoff can be built on these types of slopes if stringent erosion control measures are implemented, there is still a risk that solar development on these lands could be as harmful as the previous, poorly

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[106] The lifecycle pollution from renewable energy is important but is beyond the focus of this Article, which closely examines the land-based impacts of renewable energy generation.

[107] *See* Weselek et al., *supra* note 19, at 7 (describing how application of solar PV panels can lead to water runoffs during heavy rainfall that can cause erosion).

[108] MID-AM. REG'L COUNCIL, WHAT IS SEDIMENT POLLUTION? 2 (2005), https://cfpub.epa.gov/npstbx/files/ksmo_sediment.pdf [https://perma.cc/V984-EEEY].

[109] Billy Ludt, *Solar Can Be Installed on Uneven, Hilly Sites with Relative Ease*, SOLAR POWER WORLD (Jan. 14, 2019), https://www.solarpowerworldonline.com/2019/01/solar-can-be-installed-on-uneven-hilly-sites-with-relative-ease/ [https://perma.cc/JM5W-DW52] (noting new solar panels can be installed on uneven terrain without requiring site disturbance due to technological advancements).

[110] *Id.* (noting how grading land can lead to altered "rain runoff patterns" that negatively impact native species).

[111] *Summary of the Clean Water Act*, U.S. ENV'T PROT. AGENCY, https://www.epa.gov/laws-regulations/summary-clean-water-act [https://perma.cc/C3KX-QJAC] (last updated July 6, 2022) (describing pollution control programs established by Clean Water Act).

[112] *See* THE NATURE CONSERVANCY IN N.C., *supra* note 99, at 7.

[113] *See id.* at 6 (explaining how avoiding steep slopes for solar development will reduce risk of erosion and runoff).

monitored crop growing.[114] And given the Natural Resources Conservation Service's limited resources, diligent monitoring is a doubtful proposition.[115] The most prudent approach therefore might be to simply prohibit solar development on CRP lands with slopes exceeding a degree deemed to contribute to problematic erosion. One rule of thumb might be a cut-off at slopes with more than a ten percent grade—where roads servicing utility-scale solar installations have been deemed to increase the likelihood of erosion during strong precipitation.[116]

4. Aesthetic Impacts

A final environmental and social concern associated with solar development is its impact on aesthetics and viewsheds—transforming relatively pristine-looking farm fields into rows of solar panels.[117] Some residents who voice concerns about solar energy point particularly to "glare"—the reflection of sunlight off of the panels.[118] But these impacts, too, can and should be addressed within siting processes or subsidization of solar through programs such as the CRP. Fencing with vegetation or other natural structures can help to minimize visual impact, as can requirements for painting the panel support structures a natural color.[119] Furthermore, the glare from solar panels does not exceed the amount of light that reflects from natural features like lakes, and glare effects can be addressed through slight modifications to the tilt of the solar panels.[120]

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[114] *See id.* at 7.

[115] *See* CONG. BUDGET OFF., *supra* note 72, at 3 (listing funding amounts for Natural Resources Conservation Service conservation programs).

[116] Jason Sharp, Adam O'Connor & Mark Priddle, *Lessons Learned: Solar Projects Present Unique Stormwater Management Challenges*, ENV'T SCI. & ENG'G MAG. (Dec. 8, 2017) https://esemag.com/stormwater/lessons-learned-solar-project-present-unique-stormwater-management-challenges/ [https://perma.cc/XBC8-Q3YY].

[117] *See* Ana del Carmen Torres-Sibille, Vicente-Agustín Cloquell-Ballester, Víctor-Andrés Cloquell-Ballester & Miguel Ángel Artacho Ramírez, *Aesthetic Impact Assessment of Solar Power Plants: An Objective and a Subjective Approach*, 13 RENEWABLE & SUSTAINABLE ENERGY REVS. 986, 986 (2009) (discussing visual impact that solar panels have on rural environments).

[118] Megan Day & Benjamin Mow, *Research and Analysis Demonstrate the Lack of Impacts of Glare from Photovoltaic Modules*, NAT'L RENEWABLE ENERGY LAB'Y (July 31, 2018), https://www.nrel.gov/state-local-tribal/blog/posts/research-and-analysis-demonstrate-the-lack-of-impacts-of-glare-from-photovoltaic-modules.html [https://perma.cc/5B9U-2EP8].

[119] *See* Torres-Sibille et al., *supra* note 117, at 990.

[120] *See* Evan Riley & Scott Olson, *A Study of the Hazardous Glare Potential to Aviators from Utility-Scale Flat-Plate Photovoltaic Systems*, 2011 ISRN RENEWABLE ENERGY 1, 5-6 (concluding that glare measurements from solar PV panels and smooth water fall within same region of measurement, and that both have relatively low glare).

B. *Agricultural Impacts: Saving or Displacing Valuable Farmland?*

Beyond environmental impacts, residents of farming communities have legitimate concerns about renewable energy generation displacing prime agricultural soils.[121] Solar farms have a life of just a few decades—allowing future agricultural production on prime soils if they cannot be used during the life of the renewable energy plant.[122] However, pulling too much of this soil out of production during a rapid burst of energy development could negatively impact domestic crop production, or at least create perceptions of a problem.[123]

Despite these concerns, solar energy development often allows farmers to avoid the type of land displacement that occurs when struggling farmers agree to sell land to residential or commercial land developers—a common occurrence.[124] As explored in Part I, solar leases can stabilize income for farmers who struggle with volatile commodity prices, and lease payments for renewable energy often exceed income from harvested crops.[125] A competing concern, however, is that solar leases can increase the price of purchasing or renting farmland for other farmers.[126]

Beyond the pure revenue perspective, solar energy on farms can also enhance farm performance and improve the ecological value of land. Agrivoltaics, where crops or livestock are raised alongside or beneath solar panels, can increase

[121] *See* GROUT & IFFT, *supra* note 18, at 1 (noting New York's ambitious renewable energy initiatives will cause solar energy development to occupy "trivial" amount of land compared to "total area of New York" but that solar development will likely be concentrated on flat, dry, unshaded land—characteristics of prime farmland).

[122] *Farmer's Guide to Going Solar*, *supra* note 80 ("Land can be reverted back to agricultural uses at the end of the operational life for solar installations."); *Useful Life*, NAT'L RENEWABLE ENERGY LAB'Y, https://www.nrel.gov/analysis/tech-footprint.html [https://perma.cc/8R6C-6WWY] (last visited Feb. 10, 2023) (providing table of useful life of various technologies, including PVs).

[123] Hernandez et al., *supra* note 64, at 13580 (noting that in California's Central Valley, solar PV farms displaced 118 square kilometers (more than 29,000 acres) of "cultivated croplands"); *cf. Farmer's Guide to Going Solar*, *supra* note 80 ("There has not been any documented evidence of solar modules increasing food prices.").

[124] *See* Knezevich, *supra* note 5 (recounting farmer's statement that income from solar lease provides incentive to not sell farm).

[125] *See supra* Part I; ANUJ KRISHNAMURTHY & OSCAR SERPELL, HARVESTING THE SUN: ON-FARM OPPORTUNITIES AND CHALLENGES FOR SOLAR DEVELOPMENT 4 (2021), https://kleinmanenergy.upenn.edu/wp-content/uploads/2021/07/KCEP-Harvesting-the-Sun.pdf [https://perma.cc/FFE3-8AHX] (noting that "revenue from solar development can eclipse the revenue generated by harvest yields" but that "other studies have suggested that payback periods for on-farm solar projects are still too long"); MACKNICK ET AL., *supra* note 16, at 12 (explaining how solar technologies on agricultural land could provide more income to land owners, particularly for years when agricultural productivity is low).

[126] HALL ET AL., *supra* note 5, at 7 (noting how leasing farmland to wind and solar facilities leads to heightened land competition and increases in per-acre rental costs); DANIELS & WAGNER, *supra* note 4, at 2 (noting the benefits of utility-scale solar to farmers but also drawbacks, including higher prices for leasing land needed for agricultural production).

certain crop and livestock performance and yield.[127] This is not the case for all agricultural commodities: goats and cattle are not compatible with solar panels because cattle rub against them and damage them, and goats jump on top of the panels or try to consume parts of the panels or wires.[128] But sheep coexist well with solar panels, enjoying the shade beneath the panels on hot days and providing the plant mowing service that the solar company would otherwise have to perform.[129] And some crops that do not require full sun grow better beneath solar panels—losing less water due to transpiration and experiencing less light and heat stress.[130] In summary, the intensive land requirements for solar energy have substantial impacts—both positive and negative. Solar energy development can enhance the livelihoods of landowners (often farmers) who lease their land for this development and improve the environmental value of land and the quality of some agricultural production. But building extensive solar energy facilities on farmland also has negative impacts, which must be addressed in any policy encouraging agricultural solar development.

III. OPERATIONALIZING LAND-ENERGY LAW TO ADDRESS CLIMATE CHANGE

The land-hungry nature of renewable energy is by no means a consistently happy story. But the land-energy nexus in the agricultural context is compelling—particularly on lands already being subsidized to be kept out of production. One critical way to open up millions of acres of rural land to solar developers is to incentivize farmers' leasing of land through existing agricultural subsidies like the CRP.

A. *The CRP and Its Purpose*

The CRP, created by Congress in 1985 and administered by the USDA, pays farmers to stop farming (or in some cases refrain from farming) on "environmentally sensitive" land.[131] Instead of farming, farmers plant crops on CRP lands that help to reduce erosion or otherwise restore the land.[132] The

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[127] Barron-Gafford et al., *supra* note 19, at 850 (discussing benefit of agrivoltaics on crop yield).

[128] *Farmer's Guide to Going Solar*, *supra* note 80 (noting that "[c]attle grazing is generally not compatible with PV facilities due to the risk of damage to modules").

[129] HALL ET AL., *supra* note 5, at 13 (proposing enlisting sheep to cut grass beneath solar panels and "ease tensions between solar development and local opinion"); Michael Metzger, *Grazing Sheep on Solar Farms*, MICH. ST. UNIV. EXTENSION (Sept. 7, 2021), https://www.canr.msu.edu/news/grazing-sheep-on-solar-farms [https://perma.cc/GJ3G-SSST] ("Herbruck's Green Meadow Organics facility near Saranac has a new 7-acre solar site that recently implemented grazing sheep to manage plant growth under and around the solar panels.").

[130] KRISHNAMURTHY & SERPELL, *supra* note 125, at 5.

[131] *About the CRP*, *supra* note 71.

[132] *Id.*; *see* FARM SERV. AGENCY, U.S. DEP'T OF AGRIC., CONSERVATION RESERVE PROGRAM: 58TH GENERAL ENROLLMENT PERIOD ENVIRONMENTAL BENEFITS INDEX (EBI) 1 (2022) [hereinafter CRP FACT SHEET], https://www.fsa.usda.gov/Assets/USDA-FSA-

original purpose of the program was to "assist owners and operators of highly erodible cropland in conserving and improving the soil and water resources of their farms or ranches."[133] Farmers who enroll land in CRP cannot use this land for traditional crop production that tends to create more soil erosion, such as corn, although on some CRP lands they can raise crops that tend to hold soil and require little tillage (plowing), such as hay.[134]

The enabling text of the CRP is quite general, perhaps allowing the USDA to add solar development to the enrollment criteria even without a statutory change. The language of the CRP directs the Secretary of Agriculture to "formulate and carry out a conservation reserve program . . . to assist owners and operators of land specified" in the Farm Bill "to conserve and improve the soil, water, and wildlife resources of such land and to address issues raised by State, regional, and national conservation initiatives."[135] Specified lands include "highly erodible cropland," "marginal pasture land," grasslands, wetlands, and other croplands that could impact water quality.[136] As explored in Part II, solar development can enhance soil quality and wildlife habitat.[137] The Department of Energy notes that in the context of solar PV panels, "[g]iving soil rest can . . . maintain soil quality and contribute to the biodiversity of agricultural land."[138] Additionally, solar energy development directly addresses issues within state conservation initiatives, such as state certification of solar farms as pollinator habitats.[139]

A core question is whether solar infrastructure is allowed on CRP lands. But nothing in the CRP or its enabling statute would seem to prohibit this, provided the land were revegetated with native plants or managed under similar environmentally beneficial practices. Indeed, the grasslands program already allows grazing and "[o]ther activities, when the manner, number, intensity,

Public/usdafiles/FactSheets/2022/fsa_cpr-58th_ebi_final_3222.pdf [https://perma.cc/T2Q2-S6ZQ] ("CRP participants establish long-term, resource-conserving plant species . . . (known as 'covers') to control soil erosion, improve water quality and develop wildlife habitat."); Daniel M. Hellerstein, *The US Conservation Reserve Program: The Evolution of an Enrollment Mechanism*, 63 LAND USE POL'Y 601, 601 (2017) (describing formation of CRP under Food Security Act of 1985); *see also* Food Security Act of 1985, Pub. L. No. 99-198, § 1231, 99 Stat 1354, 1509 (codified as amended at 16 U.S.C. § 3831).

[133] Food Security Act § 1231(a).

[134] 7 C.F.R. § 1410.13(d)(2) (2022) (describing haying as permitted use of farmland under CRP subject to approved conservation plan).

[135] 16 U.S.C. § 3831(a); *see* Agriculture Improvement Act of 2018, Pub. L. No. 115-334, § 2201(b), 132 Stat. 4490, 4531; Food Security Act § 1231.

[136] 16 U.S.C. § 3831(b).

[137] See *supra* Part II for a discussion of the environmental benefits of solar development.

[138] *Farmer's Guide to Going Solar*, *supra* note 80 (noting land can be converted back to agricultural land after operational life of solar system).

[139] GEORGENA TERRY, CLEAN ENERGY STATES ALL., STATE POLLINATOR-FRIENDLY SOLAR INITIATIVES 7 (2020) (describing University of Massachusetts Clean Energy Extension's efforts to establish pollinator-friendly certification program for solar facilities).

location, operation, and other features associated with such activity will not adversely affect the grassland resources or related conservation values."[140]

Despite this general language, courts reviewing the USDA's statutory authority for including solar energy development in the CRP might find an unreasonable interpretation of vague statutory language under *Chevron* Step Two, given past practice.[141] Indeed, courts might look to past CRP amendments—which expressly allowed limited renewable energy (plant biomass) development on CRP lands—as evidence that specific authorization is required for incorporating solar into the CRP.[142] More recently, in 2022 two senators proposed supporting grazing on more CRP lands, again suggesting that Congress might assume that existing CRP language is not even broad enough to allow many traditional agricultural practices on CRP lands.[143] On the other hand, grazing can be damaging to land when land is particularly fragile or the livestock density is too high.[144]

Given the uncertainty surrounding the breadth of existing CRP language, a clear directive in the 2024 Farm Bill is advisable, in which Congress enables the USDA to include planned solar development on CRP land, accompanied by conservation measures such as planting vegetation for erosion control and wildlife habitat. The following Section explores how the USDA should incorporate solar energy potential as a selection criterion for CRP applicants and the benefits that would flow from this decision.

B. *The CRP Selection Criteria and Benefits for Enrolled Farmers*

To place a bid for inclusion within the CRP, farmers apply to the USDA, and, if accepted, receive annual lease payments from the federal government under a ten-to-fifteen-year contract.[145] The 2018 Farm Bill also introduced a CRP pilot

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140 7 C.F.R. § 1410.13(d)(5) (2022).

141 Chevron U.S.A., Inc. v. Nat. Res. Def. Council, Inc., 467 U.S. 837, 843, 845 (1984) (holding that if statute is ambiguous, inquiry becomes whether agency's interpretation is reasonable construction, and thus permissible).

142 Farm Security and Rural Investment Act of 2002, Pub. L. No. 107-171, § 1232(a)(7), 116 Stat. 134, 244 (codified at 16 U.S.C. § 3832) (permitting managed biomass harvesting); *see also* Wiesner, *supra* note 26, at 582 (discussing how statutory revision authorizes biomass harvesting if consistent with program aims).

143 *See* Conservation Reserve Program Improvement Act of 2022, S. 3892, 117th Cong. (proposing cost sharing payments under § 1234(b)(1) of Food Security Act of 1985 be amended to include "grazing infrastructure, including interior cross fencing [and] perimeter fencing").

144 *Grazing*, CTR. FOR BIOLOGICAL DIVERSITY, https://www.biologicaldiversity.org/programs/public_lands/grazing/ [https://perma.cc/ME28-RHD7] (last visited Feb. 10, 2023) (noting that "once-rich topsoil has been turned to dust, causing soil erosion" because of cattle grazing in West).

145 *About the CRP*, *supra* note 71 (noting yearly payments provided for enrollees removing "environmentally sensitive land from agricultural production").

program that included leases lasting up to thirty years.[146] Annual rental payments for any one individual or legal entity approved for enrollment under the CRP cannot exceed $50,000.[147] There are income restrictions for recipients, but they are quite high—limiting the program to individuals whose "average adjusted gross income" does not exceed "$900,000 for the 3 taxable years preceding the most immediately preceding complete taxable year."[148] Congress directs that up to 27 million acres of land may be enrolled in the CRP by 2023.[149]

Under the current version of CRP enabled by the 2018 Farm Bill, there are three types of enrollment.[150] "General" enrollment involves an annual competitive process, in which the USDA evaluates all of the applications and ranks them based on an Environmental Benefits Index ("EBI").[151] Those projects with the highest EBI scores are selected for enrollment.[152] There are six EBI factors, including: benefits to wildlife that result from nonagricultural vegetation planted on CRP land; water quality benefits from reduced soil erosion and other runoff; benefits to the farm itself from reduced soil erosion, preserving soil to support future agriculture; air quality benefits resulting from less soil being blown by the wind; and cost, in which projects that achieve the most environmental value for the least cost are prioritized.[153] All of these factors have subfactors with additional criteria. For example, under the air quality factor, applicants who show that the plan for their fallow land will help to sequester carbon receive more points.[154]

Beyond the general enrollment category, farmers proposing especially high-value environmental practices can apply to enroll in CRP throughout the year as part of continuous enrollment.[155] The lands that qualify for this noncompetitive program include those along streams and other surface waters, and "[l]and suitable for wetland restoration," among others.[156] Finally, a third CRP

[146] Conservation Reserve Program Interim Rule, 84 Fed. Reg. 66813, 66814 (Dec. 6, 2019) (codified at 7 C.F.R. pt. 1410).

[147] 7 C.F.R. § 1400.1.

[148] *Id.* § 1400.500.

[149] 16 U.S.C. § 3831(d)(1)(E) (specifying total acreages that can be "maintain[ed] in the conservation reserve" for fiscal years 2019 to 2023).

[150] Conservation Reserve Program Interim Rule, 84 Fed. Reg. at 66813 (designating "[g]eneral," "continuous," and "grassland" as "major types" of CRP enrollments). The CLEAR 30 program allows thirty-year contracts for conservation practices that help to reduce soil and nutrient "loadings" (additions) to surface water and "harmful algal blooms." *Id.* at 66817.

[151] *See* CRP FACT SHEET, *supra* note 132, at 1.

[152] *See id.* at 1-2.

[153] *See id.* at 2-3.

[154] *Id.* at 3.

[155] Conservation Reserve Program Interim Rule, 84 Fed. Reg. at 66813.

[156] *Id.*

enrollment category covers grasslands in danger of being converted to farmland.[157]

1. Compatibility of the CRP with Solar Energy

All of the CRP enrollment categories are highly compatible with solar energy development, with the exception of conservation reserve land that is very steep and on highly erodible soil, directly abuts streams and other surface waters, or is enrolled for wetlands restoration.[158] Here, the construction of solar panels could produce damaging erosion or, for wetlands, involve infrastructure, including buried wires, that would interrupt wetland habitat.[159] But for farmlands damaged by intensive crop growth, solar panels would enable the very types of environmental improvement envisioned by the CRP.

As discussed below, if the CRP were to prioritize solar-supporting lands for enrollment, strict conditions would have to be imposed to ensure the improvement of the land beneath the soil. This would be quite feasible, as an important benefit of solar is the ability to reclaim degraded land if designed properly.[160] Indeed, a study from the Midwest found that solar panels with native vegetation enhanced pollinator habitat and sequestered sixty-five percent more carbon than if the same land were cropland.[161]

Solar panels would perhaps best support the "enduring benefits" factor for CRP enrollment—which measures "the likelihood for certain practices to remain in place beyond the CRP contract"—and cost.[162] The average lifetime of a solar PV farm is twenty to twenty-five years, thus enduring well beyond a ten-to-fifteen-year CRP contract.[163] And farmers could potentially afford to continue to maintain the land in fallow condition beyond the life of the solar farm given the steady income that they had received from a solar lease. Further, because of this income solar farms on CRP lands would likely strongly support the cost factor. As it did for biomass on CRP lands, the USDA would likely deduct solar

157 *Id.* at 66814.

158 *See* Hernandez et al., *supra* note 64, at 13581-83 (explaining solar "incompatibilities" can include excessive slope, distance from transmission lines, or location near "endangered and threatened species habitat" or federal conservation areas).

159 *See* THE NATURE CONSERVANCY IN N.C., *supra* note 99, at 5 (arguing preparing solar sites can cause soil carbon loss, "microbial biomass" decreases, runoff, and soil erosion if protective measures are not implemented).

160 *See, e.g.*, Walston et al., *supra* note 104, at 2 (suggesting that moving from turfgrasses to "native grassland management practices" at solar locations may provide ecological benefits such as soil retention).

161 *Id.* at 6-8 ("Using the Midwest regional averages for all calculations, the solar-native grassland scenario for all existing solar facilities . . . had the potential above- and below-ground carbon storage capacity of 267,473 Mg C, which was 174,216 Mg and 114,778 Mg greater than the agriculture and solar-turfgrass scenarios . . . .").

162 CRP FACT SHEET, *supra* note 132, at 3 (considering both environmental advantages and "per dollar" program payments when determining cost benefits).

163 *See Farmer's Guide to Going Solar*, *supra* note 80.

lease income from the CRP award amount.[164] And finally, with CRP points now granted for carbon sequestration, solar panels' mitigation of carbon emissions, combined with sequestration by plants beneath the panels, would align with these values.

2. Modifications to the CRP to Support Solar Energy

To induce farmers to sign, or even solicit, a solar lease—beyond the incentive already provided by developers seeking open land, the USDA should modify the EBI to allocate points for proposed CRP lands that would host solar panels. These points, similar to those earned for proposing beneficial erosion control or wildlife habitat measures, would help push solar CRP projects to the top of the pile for selection.

The USDA should specify that only carefully designed solar projects would garner these points. The projects would have to involve minimal grading of land, the planting of native revegetative cover or similarly beneficial cover, and maintenance of this cover. Ideally, solar farms proposed with enhanced wildlife features, such as pollinator-friendly plantings and bird and bat roosts and nests, should receive particular priority.[165]

The pilot program allowing thirty-year CRP enrollment would also likely need to be fully extended to, and made more permanent for, CRP lands with solar projects, as solar leases typically last twenty to twenty-five years.[166] To induce farmers to both lease land to a solar developer and engage in environmental enhancement of that land under the CRP, the USDA would likely need to guarantee that payments for this environmental enhancement would last for the life of the project.

The challenge of monitoring and enforcing requirements for CRP lands hosting solar projects would also have to be addressed—potentially by slightly reducing CRP payments and using the excess funds available to pay for additional Farm Service Agency ("FSA") staff. Adding an entirely new land use for CRP lands—one that can provide environmental benefits but also has the potential to create new environmental problems—will create substantial work that is likely not feasible for existing staff. Alternatively, or additionally, with some form of excess funding, whether from slightly reduced CRP payments or additional fees levied elsewhere, the CRP could delegate some monitoring and assessment of CRP solar lands to academics and nonprofits, as it already does in

[164] *See* CRP FACT SHEET, *supra* note 132, at 3 ("Offers with lower per acre rental rates may receive more N6a [specific cost subfactor] points and have increased chances of being accepted."); *see also* Farm Security and Rural Investment Act of 2002, Pub. L. No. 107-171, § 1232(a)(7), 116 Stat. 134, 244 (codified at 16 U.S.C. § 3832) (outlining provisions for biomass on CRP lands).

[165] *See, e.g.*, THE NATURE CONSERVANCY IN N.C., *supra* note 99, at 8 (discussing benefits of supplemental wildlife habitat features near solar panels).

[166] *See Farmer's Guide to Going Solar*, *supra* note 80.

part for traditional CRP lands.[167] Specifically, the FSA provides grants to academic institutions, government agencies, and nonprofit organizations to conduct CRP assessments to "quantify outcomes and inform policy."[168] Examples of recent evaluations completed under this program include "Bird Conservation Benefits of the CRP" and "Assessing the Impact of the CRP on Honey Bee Health."[169] Based on this program, the FSA could reasonably assign an external partner to the task of assessing the net environmental outcomes of CRP lands with solar projects, focusing on metrics such as reduced or increased erosion, improvement or degradation of native plants, and improvement or degradation of wildlife diversity.

3. Objections to the Use of CRP Funds for Solar

Even without modifying the CRP to prioritize lands with solar development, the CRP itself is frequently under fire. Senator Chuck Grassley—a farmer from Iowa—argues that the CRP has "strayed from its intended focus" of reducing soil erosion, protecting water quality, and enhancing wildlife habitat.[170] While well-designed solar farms can achieve all of the values Senator Grassley references, adding solar to the mix of CRP lands is likely to enhance objections such as his.[171]

Beyond the concern that including solar development pushes the CRP beyond its purpose, paying individuals to *not* do something is a fraught task. Indeed, some have argued that it would have been more efficient for Congress to buy out farms than to make ongoing rental payments to farmers under the CRP for refraining from farming particular lands.[172] It is quite difficult to estimate baselines—whether farmers were genuinely growing erodible crops prior to this incentive payment and required CRP money to be induced to stop, for example. The USDA attempts to address the baseline problem by requiring that farmland sought to be enrolled in the CRP must have been in production for at least "four of the six years" prior to the enactment of the 2018 Farm Bill, with the exception

[167] *See Monitoring Assessment & Evaluation Reports & Articles*, U.S. DEP'T OF AGRIC.: FARM SERV. AGENCY, https://www.fsa.usda.gov/programs-and-services/economic-and-policy-analysis/natural-resources-analysis/mae-reports-and-articles/index [https://perma.cc/RHE4-TVRD] (last visited Feb. 10, 2023) (explaining partnerships on CRP assessments).

[168] *Id.* (encouraging entities to put forth preproposals for various "assessment opportunities").

[169] *Id.* (noting project examples also included "Prairie Strip Benefits" and "Saturated Buffers").

[170] Press Release, Sen. Chuck Grassley, Grassley Remarks on the Passage of the 2018 Farm Bill (Dec. 11, 2018), https://www.grassley.senate.gov/news/news-releases/grassley-remarks-passage-2018-farm-bill [https://perma.cc/2J6W-HWUT] (claiming CRP payments act as "unlimited subsidies" for affluent landowners and farmers to new farmers' detriment).

[171] *Id.* (arguing in part that attractive CRP payment rates have resulted in leased farmlands being taken from agricultural lessees).

[172] *See generally, e.g.*, Thomas L. Daniels, *America's Conservation Reserve Program: Rural Planning or Just Another Subsidy?*, 4 J. RURAL STUD. 405 (1988).

of lands such as grasslands that are subject to a threat of conversion to crop production.[173] But savvy farmers, knowing that the Farm Bill is modified approximately every five years, could purposefully plant crops on erodible lands now, hoping to be paid a tantalizing sum—up to $50,000—in five years to stop this practice.

These are reasonable concerns, but the USDA already regularly doles out CRP money, and has done so since 1985.[174] The endowment effect also makes stakeholders who have benefited from these types of funds particularly resistant to efforts to reduce the subsidies.[175] Continuing to distribute this money for land that now produces even more environmental benefits—solar farms with revegetation and wildlife habitat—seems beneficial if we accept that subsidies are quite sticky and likely here to stay, particularly given the influence of the agricultural lobby.[176]

Beyond the baseline question—whether Congress really needs to continue paying farmers to stop planting traditional crops on fragile lands—is the double dipping issue. Many farmers are already incentivized to lease their land to solar energy developers because of lucrative lease payments that allow farmers to stay in business despite volatile crop prices, increasing weather extremes, and other challenges.[177] Do farmers need an added CRP payment on top of this lucrative lease? We argue that there is good reason to allow solar energy development on CRP lands and permit the double payment to the farmer for the lease and the CRP benefit—specifically because the lease payment alone typically does not induce farmers or solar developers to engage in environmentally beneficial practices on lands leased for solar PV development. But the CRP benefit paid should take into account the lease money received by the farmer and be reduced accordingly, ideally providing an amount that is just enough to incentivize environmentally beneficial practices at the heart of the CRP program, such as enhancing soil quality by reducing erosion, improving wildlife habitat on farms, and preserving wetlands.

There are additional practical challenges that make the CRP-solar solution something far less than a silver bullet for solar energy, agriculture, and

[173] Conservation Reserve Program Interim Rule, 84 Fed. Reg. 66813, 66814 (Dec. 6, 2019) (codified at 7 C.F.R. pt. 1410).

[174] *See About the CRP*, *supra* note 71.

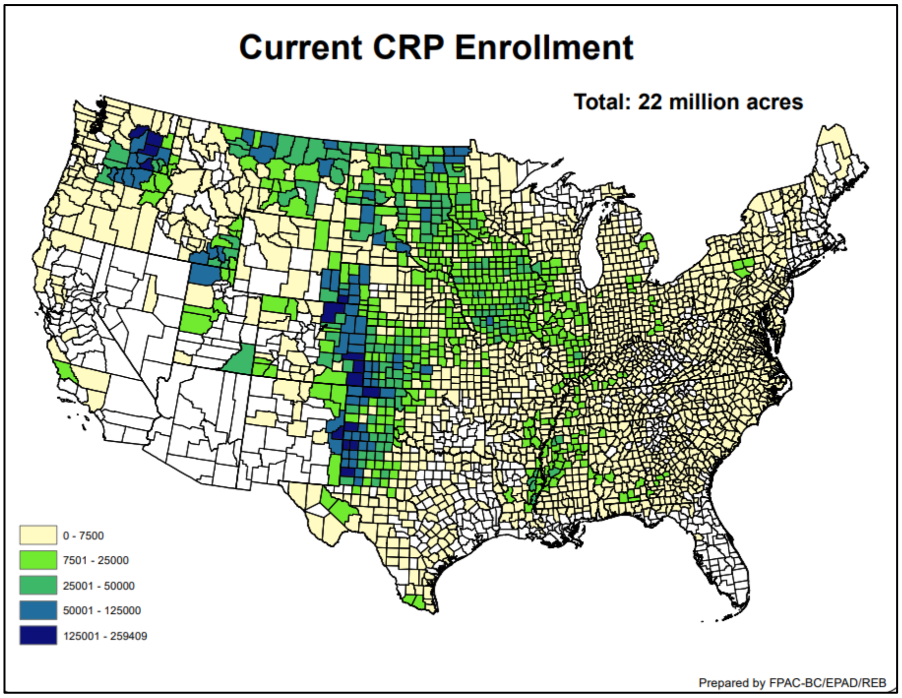
[175] *See* Mark F. Bellemare & Nicholas Carnes, *Why Do Members of Congress Support Agricultural Protection?*, 50 FOOD POL'Y 20, 23 (2015) ("The secret to every farm bill's success in Congress is the lead role played by the House and Senate Agriculture Committees, where members from farm states . . . are rewarded for their legislative efforts with generous campaign contributions from . . . organizations representing the farmers who get the subsidies." (quoting ROBERT PAARLBERG, FOOD POLITICS: WHAT EVERYONE NEEDS TO KNOW 100-01 (2010))).

[176] *See id.* at 33 (contending lobbying influences election results, and Farm Bill support heavily influenced by "electoral pressure[s]," based on constituent demographics).

[177] KRISHNAMURTHY & SERPELL, *supra* note 125, at 4 (comparing revenue from solar leases and crop yields).

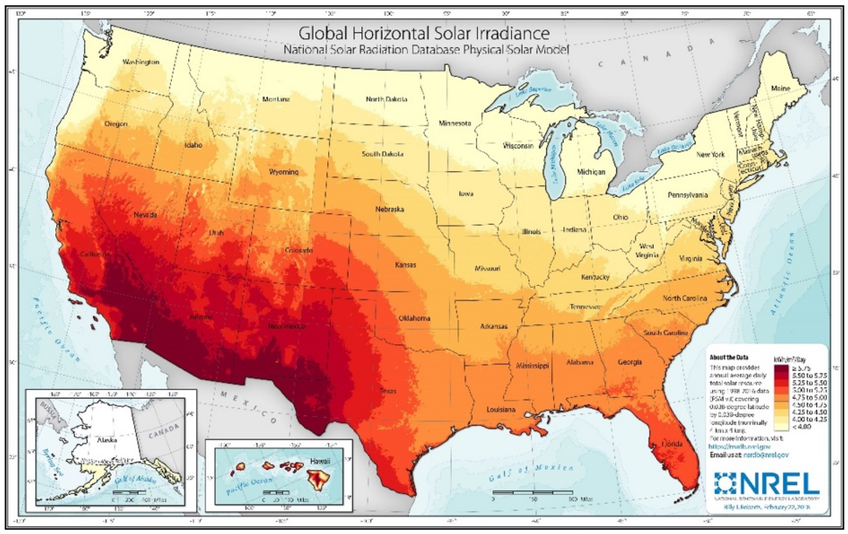
environmental protection. First, although many CRP lands are in parts of the United States where sunlight is also relatively strong, such as Texas and Colorado, and solar energy is therefore efficient, others are in places such as the Dakotas and Montana, where solar energy is not as efficient, as shown by Figures 1 and 2.

Figure 1. CRP Lands (2019).[178]



[178] Illustration of CRP Lands, *in* CURRENT CRP ENROLLMENT (2019), https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/Conservation/PDF /crp_current_enrollment_map.pdf [https://perma.cc/44H8-BMCC].

Figure 2. Solar Energy Intensity (2018).[179]



Additionally, although new agricultural lands could be enrolled in CRP with solar energy specifically in mind—pushing solar-CRP lands to the most efficient areas—many of the areas that have the strongest sunlight and are predominated by agricultural land are remote and far from existing transmission lines.[180] Solar energy developers typically cite accessibility to existing transmission lines as one of the first criteria considered when selecting a project location.[181] Building a new transmission line is an incredibly expensive endeavor and often a futile one, given that even interstate transmission lines must be approved on a state-by-state basis with respect to siting.[182] States frequently block these lines.[183] But the federal government is taking slow steps toward addressing the transmission

[179] Illustration of Solar Energy Intensity, *in* Roberts, *supra* note 76.

[180] *See* Hannah Wiseman, Lindsay Grisamer & E. Nichole Saunders, *Formulating a Law of Sustainable Energy: The Renewables Component*, 28 PACE ENV'T L. REV. 827, 854 (2011) (noting that ideal lands for renewable energy are located in rural areas distant from consumers and transmission lines).

[181] *See, e.g.*, *id.* at 844, 853-55 (explaining how potential renewable energy site access to nearby transmission lines is key siting criterion for developers).

[182] *See id.* at 857-59 (arguing building transmission lines is uncommon due to costs, procedural hurdles, and proposing process for potential RTO "interstate transmission line siting" approvals).

[183] *See* Klass et al., *supra* note 35, at 992 (noting some states have either blocked proposals to construct renewable generation or transmission line construction through siting decisions); Klass & Wilson, *supra* note 35, at 1830 (stating that challenges arise, in part, because states only consider own interests when evaluating interstate transmission line proposals).

problem, and these steps are likely to continue whether or not solar is permitted on CRP lands given the critical project of connecting remote, sunny areas with population centers.[184]

Despite these challenges, the current urgent push to rapidly expand utility-scale solar development—one that demands large swaths of open land—suggests that solar energy projects will inevitably be built on farmland, whether we think that this is a good idea or not. Encouraging solar energy development on CRP lands could push this development away from some prime agricultural soils, and provide farmers with a critical incentive to engage in environment-improving practices beneath solar farms.

CONCLUSION

The need for land has doomed some recent renewable energy projects and many transmission line projects supporting them. But it need not be an insurmountable obstacle to achieving real progress on combating climate change. Instead, it could be the key to unlocking a climate policy built on shared interests, even in the absence of shared beliefs. Beyond the nearly 30 million acres of farmland deemed unsuitable for agricultural production, many other marginal lands are prime candidates for solar production.[185] The United States hosts 1,336 "Superfund" sites, and countless acres of "greyfields" and "redfields"—previously developed commercial properties that are either underused or no longer used and, in the case of redfields, are in some form of financial distress.[186]

Avoiding cataclysmic climate impacts is proving to be as challenging as it is necessary, and there are no simple solutions. But finding political common ground is the only real hope for climate progress, and the area of agricultural policy should be a major point of focus. Marginal lands—particularly on farms—will not address all energy or climate problems, but they will go a long way toward taking a rapid solar build-out from an aspiration to a reality. At this critical juncture, with rampant wildfires, coastal flooding even on sunny days,

[184] *See* Klass et al., *supra* note 35, at 1040 (noting that 2021 Infrastructure Investment and Jobs Act gave Federal Energy Regulatory Commission "backstop siting authority for transmission lines" despite state permit denial); Infrastructure Investment and Jobs Act of 2021, Pub. L. No. 117-58, § 40105, 135 Stat. 429, 933-34 (enhancing somewhat federal authority over interstate electric transmission siting); *id.* § 40106 (creating Transmission Facilitation Program with $2.5 billion revolving loan fund).

[185] NAT'L RENEWABLE ENERGY LAB'Y, *supra* note 57 (noting U.S. government idles 30 million acres of land annually).

[186] *Superfund: National Priorities List (NPL)*, U.S. ENV'T PROT. AGENCY, https://www.epa.gov/superfund/superfund-national-priorities-list-npl [https://perma.cc/X6AN-5SLQ] (last updated Mar. 11, 2022) (listing 1,336 National Priority List sites); AM. PLAN. ASS'N, RECYCLING LAND FOR SOLAR ENERGY DEVELOPMENT 8 (2012), https://planning-org-uploaded-media.s3.amazonaws.com/publication/download_pdf/Recycling-Land-for-Solar-Development.pdf [https://perma.cc/B6RD-8Q3H] (defining greyfields as "previously developed commercial property . . . underused due to economic obsolescence" and redfields as "any commercial development in foreclosure or facing severe financial distress").

and growing weather extremes, policymakers should seize this unusual opportunity for progress.