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Getting Paid to Watch Grass Grow

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BY

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As climate change marches on, rural communities are increasingly left behind to deal with its effects on their own. National and regional electric grid infrastructure is outdated and suffering under increased stress due to climate change driven weather events, and by definition, rural communities rely more on this unreliable system than urban communities. The country depends on rural areas for its food but provides them with only short-term solutions to industrial agriculture and climate change driven problems: crop insurance payouts, artificial fertilizers, and over-tilling of cropland act as a band-aid on the larger issue of the nationwide lack of healthy soil. Although transitioning from fossil fuel energy to renewable energy would significantly ease the effects of climate change, most rural communities oppose the development of energy projects, be it transmission or generation of any type, over concerns that agricultural land is being taken out of agricultural use. Even though this would provide them with the direct benefit of cheap and clean energy, locals often oppose renewable projects sited over cropland with increasing success.

This article argues that federal legislators and/or regulators should take immediate action through IRA or Farm Bill funding to incentivize landowners of degraded farmland entering into long-term leases with solar developers. Above-ground, farmers can generate income and the local community can gain clean energy, on-ground government agents can assist farmers in designing site-specific systems of perennial plants that, below-ground, will rejuvenate depleted soils over the lifetime of the landowner's lease. To justify this leap into committing to

twenty plus year long relationships with farmers, this article begins with a survey of the current state of the national electric grid, focusing on issues specific to rural communities. Then it describes the industrial agricultural methods that have taken over the country, their effects on the ecosystem, and the healthy soil we could have if we were to drastically change our agricultural practices. Finally, it finishes with a discussion of the multiple avenues through which federal policymakers and/or regulators could incorporate dual use solar and soil recovery programs into existing law.

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I. Introduction

More than 800 excess deaths,[1] temperature records broken across two countries,[2] and an estimated $9.9 billion in losses[3] - all due to an event "virtually impossible without human-caused climate change."[4] The June 2021 Western North America heat wave and subsequent heat dome have been described as a "once-in-a-millennia" event,[5] but we now may be looking forward to such events as frequently as every five to ten years.[6] Humans are far from the only species affected; such incidents also take a toll on plant species. For example, as much as ninety percent of the Pacific Northwest's berry harvest, which the nation depends on for the large majority of its yearly frozen berry supply,[7] was "doomed to juice" as much of the crop was too dehydrated to freeze, or worse – roasted on the vine, which was a total loss.[8] Its farmers were likewise doomed to smaller net income[9] and, although they planned to apply for federal aid,[10] such aid is only reactive and would fail to address the root of the problem.

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[1] Anne C. Mulkern & E&E News, *Deadly Heat Dome Was a 1-in-10,000-Year Event*, SCIENTIFIC AMERICAN (Oct. 3, 2022), https://www.scientificamerican.com/article/deadly-heat-dome-was-a-1-in-10-000-year-event/.

[2] Elisa Stone, *Western North American Extreme Heat Virtually Impossible Without Human-Caused Climate Change*, WORLD WEATHER ATTRIBUTION (July 7, 2021), https://www.worldweatherattribution.org/western-north-american-extreme-heat-virtually-impossible-without-human-caused-climate-change/. Even in just the state of Washington, 128 records were broken. Alden Woods & Hannah Hickey, *New Report, Tool Suggest How Washington Can Better Protect Against Extreme Heat*, UNIV. OF WASH. NEWS (June 26, 2023), https://www.washington.edu/news/2023/06/26/new-report-tool-suggest-how-washington-can-better-protect-against-extreme-heat/#:~:text=In%20June%202021%2C%20the%20%E2%80%9Cheat,partly%20due%20to%20climate%20change.

[3] *Billion-Dollar Weather and Climate Disasters,* NOAA Nat'l Centers for Environmental Info., (2023), https://www.ncei.noaa.gov/access/billions/events/US/2021?disasters[]=all-disasters.

[4] Stone, *supra* note 2.

[5] Jeff Berardelli, *Pacific Northwest Bakes Under Once-In-A-Millennium Heat Dome*, CBS NEWS, (updated June 29, 2021), https://www.cbsnews.com/news/heat-wave-dome-2021-seattle-portland-weather/.

[6] Stone, *supra* note 2. "An event like this – currently estimated to occur only once every 1000 years, would occur roughly every 5 to 10 years in that future world with 2°C of global warming."

[7] Anna King, *Berry Bake: Northwest Blueberry, Raspberry, Blackberry Crops Might Be Roasted From The Heat Wave*, NORTHWEST PUBLIC BROADCASTING, (July 2, 2021), https://www.nwpb.org/2021/07/02/berry-bake-northwest-blueberry-raspberry-blackberry-crops-might-be-roasted-from-the-heat-wave/.

[8] *Id*.

[9] *Id*.

[10] *Id*.

The costs of climate change on agriculture, of course, are not limited to the Pacific Northwest. Iowa, located in the heart of the Midwest's "Corn Belt,"[11] is a region "with one of the most intense areas of agricultural production in the world and which consistently affects the global economy."[12] By the end of this century, Iowa will see much hotter and slightly wetter conditions that will stunt plant growth and increase overall water use.[13] In the Himalayas, a 400-million-year-old moss, old enough to have seen the birth of the mountains themselves and that has since evolved alongside them, is now facing extinction because global temperatures are rising faster than it can adapt to survive in.[14] While seen as a benefit to some, commercial vineyards are popping up in places like Sweden, where such large-scale operations wouldn't have been feasible if not for warming temperatures due to climate change.[15]

To top it all off, should native crops manage to grow successfully in these increasingly antagonistic conditions, they are significantly less nutritious than the same crops grown in the first half of the twentieth century.[16] Modern agricultural practices that grow these crops may increase yields, but disturb soil health and therefore the health of the plants themselves.[17] People consuming these crops are correspondingly worse at combating disease as the nutrients in food

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[11] *Agriculture in the Midwest*, U.S. DEP'T OF AGRIC. CLIMATE HUBS (last visited Nov. 25, 2023), https://www.climatehubs.usda.gov/hubs/midwest/topic/agriculture-midwest.

[12] *Id*.

[13] *Turning Soils into Sponges: How Farmers Can Fight Floods and Droughts*, Union of Concerned Scientists 1, 13 (Aug 2017). [hereinafter Sponge Soils].

[14] Chelsea Harvey, *This Moss Outlived the Dinosaurs. It May Not Survive Climate Change.*, E&E NEWS CLIMATE WIRE, (Aug. 10, 2023), https://www.eenews.net/articles/this-moss-outlived-the-dinosaurs-it-may-not-survive-climate-change/.

[15] David Keyton, *As World Warms, Sweden Sees Opportunity to Grow Its Young Wine Industry*, ASSOCIATED PRESS, (Aug. 19, 2023), https://apnews.com/article/climate-change-sweden-wine-0a82a77a9fc91e0eaaea3870cda8b3b4.

[16] One study looked at protein, calcium, phosphorus, iron, riboflavin, and vitamin C, and found losses ranging from 6 to 38% depending on the crop and the specific nutrient. Stacey Colino, *Fruits and Vegetables Are Less Nutritious Than They Used To Be*, NAT'L GEOGRAPHIC, (May 3, 2022), https://www.nationalgeographic.co.uk/environment-and-conservation/2022/05/fruits-and-vegetables-are-less-nutritious-than-they-used-to-be.

[17] Such harmful agricultural practices include irrigation, fertilization, and harvesting methods that "disrupt essential interactions between plants and soil fungi, which reduces absorption of nutrients from the soil." *Id*.

are necessary for our immune systems to function.[18] Humans developing weaker immune systems is especially problematic as instances of previously non-endemic disease will continue to rise as climate change displaces human communities and allows pathogens and their carriers to move to previously inaccessible ecosystems.[19]

And it will only get worse as time passes. Summer 2023 was Earth's hottest summer on record,[20] the latest in a long succession of record-breaking summers.[21] With that increasing heat, farmland across the country will require more water, and better management of the water that is currently allocated to farm irrigation.[22] Just as the demand for water increases in response to the rising temperatures characteristic of longer and hotter summers, so too does the demand for electricity.[23] Ravaged by hurricanes, blackouts, more heat domes, and generally sweltering conditions during the summer of 2023, the grid was operating "at the outer limits of its capability."[24]

Thus, policymakers considering rural America face a multifaceted problem – crops are being roasted, the grid is overstressed, and inevitable climate change is only going to exacerbate the situation. Faced with a multifaceted problem, it is logical to look for a multifaceted solution:

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[18] *Id*.

[19] Zoya Teirstein, *Climate Connections: A Warming Planet, Pathogens, and Diseases*, GRIST, (July 18, 2023), https://projects.apnews.com/features/2023/climate-change-disease-animals-warming-earth/index.html.

[20] Sharmila Kuthunur, *NASA Confirms Summer 2023 Was Earth's Hottest on Record*, SPACE.COM, (Sept. 16, 2023), https://www.space.com/nasa-2023-summer-hottest-on-record.

[21] Rebecca Lindsey & Luann Dahlman, *Climate Change: Global Temperature*, CLIMATE.GOV (Jan. 18, 2023), https://www.climate.gov/news-features/understanding-climate/climate-change-global-temperature#:~:text=Earth's%20temperature%20has%20risen%20by,2%C2%B0%20F%20in%20total.

[22] Melina Walling, *Climate Change May Force More Farmers and Ranchers to Consider Irrigation — At a Steep Cost*, ASSOCIATED PRESS (Aug. 23, 2023), https://apnews.com/article/irrigation-climate-change-water-resources-management-farming-70feb98331a234710f2c90a0277f1562.

[23] Utilities are already planning for more record-breaking summers. Jason Plautz, *How the Power Grid Survived a Hot, Hot Summer*, ENERGYWIRE (Aug. 25, 2023), https://www.eenews.net/articles/4-takeaways-from-the-grids-record-breaking-summer/.

[24] Utility leadership characterizes these weather patterns as a "trend, and no longer an anomaly." *Id*.

dual-use solar.[25] In this article, I propose that policymakers can kill not two, but *three* birds with one stone[26] by supporting farmers entering into long term leases with solar developers. Through that, policymakers can create (1) an increase to the quantity of local electricity, thereby reducing stress on the national electric grid and reducing the need to build additional transmission infrastructure, (2) a much-needed kickstart to the transition to emission-free power generation in rural communities, which make up the majority of the country's landmass, and (3) the time and space that the soil these projects are built on needs to naturally heal, making it and the crops it grows more resilient to the effects of climate change.

Dual use solar is exactly what it sounds like: solar, plus some other use. Also called agrivolatics, agrisolar, low impact solar, or solar grazing, dual use solar is the practice of using a piece of land for agriculture and photovoltaic energy generation symbiotically.[27] It's main attraction to developers is that it addresses two of solar siting's main concerns simultaneously: large open spaces, and unobstructed access to the sun.[28] Farm fields are by definition large tracts of land, have already been leveled and cleared of shade-producing trees and shrubs, and the same sun light that powered the crops' photosynthesis can power the photovoltaic panels.

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[25] Solar power, of course, is only generated during the day thus needs to be paired with a storage system to provide reliable power around the clock. The details of the available storage systems are out of the scope of this article, however for more information *see Solar + Storage*, SOLAR ENERGY INDUS. ASS'N (last visited Nov. 30, 2023), https://www.seia.org/initiatives/solar-plus-storage.

[26] Or, if the reader prefers, policymakers here have the opportunity to *feed* three birds with one *scone*.

[27] U.S. Department of Agriculture, *Agrivoltaics: Coming Soon to a Farm Near You?*, CLIMATE HUBS (last visited Nov. 25, 2023), https://www.climatehubs.usda.gov/hubs/northeast/topic/agrivoltaics-coming-soon-farm-near-you. This symbiosis is achieved by adjusting the height of the panels and spacing between them to accommodate the chosen agricultural practice. Ellen Rosen, *Can Dual-Use Solar Panels Provide Power and Share Space With Crops?*, N.Y. TIMES (updated July 7, 2022), https://www.nytimes.com/2022/06/28/business/dual-use-solar-panels-agrivoltaics-blue-wave-power.html.

[28] Nick Gromicko, *Disadvantages of Solar Energy*, INT'L ASS'C OF CERTIFIED HOME INSPECTORS (last visited Nov. 28, 2023), https://www.nachi.org/disadvantages-solar-energy.htm.

Siting of solar projects has plagued the industry and its developers since its inception.[29] An ideal site is as flat as possible,[30] has as many clear and sunny days as possible, is closely located to a transmission line and/or energy consumer,[31] and, above all, is available to lease or purchase. Painfully few pieces of land meet all these criteria at once, but dual use solar can be employed to help. The practice is picking up across the country, and people are starting to think about siting differently; the New Jersey Board of Public Utilities recently approved Rutgers University's three-year pilot program to pair solar generation with existing agricultural or horticultural uses,[32] California is considering placing photovoltaic panels above its canals,[33] a developer in Kentucky has proposed siting solar panels on top of old surface mining plateaus,[34] and Coloradan farmers and scientists have teamed up to find out which crops might actually *benefit* from growing under solar panels.[35]

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[29] According to American Clean Power Association, a nationwide renewable energy industry trade group with more than 750 member companies, "[c]ommonsense siting policy is essential for happy host communities and continued clean energy growth." *Solar Power Siting*, AM. CLEAN POWER ASS'N (last visited Nov. 28, 2023), https://cleanpower.org/policy/solar-siting/#:~:text=Hydrologic%20features%20(e.g.%2C%20waters%20and,Biological%20features%20(wildlife%20and%20habitat).

[30] Sites should be as flat as possible to reduce the need to grade the land, which disturbs and loosens the soil in turn leading to off-site pollution. Solar Energy Technologies Office, *Success Story: Nevados Tackles Siting Challenges with Innovative Solar Trackers*, U.S. DEP'T OF ENERGY – OFF. OF ENERGY EFFICIENCY & RENEWABLE ENERGY (Sept. 18, 2023), https://www.energy.gov/eere/solar/articles/success-story-nevados-tackles-siting-challenges-innovative-solar-trackers.

[31] Solar Energy Technologies Office, *Large-Scale Solar Siting*, U.S. DEP'T OF ENERGY – OFF. OF ENERGY EFFICIENCY & RENEWABLE ENERGY (last visited Nov. 28, 2023), https://www.energy.gov/eere/solar/large-scale-solar-siting.

[32] Press Release, New Jersey Board of Public Utilities, *NJBPU Approves Agreement with Rutgers for Dual-Use Solar Pilot Program*, (May 1, 2023), https://www.nj.gov/bpu/newsroom/2022/approved/20230501.html.

[33] Maria Gallucci, *Can America's Canals Double as Solar Farms?*, CANARY MEDIA (July 26, 2023), https://www.canarymedia.com/articles/solar/can-americas-canals-double-as-solar-farms.

[34] Julian Spector, *Rivian Backs Massive Solar Plant atop Old Coal Mine in Kentucky*, CANARY MEDIA, (Aug. 4, 2023), https://www.canarymedia.com/articles/solar/rivian-backs-massive-solar-plant-atop-old-coal-mine-in-kentucky.

[35] Alison F. Takemura, *Can Agriculture and Solar Farms Coexist? It Depends*, CANARY MEDIA (Nov. 15, 2022), https://www.canarymedia.com/articles/food-and-farms/can-agriculture-and-solar-farms-co-exist-it-depends. Dual use systems may also benefit the crops grown beneath them due to the increased shading and correspondingly smaller amount of water required to grow and, therefore, may potentially result in increasing crop yields. For an extensive discussion of the economics of dual use farms, *see* Harshavardhan Dinesh & Joshua Pearce, *The Potential of Agrivoltaic Systems*, 54 RENEWABLE & SUSTAINABLE ENERGY REVIEWS 299 (2016) (concluding that dual use farms may generate 30% more value than traditional farms, especially if shade-tolerant crops are planted, and that

But instead of growing crops underneath the panels, dual use systems could be employed to benefit the land itself. This avenue is being tentatively explored by some developers as a way to "reduce operating expenses and improve the value of [the] land,"[36] but a shift in mindset is required for the practice gain traction. Traditionally, solar facility developers and owners see vegetation as a necessary evil; it is often required by municipalities or other authorities having jurisdiction in remediation and/or stormwater retention plans,[37] but may delay reaching completion of the project due to an off-cycle growing season and requires mowing and other maintenance, an expense which significantly adds up over the lifetime of a project.

Silicon Ranch is one company that is challenging the traditional view of solar developers on vegetation. Contrary to common industry practice, Silicon Ranch actually purchases the land it builds its projects on, rather than leasing it, as a show of its commitment to the local community.[38] Instead of viewing vegetation as an opponent, Silicon Ranch has dedicated soil scientists and agriculturalists investigating ways in which grazing livestock alongside the solar project could enhance the greater ecosystem.[39] Hoping to deepen the relationship of trust

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such practices would have a significant effect on national renewable energy generation while only a negligible effect on food prices). Growing crops underneath the panels could in turn benefit the performance of the panels, due to the localized cooling effect of the crops. Press Release, Martin Heinrich: U.S. Senator for New Mexico, *Heinrich, Braun Introduce Bipartisan Bill to Support Agrivoltaics Research and Demonstration* (May 31, 2023), https://www.heinrich.senate.gov/newsroom/press-releases/heinrich-braun-introduce-bipartisan-bill-to-support-agrivoltaics-research-and-demonstration.

[36] Julian Spector, *Silicon Ranch Raises $600M for its Holistic Take on Solar Development*, CANARY MEDIA (Jan. 9, 2023), https://www.canarymedia.com/articles/solar/silicon-ranch-raises-600m-for-its-holistic-take-on-solar-development.

[37] For example, New Jersey's Soil Erosion and Sediment Control Act requires the submission and approval of a plan to manage soil erosion and stormwater drain off for all construction activities greater than 5,000 square feet. N.J.S.A. 4:24-39 et seq. Of the thirty-two practices the New Jersey Department of Agriculture suggest, ten focus on vegetation to stabilize the soil, while the other twenty-two are engineering standards. *The Standards for Soil Erosion and Sediment Control in New Jersey* 7th ed., N.J. DEP'T OF AGRIC. - STATE SOIL CONSERVATION COMM. 1, 10-11 (revised July 2017). Notably, the Department recommends permanent vegetative cover for soil stabilization where there is a need for long-term protection. *Id*. at 26. *See also NJ Soil Erosion and Sediment Control Program*, NEW JERSEY DEPARTMENT OF AGRICULTURE (last visited Nov. 25, 2023), https://www.nj.gov/agriculture/divisions/anr/nrc/njerosion.html.

[38] Spector, *supra* note 36.

[39] *Id*.

between the developer and the community, this practice reduces operating costs while improving the value of the land the project is sited on, leaving long-lasting benefits to the subsequent purchaser of the land and the community at large.[40]

However, grazing livestock is only one way to improve the value of the land. "Several farming practices have been linked to improved soil health, and they share one thing in common: they keep plants with living roots in the soil year-round."[41] Practiced for millennia worldwide, "perennialization" is the incorporation of perennial crops in long rotations on land previously used for agricultural,[42] and is the most direct and time-tested way to allow living roots to heal degraded soils. Perennialization restores soil fertility by increasing soil carbon stocks, soil nitrogen availability, and soil phosphorus retention,[43] while also increasing the soil's water infiltration capacity, all of which support the subsequent growth of more plants.[44] Although in the long term perennialization relies on the natural recolonization processes of the local ecosystem, up front it requires active management to avoid opportunistic species eliminating the possibility that the land returns to its natural equilibrium.[45] In addition to actively planning then managing a restorative perennialization system, farmers face significant socioeconomic barriers in implementing these systems because the current political climate rewards continuing existing framing practices.[46] Thus, widespread adoption of restorative perennialization systems is

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[40] *Id*.

[41] *Turning Soils into Sponges*, UNION OF CONCERNED SCIENTISTS (Aug. 7, 2017), https://www.ucsusa.org/resources/turning-soils-sponges.

[42] Samantha Mosier, S. Carolina Córdova & G. Phillip Robertson, *Restoring Soil Fertility on Degraded Lands to Meet Food, Fuel, and Climate Security Needs via Perennialization*, 5 FRONTIERS IN SUSTAINABLE FOOD SYS. 1, 2 (2021). [hereinafter Restoring Soil Fertility]

[43] *Id*.

[44] *Restoration of Organic Soils*, U.N. CLIMATE TECHNOLOGY CTR. & NETWORK (last visited Nov. 28, 2023), https://www.ctc-n.org/technologies/restoration-organic-soils#:~:text=Soil%20restoration%20refers%20to%20actions,organic%20matter%2C%20which%20promotes%20restoration.

[45] *Id*.

[46] Restoring Soil Fertility, *surpa* note 44, at 12.

unlikely to occur on the scale necessary to return the nation's soils to their previous fertility without additional support from outside the farm.

These two problems could be addressed by intentionally siting solar projects on spent farmland and providing the landowners with the support necessary to negotiate favorable leases and implement long-term regenerative soil practices beneath them. While this might happen without additional intervention,[47] the federal government should step in to assist because it furthers the federal goals expressed in its existing conservation programs. This can be accomplished through regulations promulgated by the United States Department of Agriculture (USDA) pursuant to the Inflation Reduction Act (IRA), or the Farm Bill, or both. The practice of industrial agriculture that dominates the nation depletes soil health and, although some existing conservation practices touch on the issue of soil recovery, they do not go nearly far enough. Farmland and its farmers would benefit exponentially more if the soil was left to recovery for the lifetime of a utility scale solar facility, and their communities would enjoy bolstered energy independence and reliability without the need for costly transmission lines. Farmers would be motivated to plan for the long-term health of their land by providing improved soil in the future while also being compensated for its use today.

Given that one of the key benefits of this proposal is the increase of local and renewable electric generation in rural areas, this article will begin with a discussion of the current state of the national electric grid, focusing especially on rural communities. Next, it addresses current agricultural practices and their effects on global and immediate ecosystems respectively. Then, it discusses what it means for soil to be healthy and what practices would need to be adopted to

[47] For example, farmers might be more open to leasing land which has already lost its agricultural productivity rather than more productive land.

rejuvenate depleted soil. Lastly, it concludes with a discussion of the different methodologies policymakers can employ to marry long-term solar projects with soil recovery programs.

II. The Problem

A. The National Grid

Summer 2023 was the most stressful season on record for the ageing national electric grid,[48] and it just barely survived.[49] With global temperatures increasing at exponential rates,[50] so is the stress on the grid. Not only do increasing temperatures cause higher energy demands due to the need for additional air conditioning, but it also causes power plants to become less efficient, transmission lines to carry less electricity, and critical infrastructure like transformers and inverters to fail at greater rates.[51] To make matters worse, the extreme heat this summer caused some gas and coal plants, traditionally the reliable providers of base load[52] that were already running "at full throttle," to break down.[53] Rural electric co-ops, which service 12% of the country's population (but also 92% of the country's population designated as being in persistent poverty) generally rely on a more coal-heavy generation mix than urban and suburban

[48] Rebecca Heilweil, *The US Power Grid Isn't Ready for Climate Change*, VOX (July 3, 2021), https://www.vox.com/recode/2021/7/3/22560691/power-grid-climate-change-heat-wave. One professor described summer 2023 as "the perfect storm of extreme temperatures, more electricity consumption, and aging infrastructure." *Id*. Heat drives electricity demand up as more people deploy their air conditioning units more often, however, heat also causes power plants to produce electricity, limit the amount of electricity lines can carry, and increase the occurrence of transformer failures, thereby *also* reducing supply. *Id*.

[49] Plautz, *supra* note 23.

[50] Lindsey, *supra* note 21. Earth's temperature has increased by an average of .14° F each decade since 1880, but at an average of .32° F per decade in the four decades since 1980. *Id.*

[51] Umair Irfan, *Why Every State is Vulnerable to a Texas-Style Power Crisis*, VOX (Mar. 11, 2021), https://www.vox.com/22308149/texas-blackout-power-outage-winter-uri-grid-ercot.

[52] Chris Nelder, *Why Baseload Power is Doomed*, ZDNET (Mar. 27, 2021), https://www.zdnet.com/article/why-baseload-power-is-doomed/. Typically, providers of base load run at 70 to 90 percent capacity and do not shut down except for maintenance and are critical for maintaining the grid. *Id*.

[53] Plautz, *supra* note 23.

utilities.[54] Of the 42 million people they serve, rural co-ops obtain only about 22% of their energy from renewable sources,[55] but to reach net-zero emissions by 2050, the world will have to transition to generating 90% of its electricity from renewable sources.[56]

Even if renewable generation increased, consumers county-wide would not see any benefit if grid capacity doesn't improve.[57] Improving national grid capacity hinges on interconnection, the linking of a local generation source with the regional and/or national grid so the electricity can reach its final user.[58] However, the average time between when a project

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[54] Jeff St. John, *Rural Electricity is Getting its Biggest Boost Since FDR — Here's How*, CANARY MEDIA (May 24, 2023), https://www.canarymedia.com/articles/utilities/rural-electricity-is-getting-its-biggest-boost-since-fdr-heres-how. Why rural electric co-ops are more fossil fuel-heavy is a longer story. Shortly after President Roosevelt passed the Rural Electrification Act in 1935, it quickly became apparent to rural communities that established investor-owned utilities were wholly uninterested in using the federal funds to electrify rural America. *The Story Behind America's Electric Cooperatives and NRECA*, NAT'L RURAL ELEC. COOP. ASS'N (last visited Nov. 25, 2023), https://www.electric.coop/our-organization/history. Rural areas were still in desperate need of electrification, and so communities banded together to create farmer-based cooperatives. *Id*. Two years later, the Rural Electrification Administration drafted the Electric Cooperative Corporation Act, a model law for states to adopt to enable the formation and operation of not-for-profit electric cooperatives. *Electric Cooperatives Were Created to Serve Rural America, and Do*, SAN MIGUEL ELEC. COOP. INC. (last visited Nov. 25, 2023), http://www.smeci.net/quick-facts/electric-cooperatives-were-created-to-serve-rural-america-and-do. As not-for-profit entities, however, rural electric co-ops do not owe federal income taxes, and therefore did not benefit from federal tax subsidies for clean energy, so fossil fuel generation sources continue to be the most economic option (and as cooperatives, the organization will follow the path that is best for its collection of owners, which here are also the consumers).

[55] Leah Douglas, *Biden Administration Announces $11 Billion for Rural Clean Energy Projects,* REUTERS (May 16, 2021), https://www.reuters.com/world/us/biden-administration-announces-11-billion-rural-clean-energy-projects-2023-05-16/.

[56] Press Release, International Energy Agency, *Pathway to Critical And Formidable Goal of Net-Zero Emissions by 2050 is Narrow but Brings Huge Benefits, According to IEA Special Report* (May 18, 2021), https://www.iea.org/news/pathway-to-critical-and-formidable-goal-of-net-zero-emissions-by-2050-is-narrow-but-brings-huge-benefits. This report estimated that 70% of generation will need to come from wind and solar PV generators combined.

[57] Elizabeth McGowan, *Outdated Grid Practices Could Prevent Virginia from Hitting Future Clean Energy Targets*, POWERGRID INT'L (Sept. 22, 2023), https://www.power-grid.com/renewable-energy/wind/outdated-grid-practices-could-prevent-virginia-from-hitting-future-clean-energy-targets/.

[58] Pratima Garg, *Explainer: What Are Grid Interconnections and What Complicates Them?*, CLEAN ENERGY FIN. F. (Mar. 9, 2022), https://www.cleanenergyfinanceforum.com/2022/03/09/explainer-what-are-grid-interconnections-and-what-complicates-them. The February 2021 blackout disaster in Texas is a recent example of what can happen to a system without sufficient interconnection. After a particularly intense February snowstorm, which themselves are very are in Texas, the standalone Texas grid could not supply its residents with sufficient power, causing widespread blackouts. *Id*. If the Texas grid had been interconnected to one of its neighboring regional gids, it would have been able to "borrow" power from areas of the country not overstressed by demand and avoid the blackout crisis entirely. *Id*.

developer filed an application to when that developer had a final interconnection agreement with PJM (the largest regional transmission planning organization) between 2000 and 2020 was seven years.[59] Recent reforms promulgated by the Federal Energy Regulatory Commission (FERC), the regulatory body for all interstate transmission of electricity, are expected to improve wait times, but it will still take transmission providers several years to move through the existing backlog, and in the meantime a slew of IRA-inspired projects will be building up behind.[60] Renewables, including solar, are especially vulnerable to encountering additional obstacles with interconnection because they are often located in low-density areas where transmission infrastructure is least developed and therefore developers are required to upgrade the local transmission and distribution infrastructure before they can connect their project.[61] Even with these reforms, states are unlikely to meet their renewable energy goals,[62] especially considering the trend towards expanding these goals to require even more renewable generation.[63]

A second hurdle to actually delivering electricity to an end user is the aging infrastructure of the grid itself. To meet IRA's goal of reducing U.S. greenhouse gas emissions by 50 percent below 2005 levels by 2030 by increasing renewable generators presence in the electricity

[59] McGowan, *supra* note 57.

[60] Natural Resources Defense Council, *Waiting Game: How the Interconnection Queue Threatens Renewable Development in PJM* 1, 4 (May 2023). [hereinafter PJM Interconnection]

[61] *Id*. This creates a nasty feedback loop where the long queue wait correspondingly prolongs developers' investment uncertainty because an executed interconnection agreement is often a predicate for obtaining financing for the project, causing some to drop out of the queue, shifting the costs of grid upgrades further downwards in the queue and ultimately resulting in a "cascade of withdrawal." Office of Energy Efficiency and Renewable Energy, *Tackling High Costs and Long Delays for Clean Energy Interconnection*, ENERGY.GOV (May 11, 2023), https://www.energy.gov/eere/i2x/articles/tackling-high-costs-and-long-delays-clean-energy-interconnection.

[62] Often called Renewable Portfolio Standards, almost all the states have policies that either encourage or mandate a certain amount of the state's electricity to be produced from renewable sources. *Renewable Energy Explained: Portfolio Standards*, U.S. ENERGY INFO. ADMIN. (updated Nov. 20, 2022), https://www.eia.gov/energyexplained/renewable-sources/portfolio-standards.php.

[63] PJM Interconnection, *supra* note 60.

market,[64] the nation will have to build about 75,000 miles of transmission lines by 2035.[65] Besides being exorbitantly expensive,[66] siting and building transmission infrastructure is notoriously difficult because transmission lines inherently span a multitude of jurisdictions, all with stakeholders with different interests.[67] Of course, then it must be determined which jurisdiction's ratepayers ultimately shoulder the cost of the lines, which is a contentious issue as the length of the lines makes it challenging to discern who benefits from that line[68] (except to the extent that we all benefit from an increasingly reliable grid).[69]

To address these issues,[70] FERC has been urged to finalize a regional transmission and cost allocation rule that would require grid planners to base their decisions on a broad range of

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[64] *Building a Clean Energy Economy: A Guidebook to the Inflation Reduction Act's Investments in Clean Energy and Climate Action*, CLEANENERGY.GOV 1, 6 (Jan. 2023).

[65] Diana DiGangi, *All Hands on Deck Needed to Build IRA-Driven Infrastructure, Federal Officials Say*, UTIL. DIVE (Nov. 14, 2023), https://www.utilitydive.com/news/infrastructure-inflation-reduction-act-department-energy-funding/699705/. To visualize, this would run the length between New York City and Los Angeles fifteen times. *Id*.

[66] For example, a $786 million upgrade plan was approved by PJM, the northeast's regional transmission operator, last summer to handle the shutdown of *one* power plant in its service area. Ethan Howland, *Utility Regulators Urge PJM to Move Away From 'Reactive' Planning for Grid Reliability*, UTIL. DIVE (Nov. 30, 2023), https://www.utilitydive.com/news/opsi-pjm-interconnection-transmission-planning-grid-reliability/701105/ (emphasis added). A second recently PJM-approved project costs an estimated $627 million. *Id*.

[67] Catherine Clifford, Why It's So Hard to Build New Electrical Transmission Lines in the U.S., CNBC (updated Feb. 22, 2023), https://www.cnbc.com/2023/02/21/why-its-so-hard-to-build-new-electrical-transmission-lines-in-the-us.html. One commentator observed "[i]t's like we have municipal governments trying to fund an interstate highway." *Id*.

[68] *Id*.

[69] For a discussion of grid reliability that is out of the scope of this article, *see* Frank Rusco, *Electricity Grid Resilience - Climate Change is Expected to Have Far-reaching Effects and DOE and FERC Should Take Actions*, U.S. GOV'T ACCOUNTABILITY OFF. 1, 6 (Mar. 10, 2021).

[70] Microgrids are a mechanism by which developers and communities can sidestep dealing with the national transmission system altogether. Often seen on college campuses and military bases, microgrids are interconnected systems of generation sources that serve a discrete geographic area, hence are miniatures of the national electric grid. Elisa Wood, *What is a Microgrid?*, MICROGRID KNOWLEDGE (Mar. 12, 2023), https://www.microgridknowledge.com/about-microgrids/article/11429017/what-is-a-microgrid. Notably, technologies such as backup generators and residential solar panels are not microgrids; instead, the term connotes a collection of generation sources that serves a whole neighborhood, for example. *Id*. Microgrids are usually connected to the national grid and, as long as the national grid is operating properly, operate symbiotically, enabling the community it serves to save energy costs, reallocate energy supplies, and even produce revenue by selling back to the national grid. *Microgrids*, NAT'L RENEWABLE ENERGY LAB. (last visited Nov. 30, 2023), https://www.nrel.gov/grid/microgrids.html. However, microgrids can and do operate independently, especially in remote areas where interconnection to the national grid is impracticable. *Id*. Although they comprise only a fraction of the current grid capacity, the market is exponentially picking up having grown 47% from 2017 to 2022. *U.S. Microgrid Market Capacity Reaches 10 GW in 2022*, T&D WORLD (Feb. 9, 2023),

estimated benefits to the new transmission infrastructure and that outlines a mechanism to allocate the costs of building it between the jurisdictions it crosses.[71] Additionally, on November 16, 2023, the Department of Energy, which oversees FERC, issued a notice of proposed rulemaking requesting that certain transmission projects be excluded from time-intensive environmental reviews that delay initiating building.[72] Nevertheless, rules take time to finalize and local grid planning agencies often face delays in implementing the new rules, and in the meantime the reliability of the grid suffers.[73]

Even if renewable project developers overcome interconnection and/or transmission issues to connect to the national/regional grid, they still must face local permitting bodies, which are increasingly taking the opinions of their residents (whether well-informed or not) into account. Local buy-in is notoriously difficult to gather in rural areas because communities are concerned, among other things,[74] about losing agricultural land to site new solar projects,[75] so

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https://www.tdworld.com/microgrids/article/21259806/us-microgrid-market-capacity-reaches-10-gw-in-2022. As miniature grids, though, microgrids often incorporate multiple energy technologies and require operators to manage those technologies, thus combine the difficulties of planning the creation of a generation source with the difficulties of the everyday operation of a grid. *Microgrids*, CTR. FOR CLIMATE & ENERGY SOL. (last visited Nov. 30, 2023), https://www.c2es.org/content/microgrids/. Significantly more government (or private, if it can be identified) support would be required to deploy microgrids meaningfully across rural America. Thus, this article does not consider them a currently viable alternative to grid interconnection.

[71] Ethan Howland, *Proposed Transmission Planning Rule is a 'Chief' Priority for FERC's Phillips*, UTIL. DIVE (Nov. 21, 2023), https://www.utilitydive.com/news/ferc-proposed-transmission-planning-rule-phillips-clements/700423/.

[72] National Environmental Policy Act Implementing Procedures, 88 Fed. Reg. 78681 (proposed Nov. 16, 2023) (to be codified at 10 C.F.R. pt. 1021).

[73] Not only do we need to exponentially build the grid out to meet renewable energy goals, but also to strengthen it against the extreme weather events that are becoming more and more common as we experience more of the effects of climate change. Rusco, *supra* note 69. If measures are not taken to increase the grid's resilience, total annual expenditure to repair storm damage could reach as high as $25 million. *Id*. at 6.

[74] For example, communities cite worries that solar projects will decrease property values, damage soil and water, cause health issues, threaten native plants and animals, cause overdevelopment of rural areas, and generally "change the look and feel of the place." Dan Gearino, *The Energy Transition Runs into a Ditch in Rural Ohio*, INSIDE CLIMATE NEWS (July 29, 2022), https://insideclimatenews.org/news/29072022/williamsport-ohio-solar/.

[75] Alison F. Takemura, *Agrivoltaics Finds New Fans in US Senate*, CANARY MEDIA (June 20, 2023), https://www.canarymedia.com/articles/solar/agrivoltaics-finds-new-fans-in-us-senate?utm_campaign=canary&utm_medium=email&_hsmi=263139170&utm_source=newsletter. Even though landowners could earn more by leasing their land to renewable energy developers, doing so would mean less people

much so that projects failing due to local opposition has become a "culture war" and "part of a pattern in Ohio."[76] In about half the states, whether renewable projects proceed is left up to county or township planning or zoning boards, and thus "local governments across the country [are] gatekeepers for enabling the transition away from fossil fuels."[77] In the Midwestern states in particular, there is a seemingly ever-increasing roster of ordinance restrictions on large-scale solar and wind projects.[78] Although these restrictions purport to protect local interests, the cancellation of large-scale solar projects ends up costing local governments millions of lost tax revenue.[79]

However, the tides of local opposition may be turning. For example, in Illinois, a local county board reversed its decision to reject the construction of a small solar farm after the state

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would be making their living in the farm economy, which can be a hard line for many communities. Gearino, *supra* note 74.

[76] *Id*. Much of this unrest is spread by a group called Citizens for Responsible Solar. Miranda Green, Michael Copley & Ryan Kellman, *An Activist Group is Spreading Misinformation to Stop Solar Projects in Rural America*, NAT'L PUB. RADIO (Feb. 18, 2023), https://www.npr.org/2023/02/18/1154867064/solar-power-misinformation-activists-rural-america. The name is misleading. The group regularly spreads misinformation about solar generation, specifically that it puts undue pressure on local ecosystems, is driven by Big Tech's greenwashing initiatives, produces large amounts of toxic waste and CO2 emissions, and is unreliable, even when paired with batteries. *Industrial-Scale Solar Power Plants on Rural Land Negatively Impact our Ecosystem and Contribute to Climate Change*, CITIZENS FOR RESPONSIBLE SOLAR (last visited Nov. 25, 2023), https://www.citizensforresponsiblesolar.org/ecosystem-climate-change. It claims, among other things, that the construction of large solar projects will "forever destroy" the land its sited on but at the same time cites concerns for uncontrolled sediment runoff into local waterways. *10 Reasons Industrial-Scale Solar isn't Right for Agricultural-Rural Areas*, CITIZENS FOR RESPONSIBLE SOLAR (last visited Nov. 25, 2023), https://www.citizensforresponsiblesolar.org/10-reasons. Ironically, such uncontrolled runoff would most easily be controlled by keeping the soil covered year-round and planting perennials. Sponge Soils, *supra* note 13 at 5.

[77] Jeffrey Tomich, *Midwest Taps Dueling Strategies to Supercharge Renewables*, ENERGYWIRE (Sept. 18, 2023), https://www.eenews.net/articles/midwest-taps-dueling-strategies-to-supercharge-renewables/.

[78] *Id*.

[79] For example, opponents of a solar project in Ohio successfully pressured one of the country's largest renewable developers, EDF Renewables, to withdraw its 400-megawatt project proposal by arguing that the project would hurt the community by taking farmland out of production, reducing property values, and polluting the environment. Gearino, *supra* note 74. With the project cancelled, the country will lose a projected $3.6 million per year in lost tax revenue, while the landowners who signed leases with EDF will lose an anticipated collective $3 million per year. *Id*. Over the projected lifespan of the project, the local government is missing out on about $100 million total. *Id*. It is also important to point out that since the project is a private development, no right of eminent domain is available for local governments to assert and thus, the only projects being proposed are those that the landowners have already consented to. Therefore, at least some of the residents' that local governments exist to protect are paradoxically injured by its actions.

legislature passed a landmark climate bill expanding the state's RPS.[80] Although one board member expressed concern that the new law has "taken away [the board's] options,"[81] local governments are comprised of local residents and are elected to represent local interests, which themselves seem to be changing.

A recent poll of Indiana voters found that over two-thirds supported requiring state-wide uniform standards for permitting clean energy projects while only 21% were opposed.[82] Moreover, 60-70% of respondents favored increasing the presence of solar and wind in the state's generation mix.[83] To that end, Indiana legislators passed a law that authorized funding as an incentive for counties to adopt clear and consistent standards for siting, building, and operating renewable energy projects within their jurisdictions.[84] The problem is that the law expressly prohibits the use of state funds, and no other source of funding has been identified.[85] In the meantime the office is "on the lookout for federal opportunities".[86]

B. Current Agricultural Practices

Although many rural communities cling to the belief that farmland should only be used for farming, it is questionable how much value they are truly getting out of their farmland as it is most often used today. Modern agricultural practices are, put succinctly, incredibly unsustainable on both a macro and a micro scale. Since the 1960s, the agricultural sector has been

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[80] Tomich, *supra* note 77.

[81] *Id*.

[82] *Id*.

[83] *Survey of Likely General Election Indiana Statewide Voters*, ADVANCED ENERGY UNITED REP. (Aug. 15, 2023), https://blog.advancedenergyunited.org/reports/indiana_state_polling_2023. Interestingly, the largest percentage of respondents, over four-fifths, agreed that the state needs to provide consistent and clear regulations to help attract businesses and boost the economy. *Id*. In a close second, 67%, including a majority of Republicans (who traditionally oppose renewables for fossil fuels), responded that they would like to see the state require a uniform standard for the zoning, permitting and location of renewable energy projects. *Id*. Thus, it seems at least some of the local opposition could be alleviated by addressing the lack of consistent regulation across counties.

[84] Tomich, *supra* note 77.

[85] *Id*.

[86] *Id*.

characterized by concentration and consolidation, and the resulting "cooperations" have only avoided corporation (and the responsibilities that come with it) through the 1922 Capper-Volstead Act.[87] By acreage and by number, the vast majority of farms are individual or family-owned,[88] which may lead one to believe the *approach* to farming is also individual or family-owned, however, the market for farm-produced goods is dominated by these few Capper-Volstead Act "cooperatives." This leaves local farmers with no other option to offload their products,[89] and altogether has resulted in an industry-wide shift to a system that prioritizes efficiency (meaning profit margins) over all else.[90]

This industry transformation is characterized by the exchange of farms filled with mixtures of crops and livestock to swaths of land dominated by one or two cash crops,[91] and is known as "industrial agriculture."[92] For example, in the Midwest, more than 150 million acres

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[87] Dan Kaufman, *Is It Time to Break Up Big Ag?*, THE NEW YORKER (Aug. 17, 2021), https://www.newyorker.com/news/dispatch/is-it-time-to-break-up-big-ag. The practices the Capper-Volstead Act allows the industry to engage in are the same that "others would go to jail for", found a former Justice Department antitrust attorney who investigated the industry. *Id*.

[88] Steven Savage, *Who Owns America's Farmland? And What Is Their Role In The Response To Climate Change?*, FORBES (July 19, 2022), https://www.forbes.com/sites/stevensavage/2022/07/19/who-owns-americas-farmland-and-what-is-their-role-in-the-response-to-climate-change/?sh=2b3ebf80436d. The most recent USDA Census of Agriculture in 2017 found that individual or family-owned farms account for a total of 425.3 million acres of cropland and pastureland. *Id*.

[89] Kaufman, *supra* note 87. "No other option" means exactly that – in some areas one cooperative may have long-terms exclusive contracts with every plant within hundreds of miles.

[90] Bruce Gardner, *U.S. Agriculture in the Twentieth Century*, ECON. HIST. ENCYCLOPEDIA (Mar. 20, 2003). Gardner discusses two "constellations" through which the public can view American agriculture in the twentieth century. *Id*. The pessimistic constellation focuses on social justice-type issues such as environmentally unfriendly farming techniques, the exploitation of farm laborers, and the concentration of wealth in a few farms. *Id*. The alternative constellation, Gardner argues, is more optimistic because "[i]t focuses on the increased acreage and output of the average farm, the sustained growth of agricultural productivity even through the general productivity slump of the 1980s, the substantial improvements in income and wealth of commercial farmers, the predominant role of the United States in world commodity markets, and American leadership in supplying both technological innovation and food aid for the developing world." *Id*. Note, firstly, the factors in each constellation are far from mutually exclusive (and in the real world, often do exist side-by-side), and secondly, that every singly "optimistic" factor is economic, while the "pessimistic" factors address holistic health of the people and the land. *But see* Ted Nordhaus & Dan Blaustein-Rejto, *Big Agriculture is Best*, FOREIGN POL'Y (Apr. 18, 2021), https://foreignpolicy.com/2021/04/18/big-agriculture-is-best/ (arguing that industrial agriculture is the fundamental basis for modern society and for American innovation).

[91] Sponge Soils, *supra* note 13 at 3.

[92] For more information on features of industrial agriculture that are outside the purview of this article, *see Industrial Agriculture 101*, NAT'L RES. DEF. COUNCIL (Jan. 31, 2020), https://www.nrdc.org/stories/industrial-

grow annual crops, such as corn or soybeans, which "leave[s] fields bare between summer growing seasons, making soils vulnerable to erosion [and] also often rel[ies] on tillage (plowing) practices that degrade soil structure, reduce water infiltration and water storage capacity, and increase[s] the flow of water (and any pollutants it carries) across the soil surface."[93]

Industrial agricultural practices have cascading effects beyond the farm's immediate vicinity. The increased flow of water across the soil's surface correspondingly increases stream flow and pollution in the bodies of water it eventually deposits into.[94] Industrial farms also produce more on-site waste, including the release of excess nutrients and heavy metals into the surrounding environment.[95] Mark Rice, retired former director of the Animal and Poultry Waste Management Center at North Carolina State University, sees excess nutrient runoff due to industrial agriculture as a more pressing issue than even air and water quality.[96]

Because growing the same crop on the same land year after year depletes the soil of a certain set of nutrients specific to that crops' needs, industrial farms often rely on artificial fertilizers made from nitrogen, phosphorous, and potassium (known as NPK fertilizers).[97] As innocent sounding as a fertilizer named directly off the periodic table of elements can sound,

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agriculture-101 [hereinafter Industrial Agriculture 101]; Shad Clark, *Industrial Agriculture is Far Worse Than You Think*, THE HUMAN LEAGUE (Sept. 13, 2022), https://thehumaneleague.org/article/industrial-agriculture; *10 Things You Should Know About Industrial Farming*, U.N. ENV'T PROGRAMME (July 20, 2020), https://www.unep.org/news-and-stories/story/10-things-you-should-know-about-industrial-farming.

[93] *Sponge Soils, supra note 13 at 3.*

[94] *Id.*

[95] Miranda Willson, *Rural Energy Program Draws Scrutiny Over Biden Equity Plan*, ENERGYWIRE (Aug. 27, 2023), https://www.eenews.net/articles/rural-energy-program-draws-scrutiny-over-biden-equity-plan/. If the excess nutrients end up in the waterways, they trigger algae overgrowths, which can release toxins harmful to people, animals, and the ecosystem as a whole. Industrial Agriculture 101, *supra* note 92. To decompose the algae after they have died, aquatic bacterial draw oxygen from the water around the, creating aquatic "dead zones". *Id*. These dead zones have been getting larger and more frequent, so much so that Lake Erie has a dead zone every summer. *Id*.

[96] Wilson, *supra* note 95.

[97] *How are Mineral Fertilizers Made?*, INT'L FERTILIZER ASS'N (last visited Nov. 25, 2023), https://www.fertilizer.org/about-fertilizers/how-are-fertilizers-made/#:~:text=Nitrogen%2Dbased%20fertilizers%20are%20primarily,from%20natural%20gas%20or%20coal).

names can be misleading. Manufacturing nitrogen fertilizer requires heating the nitrogen over a hydrogen source, typically natural gas or coal.[98] The production and transportation of natural gas, and especially coal, comes with its own slew of negative externalities,[99] but the burning of any fossil fuel emits an overwhelming proportion of anthropogenic greenhouse gases.[100] Phosphorous and potassium fertilizers fare no better – each require the mining of the minerals they are derived from, which in addition to endangering the health of the miners, of their communities, and of the local environment, also results in piles of radioactive material.[101]

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[98] *Id*.

[99] *Killer Coal: Just How Bad are the Health Effects of Coal?*, CLIMATE COUNCIL (May 22, 2023), https://www.climatecouncil.org.au/killer-coal-just-how-bad-are-the-health-effects-of-coal/#:~:text=Along%20with%20adding%20to%20greenhouse,miners%2C%20workers%20and%20surrounding%20communities. Such externalities include emitting toxic and/or carcinogenic substances into the air, water, and land, which can raise rates of childhood asthma, heart and lung diseases, and cancers. *Id*. Most infamously, working in coal mines is responsible for "black lung" which has caused or contributed to more than 78,000 deaths since 1968 in the United States alone. Joe Manchin, Bob Casey, Sherrod Brown, Tim Kaine, & Mark Warner, *The Black Lung Benefits Improvement Act of 2022*, https://www.manchin.senate.gov/download/black-lung-benefits-improvement-act-one-pager. Although the passage of the Federal Coal Mine Health and Safety Act of 1969 and subsequent Black Lung Benefits Act of 1972 helped alleviate the prevalence, we are now seeing a resurgence of incidence, and at younger ages. *Id*. This and other functional issues with accessing benefits of the Black Lung Benefits Program has recently led legislators to introduce updated legislation, the details of which is outside the scope of this article. *Id*. It suffices to say that more than a half-century later, we are still dealing with the health consequences of coal mining. In an effort to avoid some of the costs to human health, the coal mining industry shifted from underground mining to surface mining, the most common form being "mountaintop removal mining". As the name suggests, this involved removing the tops of mountains, removing the valuable material, and filling the valleys between the doomed mountains with the remaining rock debris. Unfortunately, research shows that this type of mining also leads to increased rates of cardiovascular disease, lung cancer, pulmonary disease, and birth defects. Richard Schiffman, *A Troubling Look at the Human Toll of Mountaintop Removal Mining*, YALE ENV'T 360 (Nov. 21, 2017), https://e360.yale.edu/features/a-troubling-look-at-the-human-toll-of-mountaintop-removal-mining. For a shocking visual on the effects of mountaintop removal mining on the natural landscape, *see World of Change: Mountaintop Mining, West Virginia*, NASA EARTH OBSERVATORY (last visited Nov. 25, 2023), https://earthobservatory.nasa.gov/world-of-change/Hobet.

[100] *Energy and the Environment Explained: Where Greenhouse Gases Come From*, U.S. ENERGY INFO. ADMIN. (updated Aug. 22, 2023), https://www.eia.gov/energyexplained/energy-and-the-environment/where-greenhouse-gases-come-from.php. Although the overwhelming proportion of greenhouse gas emissions from burning fossil fuel is due to energy needs, nitrogen-based fertilizers alone are responsible for about 2% of global greenhouse gas emissions. Spencer Scott, *Fertilizer: A New Battleground in the Fight to Solve the Climate Crisis*, ONE EARTH (Oct. 29, 2022), https://www.oneearth.org/fertilizer-a-new-battleground-in-the-fight-to-solve-the-climate-crisis/.

[101] In Florida, for example, there are currently around one billion tons of phosphogypsum, the radioactive byproduct of processing phosphate rock into phosphorus for fertilizer, in twenty-four stacks across the state. *Radioactive Material from Fertilizer Production*, U.S. ENV'T PROT. AGENCY (updated June 14, 2023), https://www.epa.gov/radtown/radioactive-material-fertilizer-production; *Phosphogypsum Stacks*, THE FLA. INDUS. AND PHOSPHATE RSCH. INST. (last visited Nov. 25, 2023), https://fipr.floridapoly.edu/about-us/phosphate-primer/phosphogypsum-stacks.php. An additional estimated 30 million tons of phosphogypsum is generated each year. *Id*.

Moreover, *any* artificial fertilizer used on a farm must of course first be brought to that farm, thus *all* external inputs require the use (and production, refinement, transportation, and burning) of hydrocarbons (at least until transportation and industrial processes are electrified and powered with renewable generation). Continued hydrocarbon/fossil fuel use perpetuates the use of fossil fuels and increases the climate damage that industrial agriculture causes.

Considering all of this, it should come as no surprise that the soil under industrial agricultural management also suffers. Its carbon stocks are depleted,[102] which in healthy soil increases the availability of nutrients and water to plants, helps provides the soil with structure to protect from erosion, and increases microbial activity.[103] Additionally, unhealthy soils have used an estimated 400 trillion additional gallons of water in the last 35 years than healthy soils would have used.[104] In the Corn Belt specifically, an average of 35% of the surveyed soils have lost the critical A-horizon soil,[105] more commonly known as the topsoil.[106] Models predict this is the highest level of soil erosion in the nation, with some areas completely stripped of A-horizon to leave bare the poor-quality B-horizon soils.[107] The result of these unsustainable farming practices is that the nation as a whole loses more than twice as much soil to erosion than the Great Plains

[102] Keith Paustian et al., *Soil C Sequestration as a Biological Negative Emission Strategy*, Frontiers in Climate (Oct. 16, 2019), https://www.frontiersin.org/articles/10.3389/fclim.2019.00008/full.

[103] *Soils and Carbon for Reduced Emissions*, AGRIC. VICTORIA (updated Aug. 24, 2023), https://agriculture.vic.gov.au/climate-and-weather/understanding-carbon-and-emissions/soils-and-carbon-for-reduced-emissions.

[104] This amount of water is equal to around nine years of irrigation water withdrawn across the entire United States at current rates. Sponge Soils, *supra* note 13 at 11.

[105] Evan A. Thaler et al., *The Extent of Soil Loss Across the US Corn Belt*, 118 THE PROC. OF THE NAT'L ACAD. OF SCI. (Feb. 15, 2021), https://www.pnas.org/doi/10.1073/pnas.1922375118.

[106] This is the uppermost layer of soil and is "most favorable to plant growth, richest in organic matter, and responsible for most of the soil's native fertility." *Major Soil Horizons*, SOIL INFO. FOR ENV'T MODELING & ECOSYSTEM MGMT. (Oct. 15, 1998), http://www.soilinfo.psu.edu/index.cgi?soil_land&us_soil_survey&map&pa&Centre&soil_info&soil_genesis&maj_soil_horiz.

[107] Thaler, *supra* note 105.

region lost annually during the peak of the Dust Bowl.[108] In addition to water and tillage erosion,[109] industrial agriculture also harms the physical structure and microbial contents of soil,[110] weakens soils' (and therefore crops') resistance to extreme weather events,[111] and pollutes local drinking water.[112]

C. Healthy Soil

Healthy soil, on the other hand, is a natural living resource, teaming with billions of bacteria, fungi, and other microbes.[113] It is both living and life-giving.[114] It is a vital living ecosystem that sustains plants, animals, and humans.[115]

Soil is where it all starts – from the ground, up. And yet, modern agricultural processes, designed to maximize crop yield (critically, here meaning *volume*) at any cost, actually end up minimizing the yield (here, meaning *value*) that those who consume those crops receive. Irrigation, fertilization, and harvesting methods disrupt essential interactions between plants and soil fungi, reducing the uptake of nutrients from the soil.[116]

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[108] Marcia DeLonge & Karen Perry Stillerman, *Tyson's Need for Feed*, UNION OF CONCERNED SCIENTISTS (Feb. 9, 2022), https://www.ucsusa.org/resources/tysons-need-feed#read-online-content.

[109] Thaler, *supra* note 105.

[110] Karen Perry Stillerman & Marcia DeLonge, *Policy Brief: Safeguarding Soil*, UNION OF CONCERNED SCIENTISTS 1, 2 (Nov. 22, 2019).

[111] *Id*. Extreme weather events which will occur more frequently as climate change intensifies. *Extreme Weather and Climate Change*, Nat'l AERONAUTICS & SPACE ADMIN., (last visited Dec. 6, 2023), https://climate.nasa.gov/extreme-weather/.

[112] Rebecca Boehm, *Dirty Water, Degraded Soil*, Union of Concerned Scientists (Jan. 14, 2021), https://www.ucsusa.org/resources/dirty-water-degraded-soil#read-online-content. Unfortunately, but all too often, taxpayers are left to pay the costs of remediating the damage that industrial agriculture causes to its surrounding environment. For example, Iowa will spend between $41 and $333 million over the next five years to remove concentrated nitrate from its drinking water. *Id.*

[113] *Soil Health*, U.S. DEP'T OF AGRIC. (last visited Nov. 25, 2023), https://www.usda.gov/peoples-garden/soil-health.

[114] *Soil Health*, U.S. DEP'T OF AGRIC. – NAT. RES. CONSERVATION SERV., (last visited Nov. 25, 2023), https://www.nrcs.usda.gov/conservation-basics/natural-resource-concerns/soils/soil-health.

[115] *Id*.

[116] Colino, *supra* note 16.

Healthy soil provides us not only bountiful crops, but also cleaner air and water, healthier forests, diverse wildlife, and beautiful landscapes.[117] The USDA emphasizes that healthy soil performs five essential functions: (1) regulating water, (2) sustaining plant and animal life, (3) filtering and buffering potential pollutants, (4) cycling nutrients, and (5) providing physical stability and support.[118] Each of these ties directly back to healthy and happy plants, as explained in the following section.

1. What Is Healthy Soil and Why is it Important?

Healthy soil not only supports life, but itself is full of life.[119] As the literal foundation of our food system, soil is essential. Farmers especially benefit from healthy soil's ability to grow healthy crops, to require fewer petro-chemical derived fertilizers, and to act as a "sponge," insulating crops from both flood and droughts while preventing pollution downstream.[120] Through the insects, fungi, and microbes it contains, healthy soil recycles decaying material into organic matter and nutrients to be used again in plants.[121] All these microactivities, notably free of cost, result in crops that are more resistant to extreme weather and store more carbon in the ground.[122]

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[117] Soil Health, *supra* note 113.

[118] *Soil Health*, U.S. DEP'T OF AGRIC. – NAT. RES. CONSERVATION SERV., (last visited Nov. 25, 2023), https://www.nrcs.usda.gov/conservation-basics/natural-resource-concerns/soils/soil-health.

[119] Stillerman, *supra* note 110 at 1.

[120] *Id*.

[121] *Id*.

[122] *Id*. In addition to providing a key element of soil health, storing carbon in the ground has the added benefit of removing carbon, in the form of carbon dioxide, from the atmosphere. Todd A. Ontl & Lisa A. Schulte, *Soil Carbon Storage*, NATURE EDUC. KNOWLEDGE (2012), https://www.nature.com/scitable/knowledge/library/soil-carbon-storage-84223790/. This process, known as "soil carbon sequestration", however, is mediated by the photosynthesis of plants. *Id*. Thus, removal of carbon dioxide from the atmosphere and rejuvenation of soil health act in a type of feedback loop.

However, the vast majority of our soil is not healthy. Once damaged, soil can take hundreds of years to heal.[123] Some studies even indicate that the United States is due for another Dust Bowl,[124] as scientists estimate that we are losing topsoil at a rate ten times faster than nature is able to replace it.[125] In the agriculture-intensive Midwest, approximately half of all topsoil loss in the last 50 years is due to erosion caused by human activity.[126] Also in the Midwest, soil is eroding between ten and a thousand times faster than before Euro-American settlement.[127] Because topsoil contains the largest fraction of carbon, it is a "key component of water and nutrient retention and soil productivity."[128] On a macro scale, soil erosion reduces yields,[129] damages the surrounding ecosystem, and negatively affects the global carbon cycle,[130] while on micro scale, it reduces the quality of the yields and correspondingly the health of the animals who consume it and their ability to fight off disease.[131] Most critically, reduced crop yields can

[123] Marcia DeLonge & Karen Perry Stillerman, *Eroding the Future*, UNION OF CONCERNED SCIENTISTS 1, 4 (Dec. 2020). Estimates suggest that it may take between three and six centuries to build a one-inch layer of healthy soil. *Id*.

[124] Nathaniel Scharping, *As the Climate Warms, Could the U.S. Face Another Dust Bowl?*, YALE ENV'T 360 (May 13, 2021), https://e360.yale.edu/features/as-the-climate-warms-could-the-u.s.-face-another-dust-bowl. The region has only narrowly missed a recurrence of the Dust Bowl through changing its land use practices, such as irrigating more often and extensively than farmers did in the 1930s. *Id*. Irrigation, however, obviously requires access to water, and the Ogallala Aquifer that feeds most of the Midwest is estimated to be 70% depleted within the next 50 years. *Id*.

[125] Keith Mulvihill, *Soil Erosion 101*, NAT'L RES. DEF. COUNCIL (June 1, 2021), https://www.nrdc.org/stories/soil-erosion-101. *See also* Susan S. Lang, *'Slow, Insidious' Soil Erosion Threatens Human Health and Welfare as Well as the Environment, Cornell Study Asserts*, CORNELL CHRON. (Mar. 20, 2006), https://news.cornell.edu/stories/2006/03/slow-insidious-soil-erosion-threatens-environment-human-health.

[126] *Id*.

[127] University of Massachusetts Amherst, *Soil in Midwestern US is Eroding 10 to 1,000 Times Faster Than it Forms, Study Finds*, PHYS.ORG (Dec. 7, 2022), https://phys.org/news/2022-12-soil-midwestern-eroding-faster.html. Industrial agriculture really only took root in the mid twentieth century, well after European settlement. Therefore, it is safe to estimate that this figure would be even more striking if its range were limited by actual agriculture practice.

[128] Thaler, *supra* note 105.

[129] One study estimated that loss of topsoil decreased crop yields by "6 ± 2%, causing $2.8 ± $0.9 billion in annual economic losses." *Id*.

[130] *Id*.

[131] The less nutrients in the soil, the less nutrients available for the plants that grow in the soil to take up, the less nutrients available for the humans that eat those plants, and the less able human bodies are to mount defense against disease. Colino, *supra* note 16. Food may no longer be able to act as an essential preventative medicine. *Id*. This issue will be confounded as more move towards plant-based diets in response to climate change and social justice. *Id*.

result in food insecurity, conflict, and in some cases have been linked to the decline of civilizations.[132] To superficially improve the quality of degraded soils, many farmers apply synthetic fertilizers which runoff into local water systems, further impairing human health and aquatic ecosystems.[133]

2. How Can We Get Healthy Soil?

As with many things in life, prevention is the best treatment. Unfortunately, many of the soils in the US are beyond that point.[134] However, luckily, unlike most things in life, soil's second-best option is to just leave it alone.[135] Beyond minimizing disturbance, the USDA's Natural Resources Conservation Service (NRDS) recommends maximizing the presence of living roots, soil cover, and biodiversity to heal and maintain soil health.[136]

Soil is most often disturbed on modern American farms through practices such as tilling and overgrazing, which leave the soil bare and/or over compacted, disturbing the essential microbes that make their home there.[137] *Strategic* grazing,[138] on the other hand, can actually

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[132] The downfall of the Maya Civilization was likely at least in part caused by famine. Joseph Stromberg, *Why Did the Mayan Civilization Collapse? A New Study Points to Deforestation and Climate Change*, SMITHSONIAN MAG. (Aug. 23, 2012), https://www.smithsonianmag.com/science-nature/why-did-the-mayan-civilization-collapse-a-new-study-points-to-deforestation-and-climate-change-30863026/. An explosion in population coupled with clearing forests for more agriculture and droughts that occurred primarily in the summer growing season proved to be catastrophic to the Mayan society. *Id*.

[133] Thaler, *supra* note 105.

[134] From 1985 to 2015 an estimated 25.8 million acres of soil has been lost. DeLonge, *supra* note 123 at 11. Furthermore, we currently losing more soil every two years than was lost during either year of the Dust Bowl. *Id*. at 12.

[135] Colino, *supra* note 16.

[136] Soil Health, *supra* note 114.

[137] *Soil Health Management*, U.S. DEP'T OF AGRIC. – NAT. RES. CONSERVATION SERV., (last visited Nov. 25, 2023), https://www.nrcs.usda.gov/conservation-basics/natural-resource-concerns/soils/soil-health/soil-health-management.

[138] What constitutes *good* grazing depends on the farm and the conditions of that year, however, *strategic* grazing overall is "graz[ing] at the right time, to the right height, and with the right amount of stock." Liz Genever & Sue Buckingham, *Planning Grazing Strategies for Better Returns*, 8 AGRIC. & HORTICULTURE DEV. BD. 1, 6 (2018). Its aim is to manage livestock movement so that the plants they eat do not get to the fourth leaf stage a die, thereby drawing nitrogen from the soil to decompose, shading out other growing plants, and plating host to pests and diseases. *Id*. at 10. Employing the basic strategy of giving the grass a rest by moving livestock to a different field can increase yields by around twenty percent. *Id*.

contribute to soil health[139] through distributing organic matter directly from the source while refraining from over compacting the ground. Living roots are the location at which nutrient and water exchange occurs between a plant and the soil,[140] therefore maintaining living roots throughout the year enables a continuous symbiotic relationship.

Some farms attempt to maintain living roots in their soil throughout the year by planting "cover crops," such as mustard, alfalfa, rye, or clovers between the growing season of the cash crops, which are the crops sold for profit. [141] Cover crops may be thought of as a "living mulch"[142] and "act on soil like a nourishing facial after the harvest."[143] They can increase soil porosity, and keeping soils continuously covered can increase the amount of water available to plants an average of 9% more than traditional annual crop systems.[144] Cover crops also "prevent erosion, improve soil physical and biological properties, supply nutrients to the following crop, suppress weeds, improve soil water availability, and break pest cycles."[145] Further, a 2023 survey of farmers who deployed cover crops found that even though payment for cover crops is an

[139] As one farmer put it, "First comes the land, the land is the canvas, and the animals are the paint." Brandon Watson, Andy Olsen & Ann Mesnikoff, *REAP Success Stories*, ENV'T L. & POLICY CTR. 1, 2 (Feb. 2023).

[140] Soil Health Management, *supra* note 137.

[141] *Cover Crops*, RODALE INST. (last visited Nov. 25, 2023), https://rodaleinstitute.org/why-organic/organic-farming-practices/cover-crops/#:~:text=Cover%20crops%20are%20different%20from,from%20erosion%20and%20nutrient%20loss.

[142] *Id*.

[143] Stephanie Strom, *Cover Crops, a Farming Revolution with Deep Roots in the Past*, N.Y. TIMES (Feb. 6, 2016), https://www.nytimes.com/2016/02/07/business/cover-crops-a-farming-revolution-with-deep-roots-in-the-past.html?_r=0.

[144] Sponge Soils, *supra* note 13 at 8. Termed "spongelike" due to their resilience to both flood and drought, healthier and therefore more absorbent soils were created by shifting farming systems to keep the soil covered year-round in 70% of the farms analyzed in one study. *Id*. at 5-6. Looking specifically at Iowa, this study found that "by shifting the most-erodible or least-profitable regions of Iowa to systems using perennial and cover crops, farmers could reduce rainfall runoff by up to 20 percent in flood events and make as much as 16 percent more water available to crops in droughts. *Id*. at 6.

[145] Fred Magdoff & Harold Van Es, BUILDING SOILS FOR BETTER CROPS 1, 137 (4th ed. 2021).

important incentive in transitioning farmers to the practice, many continue the practice long after the incentives have ended specifically because of the benefits they have seen to the soil health.[146]

Although cover crops could be planted to grow for an entire growing season, this would mean the farm would forego all income-generating crops that year.[147] Therefore most farmers plant cover crops only between cash crop growing seasons,[148] which usually range around six months, depending on the type of crop.[149] This leaves cover crops in the ground at maximum for only half the year, and any improvement in soil's organic matter may immediately be lost to tilling before planting the cash crop.[150] Moreover, most of the nation's farmland is past the point of being able to rapidly recover,[151] thus the benefits of short bouts of cover crops are negligible.

The reasoning behind planting cover crops would be more fully realized if farms were to embrace perennialization. Overused agricultural land is caught in a loop where each annual crop harvest "resets" the recolonization of native species needed to begin the healing process.[152] If the land was not tilled, planted, then harvested cyclically, such as would occur in a perennialization system, this recolonization would result in increasingly efficient nutrient cycles and correspondingly efficient plant productivity.[153] For example, in China, former maize and wheat

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[146] Jenna Hoffman, *Cash Isn't Always King in Cover Crops*, AGWEB (Aug. 28, 2023), https://www.agweb.com/news/crops/crop-production/cash-isnt-always-king-cover-crops. Farmers may also see significant savings in fertilizer and/or herbicide costs. Magdoff, *supra* note 145 at 140.

[147] *Id*. at 150.

[148] *Id*.

[149] For a detailed analysis of the growing seasons of the most common cash crops in the U.S., *see* United States Department of Agriculture & National Agricultural Statistics Service, *Usual Planting and Harvesting Dates for U.S. Field Crops*, 628 AGRICULTURAL HANDBOOK 1 (Dec. 1997).

[150] Magdoff, *supra* note 145 at 138.

[151] Samantha Mosier, S. Carolina Córdova & G. Phillip Robertson, *Restoring Soil Fertility on Degraded Lands to Meet Food, Fuel, and Climate Security Needs via Perennialization* 5 FRONTIERS IN SUSTAINABLE FOOD SYS. 1, 11 (2021).

[152] *Id*. at 2

[153] *Id*.

croplands converted to perennial grasslands measured higher nitrogen, phosphorus, and soil fertility as well as sequestered more carbon from the atmosphere.[154]

However, the process of perennialization is no small undertaking. To begin with, it would take a piece of land out of production much longer than the half a year of cover crops would, some even indefinitely.[155] Although soil may begin to show signs of recovery via increased carbon presence and microbial mass relatively rapidly the first year after planting,[156] the longer the system is maintained, the greater gains are seen all around.[157] Furthermore, the rates of recovery vary significantly across the nation, depending on factors such as pervious disturbance, previous land use, and climate.[158] Secondly, landowners face significant barriers in adopting perennialization systems; demand for food is growing, current policies (such as crop insurance, which incentivizes growing on degraded land as low yields will be ameliorated by the insurance program) reinforce annual cropping, and there is little to no financial incentive to plant perennials.[159]

All soil restoration programs require substantial planning and monitoring. The mix of perennials planted must be carefully chosen to avoid non-native invasive species from replacing the original native ecosystem and the associated benefits of its biodiversity.[160] If plants are not carefully chosen based on a thorough ecological analysis of the site, the investment may be lost

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[154] *Id*. at 11. One study found that growing perennials on former agricultural lands restocked amounts of soil carbon by 19-39%. Lucas A. Chamberlain et al., *Rapid Improvement in Soil Health Following the Conversion of Abandoned Farm Fields to Annual or Perennial Agroecosystems*, FRONTIERS IN SUSTAINABLE FOOD SYS. 1, 2 (Oct. 21, 2022).

[155] The overwhelming proportion of research on planting perennial systems on agricultural land addresses *abandoned* agricultural land, probably because researchers would have a very difficult time convincing a landowner to take a productive (regardless of how minimally productive) piece of agricultural land out of use with their limited grant budget.

[156] Chamberlain, *supra* note 154.

[157] Mosier, *supra* note 151.

[158] *Id*.

[159] *Id*. at 12.

[160] *Id*. at 11.

and ecological equilibrium of the site and surrounding land disturbed.[161] Likewise, perennialization systems must be monitored to ensure survival rates of planted species and that opportunistic invasive species have not colonized the site.[162] Thus, as much potential as perennialization has to restore degraded cropland, farmers are unlikely to adopt it without substantial help.

In summary, rural communities are in an especially tight spot; rising temperatures and increasingly frequent extreme weather events will continue to stress the national grid as climate change marches on, and linking local end users of electricity to the grid is increasingly difficult. FERC reforms aimed at streamlining transmission siting and payment allocation and interconnection procedures *should* help, but it is yet to be seen if they can be implemented in a timely enough fashion. And to top it all off, renewable projects of any kind[163] face significant opposition from local communities because many view them as taking "productive" agricultural land out of commission.

Moreover, it is abundantly clear that current agricultural practices, namely industrial agricultural practices, cannot continue if we hope to use this land productively in the future. Planting the same few annual crops year after year depletes the soil's nutrient stocks, leaves the soil vulnerable to erosion, and necessitates using more water to grow these crops. The continual harvest, till, plant, harvest cycle of the same few crops damages the soil and creates a feedback

[161] *Restoration of Organic Soils*, U.N. CLIMATE TECHNOLOGY CTR. & NETWORK (last visited Nov. 28, 2023), https://www.ctc-n.org/technologies/restoration-organic-soils#:~:text=Soil%20restoration%20refers%20to%20actions,organic%20matter%2C%20which%20promotes%20restoration.

[162] *Id*. This guide recommends at least two years of monitoring along with active participation of the community, as they will ultimately benefit from the improved soil.

[163] Communities also oppose non-renewable projects like transmission siting and natural gas power plants for many of the same reasons. Dan Gearino, *The Energy Transition Runs into a Ditch in Rural Ohio*, INSIDE CLIMATE NEWS (July 29, 2022), https://insideclimatenews.org/news/29072022/williamsport-ohio-solar/.

loop where the negative effects of these practices requires more and more external inputs, further harming the soil and plants that grow from it.

The effects of these practices accumulate in the basis of all agriculture: the soil. Although healthy soil is essential to maintaining productive ecosystems long term, the majority of the agricultural soil in the U.S. is far from healthy. Some farms attempt to address the issue by planting cover crops between cash crops' growing seasons, but the cover crops' ability to heal the soil is significantly truncated by economic circumstances that push the farmer into growing more profitable annual cash crops. Perennialization is a time-proven method of naturally rejuvenating damaged soils, but farmers face considerable difficulties in planning and implementing a perennial system. Not only are perennialization systems complicated to plan and monitor, they also inherently involve removing economically productive land from use with no financial incentive to do so.

II. The Solution

The problem is evident: climate change is intensifying, crops and their soils are struggling, and rural communities aren't too keen on solar development.[164] This begs the question of what is to be done, and who is going to do it.

Farmers have no reason to transition degraded farmland out of rotation as long as current policies that enable the use of artificial fertilizers and insure against low crop yields stay in place. To do so would remove their main source of income and possibly ostracize them from their community, all for the benefit of subsequent landowners. Given that soil degradation and the need for clean energy affects all citizens through the food we eat and the power we use, the

[164] Notably, rural communities are also not particularly keen on other renewable generation development, such as wind and geothermal projects, or the transmission lines needed to connect the generators to the end users.

government should step in to help ease farmers' transition into planning for the long-term health of the soils of the nation. Specifically, farmers need help in (1) negotiating fair leases with solar developers, (2) designing and monitoring perennialization systems custom fit to that site's ecosystem, and (3) financial support during the transition period.

Farmers, along with the vast majority of landowners in general, are most likely not sophisticated enough to negotiate truly mutually beneficial leases with solar developers and their mass of resources. By taking previously "productive" land out of traditional agricultural use, farmers face huge risks to their income if a project fails to be built, is built late, or is closed early. Thus, farmer-lessors must take care to ensure that the lease agreement properly protects them against this risk.[165] Areas of specific concern include establishing a fair rent amount for the area and specific features of the land (including escalation clauses to keep up with inflation as these leases usually last at least twenty-five years),[166] allocating the tax consequences of attaching "real property" to their land to the developer,[167] designing construction activities so that they will not interfere with other landowner activity,[168] adding a liquidated damages provision in case of late project completion if rent is somewhat based on energy production, and ensuring that termination provisions adequately compensate the landowner if the developer defaults.

Farmer also need help designing perennial soil recovery systems because they must be carefully created to complement the natural ecosystem and the specific qualities of the soil and site. They also must be monitored to protect against invasive species establishing themselves

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[165] For a high-level overview of the leasing process, *see Guide to Land Leases for Solar*, SOLAR ENERGY INDUS. ASS'N 1 (July 2016).

[166] *Solar Rent Payments vs Solar Royalty Payments*, LANDGATE (updated Oct. 20), https://www.landgate.com/news/solar-rent-payments-vs-solar-royalty-payments. (recommending an escalator of at least 2-3%). Additionally, landowners should be sure to steer clear from using royalty payments as rent because there are too many variables in calculating revenue and expenses associated with a large-scale solar project. *Id*.

[167] *Fact Sheet – Landowner Considerations for Solar Land Leases*, N.Y. STATE ENERGY RSCH. & DEV. AUTH. 1, 1 (June 2016).

[168] *Id*. at 2.

instead of the intended perennials. Ecosystems are complex, interrelated networks of plants, animals, fungi, and other microorganisms,[169] and may easily be thrown out of balance if not carefully planned and maintained.[170]

Farmers would require financial support during the period between ending agricultural production on their spent land and the beginning of lease payments. The development phase of building a solar project most often begins with an option to lease,[171] granting the developer the exclusive right to enter into a lease with the landowner for a certain period of years while the developer determines if the project will actually move forward.[172] The option payments are almost always significantly less than the lease payments because the developer is not yet sure if the project will move forward and therefore also unsure if it will generate income off the land, leaving the landowner with less income and more uncertainty than it would have had it kept farming. Additionally, some jurisdictions such as New York State mandate that a landowner pays a "conversion fee" when converting agricultural land into non-agricultural use.[173] The state statute specifically excludes the "nonuse or idling of such land"[174] but it is unclear whether establishing and maintaining a perennial system under the panels would constitute "nonuse". Lastly, farmers need assistance actually purchasing the plants and equipment needed to establish

[169] *How Can You Maintain the Ecosystems in Your Surrounding Area?,* DGB GRP. (May 31, 2023), https://www.green.earth/blog/how-can-you-maintain-the-ecosystems-in-your-surrounding-area.

[170] An example of an invasive species disturbing a local ecosystem many of the readers may be familiar with is the spotted lanternfly's presence in the United States, which poses significant threats to multiple plant-related industries. For the latest information on the spotted lanternfly in the U.S., *see Spotted Lanternfly*, U.S. DEP'T OF AGRIC. – NAT'L INVASIVE SPECIES INFO. CTR. (last visited Dec. 4, 2023), https://www.invasivespeciesinfo.gov/terrestrial/invertebrates/spotted-lanternfly.

[171] Solar Energy Industries Association, *supra* note 165 at 2.

[172] This determination is based whether the developer can obtain the necessary similar options to lease from neighboring plots and easements to connect to the grid, along with the results of geotechnical studies that determine the suitability of the land itself for construction. *Deep Excavation for Solar Farms Foundation Design and Installation*, UTIL. ONE (Sept. 8, 2023), https://utilitiesone.com/deep-excavation-for-solar-farms-foundation-design-and-installation.

[173]New York State Energy Research & Development Authority, *supra* note 167.

[174] N.Y. Agric. & Mkts. Law § 301(8).

them. Although not particularly expensive,[175] *any* money spent after agricultural land is taken out of production is an additional disincentive for farmers to do so.

Supporting long-term leasing to solar developers as a conservation practice would be a direct pathway to restoring soil health while remaining attractive enough that farmers will feel comfortable taking their land out of production. Solar panels can remain in operation for 25-40 years,[176] and once an array is in place, it only needs maintenance a couple times a year at most.[177] Thus, after construction is complete, the soil would be left alone with more than adequate time to heal naturally. This is a win-win-win. Farmers get paid for the use of their land, their community gets an additional source of clean and reliable energy without massive infrastructure investments that would be required to import that energy, and the soil will be left undisturbed to recover.

As we have seen, variation between neighboring municipal governments' policies is often fatal to large-scale solar projects.[178] Because soil degradation and lack of investment in climate-

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[175] For example, the United Nations estimates that it costs $2,886 to restore one hectare. United Nations Climate Technology Centre and Network, *supra* note 44.

[176] Brandon Kiger, *Life Cycle Assessment and Photovoltaic (PV) Recycling: Designing a More Sustainable Energy System*, NAT'L RENEWABLE ENERGY LAB'Y (Apr. 19. 2016), https://www.nrel.gov/state-local-tribal/blog/posts/life-cycle-assessment-and-photovoltaic-pv-recycling-designing-a-more-sustainable-energy-system.html. Although a quarter century may seem like a long time, it is relatively short in the energy industry. Thus, concerns have justifiably been raised regarding what happens to the materials used to make the panels after their useful lifecycle has ended. Atalay Atasu, Serasu Duran, & Luk N. Van Wassenhove, *The Dark Side of Solar Power*, HARV. BUS. REV. (June 18, 2021), https://hbr.org/2021/06/the-dark-side-of-solar-power. (discussing the "solar trash wave"). Currently, recycling PV panels is much more expensive that disposing of them in a landfill, however, in recognition of this externality, the Department of Energy's Solar Energy Technologies Office has begun investigation into productive end-of-life practices for PV panels. The details of their plan and solar PV recycling practices in general is beyond the scope of this paper, but more information can be found at *End-of-Life Management for Solar Photovoltaics*, U.S. DEP'T OF ENERGY - OFFICE OF ENERGY EFFICIENCY & RENEWABLE ENERGY, (last visited Nov. 25, 2023), https://www.energy.gov/eere/solar/end-life-management-solar-photovoltaics and *Solar Energy Technologies Office Photovoltaics End-of-Life Action Plan*, U.S. DEP'T OF ENERGY - OFFICE OF ENERGY EFFICIENCY & RENEWABLE ENERGY 1 (Mar. 2022).

[177] *Best Practices for Solar Operations and Maintenance*, C.I. SERVICES (last visited Nov. 25, 2023), https://www.ciservicesinc.com/best-practices-for-solar-operations-and-maintenance/. Although dust and debris build-up can decrease a panel's performance, natural precipitation like rain and snow are usually sufficient to clean the panel. *Id*. As long as the panels are still producing, only yearly maintenance is needed. *Id*.

[178] And, for that matter, large-scale wind projects. In May of 2023, a New Jersey county Board of Commissioners unanimously passed a resolution finding that the offshore wind projects planned in its jurisdiction

friendly yet reliable rural energy is inherently a regional problem,[179] state programs, limited by their borders, do not have the reach required by such a widespread issue. Thus, the most logical place to look for solutions is federal legislators.

Partially in recognition of the fundamentally interrelated challenges the environment and the electric grid faces due to climate change, federal legislators passed the IRA in 2022, investing over $370 billion in clean energy development and deployment.[180] This was especially big news for rural communities, as rural electric co-ops that, as non-taxable entities, were previously unable to access tax credits for clean energy can now do so.[181] Almost $20 million in

would "cause great harm to [the] marine environment and great harm to the tourism and fisheries sector of [the] local economy and may cause great harm to other sectors such as real estate." *Resolution Opposing Ocean Wind & Supporting Documents*, CAPE MAY COUNTY NEW JERSEY (last visited Nov. 25, 2023), https://capemaycountynj.gov/1627/Resolution-Opposing-Ocean-Wind-Supportin. (click "Resolution 314-23 Opposing Orsted Wind Projects Ocean Wind 1 and 2"). The Board further resolved that "all reasonably necessary and available resources" of the county be deployed to advance the goal of preventing the project's construction. *Id*. This resolution came after months of heated opposition from local residents, who cited concerns ranging from the aforementioned potential economic affects to excess whale deaths. mvitale, *Cape May County Turns Out to Oppose Wind Farm Project*, OCNJ DAILY (Mar. 16, 2023), https://ocnjdaily.com/cape-may-county-turns-oppose-wind-farm-project/. The overall sentiment, however, was that the developer rushed through project permits and the municipality and its residents lacked all the facts. *Id*. On October 17, 2023, the county and several local fishing and tourism business groups sued the developer, claiming that the United States Bureau of Ocean Management ("BOEM", the federal agency responsible for the permit process for offshore wind energy projects) shortcut a laundry list of federal statutes in approving the developer's proposal. Complaint to Reverse and Set Aside Final Agency Action, 3, *County of Cape May v. United States*, No. 1:23-cv-21201 (Dist. Ct. N.J.). Exactly two weeks later, the developer cancelled the two projects in question, citing supply chain issues and rising interest rates. Wayne Parry, *Orsted Scraps 2 Offshore Wind Power Projects in New Jersey, Citing Supply Chain Issues*, ASSOCIATED PRESS (Oct. 31, 2023), https://apnews.com/article/offshore-wind-orsted-new-jersey-cancelled-b30049502ac14ca6b46e2d3386a350fd. However, it is still moving forward with other projects in Connecticut and Rhode Island. *Id*.

[179] A regional governing body is another reasonable place to look for governance regarding these regional issues, however regional entities are cooperative and therefore voluntary programs that leave the implementation of regional rules to the participating states. For example, the Regional Greenhouse Gas Initiative (RGGI) is a regional effort between twelve Northeast states that promulgates a Model Rule for establishing carbon dioxide budget trading programs, which each state then uses to form its own unique trading program. *The Regional Greenhouse Gas Initiative Fact Sheet*, REG'L GREENHOUSE GAS INITIATIVE 1, 1 (updated Jan. 2023). Participating states can choose to withdraw at any time, as New Jersey did in 2011. *New Jersey Participation*, REG'L GREENHOUSE GAS INITIATIVE (last visited Dec. 4, 2023), https://www.rggi.org/program-overview-and-design/design-archive/nj-participation. The ability for states to leave such an organization at will creates too much instability and uncertainty that would significantly detract from farm participating in their programs. Additionally, a regional organization would have to be created (and states enrolled, and bylaws established) before any programs would be implemented on farms, thus delaying any beneficial effects.

[180] *Building a Clean Energy Economy: A Guidebook to the Inflation Reduction Act's Investments in Clean Energy and Climate Action*, CLEANENERGY.GOV 1, 5 (Jan. 2023).

[181] St. John, *supra* note 54.

IRA funding will be invested into four of the USDA's Natural Resources Conservation Service's (NRCS) chronically oversubscribed conservation programs:[182] the Environmental Quality Incentives Program (EQIP),[183] the Conservation Stewardship Program (CSP),[184] the Agricultural Conservation Easement Program (ACEP),[185] and the Regional Conservation Partnership Program (RCPP).[186]

Nevertheless, the IRA as it stands is no panacea. Although it is clear that political minds are somewhat attuned to the potential symbiotic relationship between protecting the environment and enriching local rural communities,[187] there are more legislative avenues to explore. One such

[182] Press Release, U.S Dep't of Agric. – Nat. Res. Conservation Serv., *Biden-Harris Administration Announces Availability of Inflation Reduction Act Funding for Climate-Smart Agriculture Nationwide* (Feb. 13, 2023), https://www.nrcs.usda.gov/news/biden-harris-administration-announces-availability-of-inflation-reduction-act-funding-for.

[183] EQIP works one-on-one with member farmers to develop conservation plans tailored to their specific concerns. *Environmental Quality Incentives Program*, U.S DEP'T OF AGRIC. – NAT. RES. CONSERVATION SERV. (last visited Nov. 25, 2023), https://www.nrcs.usda.gov/programs-initiatives/eqip-environmental-quality-incentives. [hereinafter Environmental Quality Incentives Program]

[184] CSP may be viewed as a second-stage EQIP, where the NRCS will work with members to enhance existing conservation practices. *Conservation Stewardship Program*, U.S DEP'T OF AGRIC. – NAT. RES. CONSERVATION SERV. (last visited Nov. 25, 2023), https://www.nrcs.usda.gov/programs-initiatives/csp-conservation-stewardship-program. [hereinafter Conservation Stewardship Program]

[185] ACEP assists landowners in protecting and restoring wetlands that were previously degraded by agricultural uses and helps landowners place conservation easements on current agricultural land to limit non-agricultural use. *Agricultural Conservation Easement Program*, U.S DEP'T OF AGRIC. – NAT. RES. CONSERVATION SERV. (last visited Nov. 25, 2023), https://www.nrcs.usda.gov/programs-initiatives/acep-agricultural-conservation-easement-program.

[186] RCPP partners the NRCS with local organization to enact wide-ranging conservation studies and programs. *Regional Conservation Partnership Program*, U.S DEP'T OF AGRIC. – NAT. RES. CONSERVATION SERV. (last visited Nov. 25, 2023), https://www.nrcs.usda.gov/programs-initiatives/rcpp-regional-conservation-partnership-program. Partners are required to significantly contribute to the cost of the project. *Regional Conservation Partnership Program*, NAT'L SUSTAINABLE ARGIC. COAL. (updated July 2019), https://sustainableagriculture.net/publications/grassrootsguide/conservation-environment/cooperative-conservation-partnership-initiative/#eligible.

[187] For example, on September 20, 2023, the Biden Administration introduced the American Climate Corps, a job training program focused on environmentally friendly goals like restoring land, improving communities' resilience to natural disasters, and deploying clean energy. Eric McDaniel, *Biden is Unveiling the American Climate Corps, a Program with Echoes of the New Deal*, NAT'L PUB. RADIO (Sept. 20, 2023), https://www.npr.org/2023/09/20/1200483937/biden-climate-corps-job-training. Additionally, the IRA itself contains an additional 10% tax credit for projects that are built in "energy communities", meaning brownfield sites, statistical areas with elevated levels of unemployment, and census tracts containing recently closed coal-powered electric plants. *Energy Community Tax Credit Bonus*, INTERAGENCY WORKING GRP. ON COAL & POWER PLANT CMTY. & ECON. REVITALIZATION (last visited Dec. 5, 2023), https://energycommunities.gov/energy-community-tax-credit-bonus/. However, besides some areas of Illinois, much of the Midwest is not an energy community thus renewable projects located there would not qualify for this tax credit. *Id.*

is the Farm Bill,[188] which is due for reauthorization this year, and gives federal legislators a broad opportunity to address national agricultural and food related issues.[189] To that end, the following subsections will consider each of the pathways available[190] to simultaneously achieve all three of goals of enriching local rural communities, allowing damaged soil to recover, and building the clean energy sources the nation requires to fight climate change.

A. The Natural Resource Conservation Service's Conservation Programs

The immediately evident pathway to marrying community acceptance, soil recovery, and clean energy development is to place that responsibility directly on regulators within the USDA because they already administer several conservation programs.[191] As mentioned above, IRA granted funding to four USDA conservation programs, but only the Conservation Stewardship Program (CSP) and the Environmental Quality Incentive Program (EQIP) relate to the concerns addressed in this article, so I will only discuss those two.

IRA's cash injection into EQIP and CSP was much needed, as existing conservation programs are oversubscribed by as much as three to one[192] with demand for specific programs

[188] The so-called "Farm Bill" is an omnibus law that governs a cornucopia of programs related to food and agriculture. *Farm Bill Primer: What Is the Farm Bill?*, CONG. RSCH. SERV. 1, 1 (updated June 16, 2023). It contains programs such as the Supplemental Nutrition Assistance Program ("SNAP"), federal crop insurance, and commodities, as well as the USDA's conservation initiatives. *Id*. Some of its programs need to be reauthorized when the Farm Bill is due for renewal every five years, while others don't. *Id*.

[189] *Id*.

[190] The Farm Service Agency, a sub-agency of the USDA, also administers the Conservation Reserve Program (CRP), which pays farmers yearly rental payments to compensate them for removing certain environmentally sensitive land from agricultural production, *Conservation Reserve Program Fact Sheet*, U.S. DEP'T OF AGRIC. – FARM SERV. AGENCY 1, 2 (Feb. 2022), and which would seemingly mesh well with my proposal. However, the CRP does not specifically designate soil health as one of its selection criteria and its rent payments are the only sort of support offered to participants. *Id*. Thus, because the CRP draws its funding from the Farm Bill, a simpler path for legislators would be to create a new program through the Farm Bill rather than modify this one.

[191] Specifically, the USDA is tasked with managing the nation's food, agriculture, natural resources, rural development, nutrition, and related issues. *About the U.S. Department of Agriculture*, U.S. DEP'T OF AGRIC. (last visited Nov. 25, 2023), https://www.usda.gov/our-agency/about-usda.

[192] Jacqui Fatka, *Inflation Reduction Act Includes Ag Funding*, FARMPROGRESS (July 29, 2022), https://www.farmprogress.com/farm-business-planning/inflation-reduction-act-includes-ag-funding.

regularly overwhelming funding available.[193] Grants given through EQIP or CSP are used for a variety of farm-focused conservation practices such as planting perennial and cover crops, diversifying crop rotations, and other practices aimed to make farmland spongier and therefore more resilient to flood and drought.[194] Nonetheless, farmers still face significant barriers in implementing these new practices, most notably with the up-front costs of implementing new practices. Thus, policymakers could use the additional funding from IRA to incorporate long-term dual use solar systems into these existing conservation programs and ease participant farmers' transitions.

Although many of their actual conservation practices overlap, EQIP may be seen as a "shorter-term [and] more narrowly tailored focused program"[195] while CSP is a longer commitment and entails the entire farm's operation.[196] These two programs also vary in their contractual setup.[197] Therefore I will address the two programs separately.

1. Conservation Stewardship Program

As mentioned above, the CSP is wildly oversubscribed and its popularity has only increased after passage of IRA – as of September 2023, one year after IRA passed, it had "received nearly 3,700 applications requesting funding that exceeds the available amount of $250 million."[198] CSP focuses on holistic farm health, as the NRCS explains, to "improve

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[193] Tom Philpott, *How the Inflation Reduction Act Affects Food and Agriculture*, WIRED (Aug. 20, 2022), https://www.wired.com/story/how-the-inflation-reduction-act-affects-food-and-agriculture/.

[194] Karen Perry Stillerman, *Why I Have Renewed Hope for Climate Action on Farms*, UNION OF CONCERNED SCIENTISTS (Aug. 2, 2022), https://blog.ucsusa.org/karen-perry-stillerman/why-i-have-renewed-hope-for-climate-action-on-farms/.

[195] Brian German, *CSP Explained: Understanding the Differences Between EQIP and CSP*, AGNET W. RADIO NETWORK (June 3, 2020), https://agnetwest.com/csp-explained-understanding-the-differences-between-eqip-and-csp/.

[196] *Id*.

[197] Notably, EQIP contracts can last up to ten years, while CSP only five, however CSP can be renewed for subsequent five-year periods. *EQIP, CSP, and CLC*, GREEN LANDS BLUE WATERS 1, 2-3 (2016).

[198] Press Release, U.S. Dep't of Agric., *As USDA Sees Record Interest in Conservation and Clean Energy Programs, Swift Implementation of Inflation Reduction Act Funding Continues* (Sept. 19, 2023),

grazing conditions, increase crop resiliency, or develop wildlife habitat" to capitalize on the "benefits of cleaner water and air, healthier soil and better wildlife habitat, all while improving their agricultural operations."[199] After acceptance into the program, an NRCS partner will be sent out to the program member's farm and work one-on-one with them to identify natural resource problems in their farm and provide technical and financial assistance to solve those problems in an environmentally beneficial and cost-effective manner.[200]

CSP contracts last five years and include an option to renew for longer if the farm successfully implements its conservation practices.[201] CSP members earn annual payments up to $40,000[202] for maintaining their existing level of conservation practices assessed at the time they enter into their contract and to implement additional conservation activities with the guidance of their NRCS partner.[203] After the initial five-year term, farmers may be eligible to renew if, in addition to meeting the terms of their original contract, they agree to implement additional "priority" resource concerns or escalate their current conservation practices.[204]

Using IRA's additional funding, USDA regulators could decide to include negotiation of leases with solar developers and subsequent planning of local perennial soil recovery systems as a CSP conservation practice. This fits directly with CSP's goals of improving farms' health holistically, as soil is the root of biological activity on the farm. Additionally, CSP already has NRCS partners located throughout the country in USDA Service Centers[205] who work one-on-

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https://www.usda.gov/media/press-releases/2023/09/19/usda-sees-record-interest-conservation-and-clean-energy-programs.

[199] Conservation Stewardship Program, *supra* note 184. If the reader is interested, this website also contains short videos of farmers who have implemented different conservation practices.

[200] *Id*.

[201] *Id*.

[202] Green Lands Blue Waters, *supra* note 196 at 2.

[203] Conservation Stewardship Program, *supra* note 184.

[204] *Id*.

[205] *Service Center Locator*, U.S. DEP'T OF AGRIC (last visited Dec. 5, 2023), https://offices.sc.egov.usda.gov/locator/app.

one with each farm already so it is very well positioned to assist with developing farm-specific preimmunization systems. CSP specifically contemplated the possibility of combining conservation practices to improve farm health - "[f]or example, if you have been planting a cover crop, you may decide to try an enhancement for a multi-species cover crop or implement a deep-rooted cover crop to break up soil compaction and further improve the health of your soil."[206] Lastly, CSP contracts last only five years, which aligns well with the amount of time it takes to negotiate an option to lease and the accompanying lease, then implement a perennial system on the former cropland and monitor for a couple years.

The two major limitations here are that NRCS partners would not necessarily be more apt at negotiating fair contracts than the farmers would be, and that any recovery system would be destroyed once construction began, which in most cases will be several years after signing the option. The first limitation could be lessened by promulgating training and supportive materials instructing NRCS partners how to help landowners negotiate leases and key provisions they need. Overcoming the second limitation is more difficult; NCRS partners could delay planting perennial systems until after construction has finished, but it's very difficult to predict when that is, and whether it would fall within the five-year contract term. In the meantime, farmers could implement other approved CSP conservation practices and continue farming their cropland but would experience negligible benefits from my proposal if construction were to finish after the five-year mark. Farmers would be discouraged from enrolling because of the lack of certainty they can even implement perennial systems with the necessary help. Thus, although possible if regulators were to significantly alter the design of CSP, my proposal would be unlikely to pick up much participation via this program.

[206] Conservation Stewardship Program, *supra* note 184.

2. Environmental Quality Incentive Program

Mirroring the interest in CSP, EQIP also saw exponentially increased enrollment (on top of its preexisting oversubscription) after the passage of IRA.[207] And also like CSP, EQIP aims to address a broad range on environmental concerns such as improving water and air quality, conserving ground and surface water, increased soil health, reducing soil erosion and sedimentation, improving or creating wildlife habitat, and mitigating against drought and increasing weather volatility.[208]

EQIP differs from CSP in that its financial assistance is mainly available through its conservation initiatives and its Conservation Innovation Grants (CIG). Because EQIP's conservation initiatives are limited to very particular circumstances,[209] I will not address them in this article. CIG is a competitive program that "supports the development of new tools, approaches, practices, and technologies to further natural resource conservation on private lands".[210] It calls for proposal submissions from private entities in its three annual competitions: the National CIG Classic, the State CIG Classic, and the CIG On-Farm Conservation Innovation Trials.[211] While all three competitions share the same goals, the State CIG Classic funds projects that address state-identified conservation practices,[212] and therefore project submissions depend more heavily on local and regional goals more than the other two grant programs. The state

[207] In the year since IRA passed, EQIP received nearly 9,000 applications requesting a total of nearly $475 million while IRA only allocated $250 million. Press Release, United States Department of Agriculture, *supra* note 197.

[208] Environmental Quality Incentives Program, *supra* notes 183.

[209] EQIP's initiatives are: High Tunnel Initiative, Organic Initiative, Air Quality Initiative, Landscape Conservation Initiative, On-Farm Energy Initiative, Colorado River Basin Salinity Project, therefore not applicable to the concerns I address in this article. *Id*.

[210] *NRCS Conservation Innovation Grants*, U.S DEP'T OF AGRIC. – NAT. RES. CONSERVATION SERV. (last visited Nov. 25, 2023), https://cig.sc.egov.usda.gov/#:~:text=Conservation%20Innovation%20Grants%20(CIG)%20is,resource%20conservation%20on%20private%20lands.

[211] *Id.*

[212] *Id*.

competitions also have the advantage of granting state NRCS offices the opportunity to administer their own CIG competitions.[213]

Siting solar arrays with soil recovery programs directly fits within EQIP's goals of increasing soil health while minimizing negative impacts to the greater ecosystem. To incorporate supporting farmers' entering into long-term solar leases and planning of the underlying perennial soil recovery programs, local NRCS offices could administer CIG competitions specifically aimed at combining the practices. For example, NRCS offices could advertise the general idea of pairing the two land uses together to both local solar developers and local ecologists and encourage the two groups to work together on specific submittals for grants, and then assist participating farmers in developing their relationships with these parties. Solar developers and ecologists would be involved from the very beginning, ideally streamlining the process. Furthermore, local communities may be more accepting of solar development if it results from a locally sourced competition and involves local ecologists and farmers. NRCS offices may choose to pair with nearby universities and gain more community acceptance by using the soil recovery planning process as an educational supplement for students. Of course, the main drawback of this approach is that, although NRCS offices can *encourage* certain types of submissions or run competitions only accepting certain types of proposals, which proposals are actually submitted is entirely out of its control.

In comparison, the On-Farm Conservation Innovation Trials, which focus on compensating for the risks of developing new practices that could find more widespread adoption in partnership with agricultural producers across the nation,[214] are already being used by policymakers to improve soil health. On-Farm Trials applicants are limited to submitting

[213] *Id.*
[214] *Id.*

projects relating to one of the NRCS's chosen priority topics of that year,[215] but in 2018, the Farm Bill established the Soil Health Demo (SHD) Trial to implement conservation practices that improve soil health on farms and measure the results.[216] The SHD awards grants through CIG On-Farm Trials of up to $5 million to farmers who implement soil management practices that minimize disturbance, maximize soil cover, maximize biodiversity, and maximize the presence of living roots.[217] Grants may be awarded to proposals that only address one management technique, but "[a]pplicants are strongly encouraged to address all four principles."[218]

My proposal addresses all four techniques. As discussed above, solar arrays only need maintenance a couple times a year at most, so once construction has finished, the site would be left largely undisturbed for the lifetime of the panels besides the minimally intrusive visits needed to monitor the development of the perennial system. Likewise, perennial systems' *purpose* is to maximize native biodiversity and the presence of living roots throughout the year. Lastly, perennial systems would be designed to cover all of the soil, minus the minimal areas necessary to support the solar array. As On-Farm Trials look for "innovative" ideas, my proposal has an additional edge in that it provides additional benefits to the landowner and the community through increased green energy generation.

However, this approach faces the same difficulty as the state CIG competitions in that policymakers only have the reactive role of choosing between proposals submitted by the public. As with the State CIG competition, policymakers could use that discretion to score dual use solar

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[215] *$25 Million Available for On-Farm Conservation Innovation Grants*, NAT'L SUSTAINABLE ARGIC. COAL. (July 27, 2022), https://sustainableagriculture.net/blog/25-million-available-for-on-farm-conservation-innovation-grants/.

[216] *Soil Health Demo Trial Minimum Data Sets for Environmental, Financial and Social Data*, U.S. DEP'T OF AGRIC. 1, 1 (Mar. 1, 2022). [hereinafter SHD Minimum Data Sets]

[217] National Sustainable Agriculture Coalition, *supra* note 215.

[218] *Id*.

submissions higher due to their multifaceted benefit, however altogether, this approach leaves a lot to chance.[219] Furthermore, the SHD program requires participants to collect soil/environmental, financial, and social data regarding the outcome of their management practices,[220] which is quite onerous your everyday farmer, and the grant is the only aid provided to participants. Lastly, the On-Farm Trials are truly only trials, as wider implementation depends on the outcome of the data collected by participants. Although this may seem like a benefit to some, it significantly delays initiating the development of these dual use systems which already take several years to begin benefiting the land.

Nonetheless, considerable funds were already allocated to the USDA's conservation programs in the IRA so the money to support farmers is already there. If regulators were able to modify the CSP and/or EQIP CIG competitions to incorporate supporting farmers transitioning into dual use systems, the goals of both programs would be addressed, with the added benefit of increasing renewable energy generation, which is one of IRA's core goals. IRA's passage reflected legislator's prioritization of conservation and clean energy which hopefully reflected their constituents' prioritization of the same, thus by supporting projects that farmers brought to the NRCS, rather than the other way around, dual use projects of this type could be more accepted by the communities they are located in.

[219] Nonetheless, as recently as October 11, 2023, a proposal to teach local farmers conservation practices to maintain the health of their soil won the CIG grant competition. Thomas Kielbasa, *'From Farmers to Soil Health Managers' Grant Aims to Keep Soil Productive in the Pacific Northwest*, U.S DEP'T OF AGRIC. – NAT. RES. CONSERVATION SERV. CONSERVATION INNOVATION GRANTS (Oct. 11, 2023), https://cig.sc.egov.usda.gov/impact/farmers-soil-health-managers-grant-aims-keep-soil-productive-pacific-northwest.

[220] SHD Minimum Data Sets, *supra* note 216.

B. The Farm Bill

Instead of supporting dual use solar and soil recovery programs through existing conservation programs, legislators could create a new program through the Farm Bill, the omnibus multiyear law that covers all things agriculture,[221] which fortuitously is due to expire in 2023.[222] The Farm Bill is the nation's biggest opportunity to address widespread agricultural or agriculturally-adjacent issues, and legislative debate is significant.[223] So much so, that it regularly takes a year or more from introduction to passage, and only two Farm Bills were successfully enacted before their September 30th expiration date.[224] This year's Farm Bill is no exception – despite technically expiring at the end of the 2023 Fiscal Year[225] (September 30th), as of November 2023, Congress is "far behind"[226] schedule, and has only managed to avoid expiration of key programs through an extension, pushing the actual renewal into 2024.[227]

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[221] The Farm Bill has an astounding effect on the nation's farmers, farming practices, and food and "sets the stage for our food and farm systems." *What is the Farm Bill?*, NAT'L SUSTAINABLE AGRIC. COAL. (last visited Nov. 25, 2023), https://sustainableagriculture.net/our-work/campaigns/fbcampaign/what-is-the-farm-bill/.

[222] *Farm Bill Primer: What Is the Farm Bill?*, CONG. RSCH. SERV. 1, 1 (updated June 16, 2023). [hereinafter Farm Bill Primer]

[223] "Over time, farm bills have tended to become more complicated and politically sensitive. As a result, the timeline for reauthorization has become less certain. With the exception of the 2018 farm bill, recent farm bills have taken longer to enact than in previous decades. Beginning in 2008, farm bills have been subject to various developments that have delayed enactment, such as insufficient votes to pass the House floor, presidential vetoes, or short-term extensions." *Farm Bills: Major Legislative Actions, 1965-2018*, CONG. RSCH. SERV. 1, 2 (updated Dec. 21, 2018).

[224] *Id*. at 4.

[225] Farm Bill Primer, *supra* note 222 at 1.

[226] Meredith Lee Hill & Garrett Downs, *Johnson's Precarious Farm Bill Extension Dance*, POLITICO (Nov. 13, 2023), https://www.politico.com/newsletters/weekly-agriculture/2023/11/13/johnsons-precarious-farm-bill-extension-dance-00126778.

[227] Press Release, U.S. Senate Comm. on Agric., Nutrition, & Forestry, *Stabenow, Boozman, Thompson, Scott Statement on Farm Bill Extension* (Nov. 12, 2023), https://www.agriculture.senate.gov/newsroom/dem/press/release/stabenow-boozman-thompson-scott-statement-on-farm-bill-extension.

The Farm Bill has long since been the best place to enact new agricultural programs – CSP was created in the 2002 Farm Bill[228] and EQIP in the 1996 Farm Bill.[229] Procedurally, the Congressional Budget Office first creates a baseline budget that acts as a benchmark to measure changes legislators' propose.[230] After much debate, it is Congress' responsibility to pass the bill, then the USDA creates regulations enacting the bill.[231] Federal legislators are becoming increasingly attuned to the opportunities for both local communities and the nation at large posed by incentivizing dual use solar.[232] The Farm Bill, however, affords legislators an opportunity to get creative with new programs, *and* the 2023 Farm Bill allocated more funding to non-nutritional programs than in previous Farm Bills,[233] leaving more room for new programs.

Since its inceptions the Farm Bill has had three goals: to keep food prices fair for farmers and consumers, to ensure an adequate food supply, and to protect and sustain the country's vital natural resources.[234] Pairing solar arrays with soil recovery works toward all three of these goals.

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[228] *Conservation Stewardship Program*, NAT'L SUSTAINABLE ARGIC. COAL. (updated Apr. 2019), https://sustainableagriculture.net/publications/grassrootsguide/conservation-environment/conservation-stewardship-program/.

[229] *Environmental Quality Incentives Program*, NAT'L SUSTAINABLE ARGIC. COAL. (updated May 2019), https://sustainableagriculture.net/publications/grassrootsguide/conservation-environment/environmental-quality-incentives-program/#:~:text=the%20NSAC%20blog!-,Program%20History%2C%20Funding%2C%20and%20Farm%20Bill%20Changes,subsequent%20farm%20bill%20since%20then.

[230] Farm Bill Primer, *supra* note 222 at 2.

[231] National Sustainable Agriculture Coalition, *supra* note 221.

[232] Examples include a bipartisan bill to support research and development of agrivoltaics, Press Release, Martin Heinrich: U.S. Senator for New Mexico, *Heinrich, Braun Introduce Bipartisan Bill to Support Agrivoltaics Research and Demonstration* (May 31, 2023), https://www.heinrich.senate.gov/newsroom/press-releases/heinrich-braun-introduce-bipartisan-bill-to-support-agrivoltaics-research-and-demonstration, and an act to add to the Farm Bill that would pair pollinator habitats with new solar projects. Press Release, Jeff Merkley: Senator for Oregon, *Merkley, Booker Introduce New Legislation to Create Pollinator Habitats Surrounding Solar Power Projects* (May 11, 2023), https://www.merkley.senate.gov/merkley-booker-introduce-new-legislation-to-create-pollinator-habitats-surrounding-solar-power-projects/. From here it is not that much of a stretch to call on legislators to address plant health from below ground, as they look to address it from the air above.

[233] Nutrition, mainly in the form of SNAP benefits, makes up a large portion of each Farm Bill. However, the 2023 Farm Bill allocated more baseline funding to non-nutritional programs than the 2018 Farm Bill by an additional $30 billion. Farm Bill Primer, supra note 222 at 2.

[234] National Sustainable Agriculture Coalition, *supra* note 221.

It keeps food prices fair for farmers by minimizing the amount artificial inputs they would have needed to supplement degraded soil, savings which will be passed on to consumers. It also allows more farms to reenter traditional agricultural production after their array has finished its lifetime and the soil healed, keeping more farmers in the business and enhancing market competition. With healthier soil and more resilient crops, fewer farms would have to rely on crop insurance payments to supplement their income.

Restoring nutrients in soil helps ensure an adequate food supply because "adequate" surely includes having a satisfactorily quality of food, as well as quantity. We eat food to gain nutrition, not just mass, so eating food with sufficient vitamins and minerals is essential to any "adequate" food supply. Lastly, it is indisputable that soil is an essential natural resource – the NRCS classifies the degradation of the nation's soils as a "Natural Resource Concern".[235] It is an essential natural resource because it supports the growth of all plants, provides a stable base for buildings, minimizes erosion and its accompanying pollution of waterways.[236] Ultimate, healthy soil strengthens land against both flooding and drought,[237] minimizing some of the effects of climate change.

Legislators' limitations in enacting a program through the Farm Bill is the same as all other legislative actions: getting enough votes to pass. Unfortunately, as with many other legislative topics, the Farm Bill is becoming increasingly contentious. Much of the debate in this year's Farm Bill positions the conservation programs against crop subsidies programs,[238] reflecting the ideological divide between legislators who hope to protect the nation against

[235] *Natural Resource Concerns*, U.S. DEP'T OF AGRIC. – NAT. RES. CONSERVATION SERV. (last visited Dec. 6, 2023), https://www.nrcs.usda.gov/conservation-basics/natural-resource-concerns.

[236] *Soil Health*, FARMERS.GOV (last visited Dec. 6, 2023), https://www.farmers.gov/conservation/soil-health.

[237] Sponge Soils, *supra* note 13 at 13.

[238] Chuck Abbott, *Claim: Farm Bill Debate Pits Conservation vs. Commodities*, SUCCESSFUL FARMING (Nov. 20, 2023), https://www.agriculture.com/claim-farm-bill-debate-pits-conservation-vs-commodities-8404661.

climate change and legislators who prioritize protecting farmers' income. However, both goals could be addressed if legislators created a program that (1) aids farmers in entering into long term leases with solar developers, thereby supplementing their income, and (2) helps plan and monitor site-specific systems of perennial plants to heal their soil over the lifetime of the lease. Thus, legislators can and should come together over these shared goals, and create a new UDSA conservation program that supports farmers during the transition between damaging industrial agricultural farming and restoring the soil their farm relies on.

IV. Conclusion

Panels of utility-scale solar arrays do not lie directly on the ground, and that space is wasted when landowners and developers delegate the site to a single purpose. With increasing proportions of America's cropland falling into disrepair, *everyone* would benefit from siting arrays on top of soil recovery programs. Farmers would be paid for the use of their land,[239] the community would gain access to cheap green power,[240] the national grid's infrastructure would require less updating,[241] and future generations would literally reap the benefits of healthy soil.[242]

Regulators have a unique opportunity to incentivize and support farmers' transitions into dual use systems this year because of the amalgamation of the IRA and the Farm Bill. They need

[239] Estimates range from $400 to $2,000 per acre, depending, of course of the particular situation. *Getting Paid for Solar Lease on Your Land*, LANDGATE (updated Dec. 6, 2023), https://www.landgate.com/news/getting-paid-for-solar-lease-on-your-land.

[240] Included in consumers' power bills are the costs of transmission and converting high-voltage electricity into the lower voltage that may be used in homes. John Bernhardt, *The Power of Local Energy*, FORBES (Apr. 28, 2014), https://www.forbes.com/sites/realspin/2014/04/28/the-power-of-local-energy/?sh=62413ee075d9. With local generation, generators could directly connect to the local co-op's distribution lines and sell power without the upcharges necessary to maintain lengthy transmission infrastructure or to compensate for the inevitable loss of energy as the electrons travel great distances. *Id*.

[241] Peter Fairley, *The US Electricity Transmission System is in Gridlock*, SIERRA CLUB (Sept. 18, 2023), https://www.sierraclub.org/sierra/2023-3-fall/feature/us-electricity-transmission-system-gridlock. (noting that MISO, the regional transmission operator of much of the Midwest, is "inching forward" when it has "miles to go").

[242] Which will be able to sustain plant, animal, and human lives. Mahdi Al-Kaisi, *Soil Health Benefits for Sustaining Crop Production*, IOWA STATE UNIV. (Apr. 13, 2016), https://crops.extension.iastate.edu/cropnews/2016/04/soil-health-benefits-sustaining-crop-production.

to take advantage of this opportunity before industrial agriculture and climate change push the nations croplands beyond saving. At the same time communities harvest energy from above, communities should restore energy stores from below, and both can be achieved by implementing dual use solar and soil recovery programs on the same plot of land.