Solar Power to the People: A Call to Integrate Agrivoltaics into the Biden Administration's Plans for Supporting Minority Farmers and Reducing Carbon Emissions

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I. INTRODUCTION

Combating climate change and revitalizing rural America have become prominent priorities as the Biden administration reveals plans to invest in sustainable agriculture and renewable energy.[1] The administration has also pledged to confront a legacy of systemic discrimination that has left Black and Native American farmers without access to "land, loans and other assistance," including "climate smart" technology.[2] The significant loss of agricultural land within minority populations affects the economy, environment, and local communities. [3] The administration has "promised to make agriculture a cornerstone of its . . . climate agenda, looking to farmers to take up farming methods that could keep planet-warming carbon dioxides locked in the soil and out of the atmosphere."[4] However, current proposals for addressing these issues fail to consider trending technologies and techniques, such as agrivoltaics, which could provide additional revenue, reduce global emissions, and produce clean energy alongside agriculture.

Agrivoltaics is a method of developing the same area of land for both solar photovoltaic ("PV") power and agriculture. Studies have demonstrated that incorporating PV on farmland has promising implications for water savings, food cultivation, heat stress reduction, and renewable energy production.[5] Growing vegetation around the solar array's base benefits the PV system as well as the crops planted below. The PV modules benefit from this arrangement as energy

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[1] Rob Garver, *Biden Plans Ambitious Agenda for First 100-Days*, VOICE OF AMERICA (Jan. 19, 2021), https://www.voanews.com/usa/biden-plans-ambitious-agenda-first-100-days.

[2] Hiroko Tabuchi & Nadja Popovich, *Two Biden Priorities, Climate and Inequality, Meet on Black-Owned Farms*, N.Y. TIMES (Feb. 18, 2021), https://www.nytimes.com/2021/01/31/climate/black-farmers-discrimination-agriculture.html.

[3] *See Ximena Bustillo, Black Farmers Look to Next Congress, Biden to Dismantle 'Culture of Discrimination', Politico (Jan. 1, 2021, 4:30 AM), https://www.politico.com/news/2021/01/01/black-farmers-systemic-racism-453220 (stating the United States Secretary of Agriculture, Tom Vilsack, met with community-based groups to reaffirm the administration's "commitment to ensuring fairness and equity for Black farmers," according the Biden-Harris transition team); see also Jeanne S. White, Beating Plowshares into Townhomes: The Loss of Farmland and Strategies for Slowing Its Conversion to Nonagricultural Uses, 28 Env't L. 113 (1998).*

[4] Tabuchi & Popovich, *supra* note 2.

[5] *Benefits of Agrivoltaics Across the Food-Energy-Water Nexus*, NAT'L RENEWABLE ENERGY LAB'Y. (Sept. 19, 2019), https://www.nrel.gov/news/program/2019/benefits-of-agrivoltaics-across-the-food-energy-water-nexus.html; *see also infra* notes 11-12. *See generally* Greg A. Barron-Gafford et al., *Agrivoltaics Provide Mutual Benefits Across the Food–Energy–Water Nexus in Drylands*, 2 NATURE SUSTAINABILITY 848 (2019), https://doi.org/10.1038/s41893-019-0364-5.

production is sensitive to heat and generation degrades after reaching a specific temperature unique to an individual module.[6] Additionally, the impact of this integration allows farmers to diversify their income through renewable energy generation, while maintaining agricultural use of their land and reducing their greenhouse gas emissions.[7]

This synergistic relationship between energy generation and crop production has the potential to uplift rural communities, providing energy, food, and jobs.[8] While some farmers have replaced crop production with solar energy production on areas of their farms, few are producing crops and energy on the same plot of land. This "either–or" discourse[9] drives many policies and development decisions around conservation practices, land and water allotments for agriculture, and the permitting of large-scale renewable energy installations."[10] Co-locating energy production and food production, which thrive in similar environments,[11] "could provide 20% of total electricity generation in the United States with an investment of less than 1% of the annual U.S. budget."[12]

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6 *See* discussion *infra* Section I.C.

7 *Benefits of Agrivoltaics Across the Food-Energy-Water Nexus*, *supra* note 5.

8 *See* Barron-Gafford et al., *supra* note 5, at 848 ("Together, these results suggest that the novel colocation of agriculture and PV arrays could have synergistic effects that support the production of ecosystem services such as crop production, local climate regulation, water conservation and renewable energy production.").

9 The "either-or" describes the dichotomy of land use, either used for food production or clean energy production, but not both. The practice of agrivoltaics is slowly changing this discussion by proving that land can be dually utilized with this complimentary technique. *See infra* note 27.

10 *See* TRIEU MAI ET AL., RENEWABLE ELECTRICITY FUTURES STUDY. VOLUME 1: EXPLORATION OF HIGH-PENETRATION RENEWABLE ELECTRICITY FUTURES (2012), https://www.osti.gov/biblio/1046880-renewable-electricity-futures-study-volume-exploration-high-penetration-renewable-electricity-futures.

11 *See* Russell McLendon, *Solar Panels Pair Surprisingly Well with Tomatoes, Peppers and Pollinators*, TREEHUGGER (Oct. 4, 2019), https://www.treehugger.com/agrivoltaics-solar-power-crops-bees-4863595 (explaining that recent studies have found areas with the "greatest potential for solar power" are also the most ideal areas for croplands, given both of their needs for sunlight).

12 Sean Nealon, *Combining Solar Energy and Agriculture to Mitigate Climate Change, Assist Rural Communities*, OR. STATE UNIV. (Jan. 4, 2021), https://today.oregonstate.edu/news/combining-solar-energy-and-agriculture-mitigate-climate-change-assist-rural-communities; *see also* E. H. Adeh et al., *Solar PV Power Potential is Greatest over Croplands*, 9 SCI. REPORTS 11442 (2019), https://doi.org/10.1038/s41598-019-47803-3 ("Global energy demand would be offset by solar production if even less than 1% of cropland were converted to an agrivoltaic system. According to Higgins' research, if even less than 1% of existing cropland was converted to an agrivoltaic system, solar power could fulfill global demand for electricity."). *But cf.* S.P. Good et al., *A Mesic Maximum in Biological Water Use Demarcates Biome Sensitivity to Aridity Shifts*, 1 NATURE ECOLOGY & EVOLUTION 1883 (2017), https://doi.org/10.1038/s41559-017-0371-8 ("The reduced order model was re-evaluated to assess the potential for agrivoltaic globally, and the global energy demand (21 PWh) could be offset by solar production if <1% of agricultural land at the median power potential of 28 W/m^2 were suitable candidates for agrivoltaic systems and converted to dual use. Lack of energy storage and the temporal variance in the availability of solar energy will restrict this expansion.").

To address these goals, the Biden administration proposed The American Jobs Plan, which evolved into the Build Back Better Act ("BBB Act").[13] The BBB Act aims to reduce carbon emissions; invest in agriculture; help rural, marginalized communities; and build rural infrastructure.[14] The ambitious plan focuses on milestones of "achiev[ing] net-zero emissions and creat[ing] new sources of income for farmers in the process," but does not consider commingling renewable energy and agricultural production.[15] Agrivoltaics integrates these goals and offers a solution to address them simultaneously. By adding agrivoltaics to the sustainable farming methods outlined in the BBB Act, farmers would be compensated for emission reductions and carbon sequestration while diversifying their income through farming and producing clean energy for the electric grid.[16] Through the diversification of income, farmers have a higher likelihood of retaining their land and adding a level of resiliency against unforeseen events caused by climate change.[17]

Part I of this article examines the history and benefits of agrivoltaics, including water reduction, food production, and energy generation.[18] It discusses how disenfranchised, minority farmers have been historically discriminated against, causing them to lose their land and valuable resources to the benefit of their white counterparts. Additionally, it examines how minority farmers might benefit from adopting an agrivoltaics system, which could result in alternative revenue and lower operational costs.[19] Part II discusses the sunsetting incentives and zoning restrictions that hinder development of agrivoltaics systems. Such impediments to renewable development reduce the likelihood of the United States reaching its ambitious emission reduction goals. Part III offers suggestions to incorporate clean technology into agricultural practice, through the application of incentive programs, the results of which could benefit minority farmers, the environment,

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[13] Build Back Better Act, H.R. 5376, 117th Cong. (2021).

[14] Mitchell T. Emmert et al., *House Rules Committee Modifies Green Energy Bill,* TROUTMAN PEPPER (Nov. 10, 2021), https://www.troutman.com/insights/house-rules-committee-modifies-green-energy-bill.html.

[15] Chuck Abbott, *Biden Vows to Pay Farmers to Plant Cover Crops and Put Land in Conservation,* SUCCESSFUL FARMING (Dec. 14, 2020), https://www.agriculture.com/news/business/biden-vows-to-pay-farmers-to-plant-cover-crops-and-put-land-in-conservation (quoting the Biden administration's initiative to make "American agriculture the first in the world to achieve net-zero emissions and create new sources of income for farmers in the process, by paying farmers to put their land in conservation and plant cover crops that use the soil to capture carbon.").

[16] Though other barriers to entry in this market remain, including insurance obstacles and structural design, those challenges are beyond the scope of this article.

[17] Kyle W. Proctor, Ganti S. Murthy & Chad W. Higgins, *Agrivoltaics Align with Green New Deal Goals While Supporting Investment in the US' Rural Economy,* 13 SUSTAINABILITY 137, 137 (2020) (explaining that agrivoltaics can provide a secondary source of revenue for farmers, depending on the funding structure, "providing resiliency in cases of crop failure or other unforeseen events").

[18] *See* discussion *infra* Section I.A & Part I.C.

[19] *See* discussion *infra* Section I.B.

and rural America.[20] Part III compares successful incentive programs currently utilized in some states and suggests those same incentive structures could be successful nationally.[21] It also explores some of the proposed relief provisions in the BBB Act, which include financial distributions for minority farmers and clean energy incentives. However, the BBB Act fails to creatively combine these two goals, which could be addressed through agrivoltaics.[22]

II. WHAT IS AGRIVOLTAICS AND WHO STANDS TO BENEFIT?

The United States Department of Agriculture's ("USDA") "well-documented" history of racially biased laws resulted in Black Americans, Native Americans, and other minority farmers' systematic loss of land.[23] As rural and minority farmers continue to struggle to maintain active farms,[24] many have turned to renewable energy, such as solar and wind power, to provide additional income from land previously used strictly for agriculture.[25] In an effort to keep their farms economically viable, these farmers forgo food production on those tracts of land dedicated to energy generation.[26] In recent years, this false dichotomy between energy generation and food production has been invalidated in promising studies through the deployment of agrivoltaics.[27] The potential for dual-use agrivoltaic

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20 *See* discussion *infra* Part II & Part III.

21 *See* discussion *infra* Part III.

22 *See* discussion *infra* Part III.

23 Chris Kromm, *The Real Story of Racism at the USDA*, THE NATION (July 23, 2010), https://www.thenation.com/article/archive/real-story-racism-usda/.

24 M. Shahbandeh, *Total Number of Farms in the United States from 2000 to 2020*, STATISTA (Feb. 24, 2021), https://www.statista.com/statistics/196103/number-of-farms-in-the-us-since-2000/ (last visited Apr. 22, 2021) (showing a steady decrease in farmland in the United States since 2007) ("In 2020, there were just over two million farms in the United States. However, the number of farms has been steadily dropping since the year 2007, when there were about 2.2 million farms in the United States."); *see also* Daniel Aminetzah et al., *Black Farmers in the US: The Opportunity for Addressing Racial Disparities in Farming*, McKinsey & Company (Nov. 10, 2021), https://www.mckinsey.com/industries/agriculture/our-insights/black-farmers-in-the-us-the-opportunity-for-addressing-racial-disparities-in-farming (discussing the decline of Black owned farmland in the last century).

25 Jessica Owley & Amy Wilson Morris, *The New Agriculture: From Food Farms to Solar Farms*, 44 COLUM. J. ENV'T L. 409, 410 (2019) ("Renewable energy development pressures are accelerating the existing loss of agricultural land, heightening concerns about food security and the economic viability of agricultural communities.").

26 McLendon, *supra* note 11 ("Farming in the U.S. has become increasingly difficult lately, due to a mix of factors from droughts and floods to the U.S.-China trade war, which has reduced demand for many American crops. As the Wall Street Journal reports, this is leading some farmers to use their land for harvesting solar power instead of food, either by leasing the land to energy companies or by installing their own panels to cut electricity bills.").

27 In a study conducted by the National Renewable Energy Laboratory (NREL) researchers found that there does not need to be a trade-off "between crops and electron… they can grow in tandem." *See generally* Proctor, Murthy & Higgins, *supra* note 17. *See also* Harrison Dreves, *Beneath Solar Panels, the Seeds of Opportunity Sprout*, NAT'L RENEWABLE ENERGY LAB'Y (Apr. 1, 2019), https://www.nrel.gov/news/features/2019/beneath-solar-panels-the-seeds-of-opportunity-sprout.html; Barron-Gafford, *supra* note 5 (arguing that society should no longer view land

systems may alleviate land competition and other spatial constraints for solar power development, creating a significant opportunity for future energy sustainability and food security.[28] The discussion below provides a brief description of agrivoltaics and its deployment, identifies the USDA's discriminatory practices against minority farmers, and explores the multitude of benefits an agrivoltaic system could provide when incorporated into traditional farming in areas traditionally occupied by minority and Indigenous communities.

A. A Brief Description of Agrivoltaics

In 1981, Armin Zastrow and Adolf Goetzberger pioneered what we refer to today as agrivoltaics.[29] They proposed the dual use of arable land for solar energy generation and plant cultivation. The idea was to co-develop the land to simultaneously produce crops and electricity, alleviating competition between developers and farmers.[30] The original concept envisioned creating space between the rows of PV panels in order to grow crops. However, in recent years, promising research has shed light on the ability to mount PV arrays above, rather than alongside, crops without hindering food production.[31]

Over the last 40 years, progress in the agrivoltaics area has been slow moving due, in part, to the prohibitive cost and upfront capital required to purchase solar equipment.[32] However, solar equipment costs decreased 70% from 2010 to 2020,

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competition between solar and agriculture as a "zero-sum game," and offering research that shows "each portion of the food–energy–water nexus can respond positively to the colocation of these seemingly disparate needs.").

[28] Barron-Gafford et al., *supra* note 5.

[29] A. Goetzberger & A. Zastrow, *On the Coexistence of Solar-Energy Conversion and Plant Cultivation*, 1 INT'L J. SOLAR ENERGY, 55 (1982).

[30] Victoria Corless, *No Longer Just Solar Sharing: Bringing Agrivoltaics to the Next Level*, ADVANCED SCIENCE NEWS (Aug. 3, 2020), https://www.advancedsciencenews.com/no-longer-just-solar-sharing-bringing-agrivoltaics-to-the-next-level/.

[31] *See Agroforestry*, USDA, https://www.usda.gov/topics/forestry/agroforestry, (last visited Apr. 22, 2021) (Describing the precursor to the agrivoltaic system was the agroforestry system, which involved intercropping between vegetation and trees. In the past, the solution for competition issues between food and energy production was addressed by the division of land, but studies have found it is possible to combine food and energy generation on the same piece of land while maintaining the production of both); *See generally* Bernd Kuemmel et al., *Energetic, economic and ecological balances of a combined food and energy system*, 15 BIOMASS AND BIOENERGY, 407–416 (1998); *see also* Good, S. P., et la., note *supra* 12 (describing [a]grivoltaic systems' ability to "leverage the superposition of energy and food production for mutual benefit" of both PV and crops, which are able to grow in " intermittent shade cast" by the panels without "diminish agricultural yield.").

[32] From 2010 to 2020, the cost of solar has dropped more than 70%, leading to the installation of solar nationwide. *See* Solar Milestones, SOLAR ENERGY INDUSTRIES ASS'N , https://www.seia.org/blog/2010s-solar-milestones (last visited Apr. 22, 2021) ("Costs have fallen by 70% since 2010, making both rooftop and utility-scale solar generation competitive with other forms of electricity generation.").

catalyzing a renewed focus on agrivoltaics.[33] Additionally, farmers and scientists have shown reinvigorated interest in this field, due to the negative impacts of climate change, reduction in farming revenues, and subsequent lack of successors.[34]

B. The Loss of Rural Farmland and the Disproportionate Burdens on Black and Native American Farmers

In the last 20 years, 11 million acres of American farmland has been converted into residential and commercial land use.[35] As renewable energy rapidly develops, a competition between agriculture and clean energy production creates incentive for non-profitable farmland to be temporarily converted into commercial solar facilities.[36] This competition can be alleviated by the introduction of agrivoltaics, allowing farmers to gain supplemental income while maintaining their agricultural operation.[37] As land competition is projected to intensify, with more affordable solar installations and increasingly unpredictable weather, agrivoltaics is an attractive option to merge the two competing needs for land resources.[38]

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33 *Id. See* Anuj Krishnamurthy & Oscar Serpell, *Harvesting the Sun: On-Farm Opportunities and Challenges for Solar Development*, Univ. of Penn. (Jul. 12, 2021), https://kleinmanenergy.upenn.edu/research/publications/harvesting-the-sun-on-farm-opportunities-and-challenges-for-solar-development/ (describing the renewed financial viability of agrivoltaics).

34 *Largest Agrivoltaic Research Project in U.S. Advances Renewable Energy While Empowering Local Farmers*, Solar Power World (Jun. 10, 2021), https://www.solarpowerworldonline.com/2021/06/largest-agrivoltaic-research-project-in-u-s-advances-renewable-energy-while-empowering-local-farmers/#:~:text=The%20global%20installed%20capacity%20of,approximately%202%2C900%20MW%20in%202020 (describing the growth in agriovlatic arrays in the last decades, from about 5 MW in 2012 to approximately 2,900 MW in 2020); *see also* Junko Movellan, *Japan Next-Generation Farmers Cultivate Crops and Solar Energy*, RENEWABLE ENERGY WORLD (Oct. 10, 2013), https://www.renewableenergyworld.com/2013/10/10/japan-next-generation-farmers-cultivate-agriculture-and-solar-energy/.

35 Adam Wernick, *US Lost 11 Million Acres of Farmland to Development in Past 2 Decades*, THE WORLD (Aug. 7, 2020) ("A series of studies by the American Farmland Trust shows that agricultural land is increasingly being converted, fragmented, or paved over — threatening the integrity of local and regional food systems."); *see also* Proctor, Murthy & Higgins, *supra* note 17 (explaining that solar energy proves to be a promising technique "for meeting the [electricity] resource challenges of the 21st century", but "utility scale solar requires large tracts of land" that is typically taken from existing farmland. "[M]ore than 11 million acres of farmland were transitioned to other forms of land-use between 2001 and 2016" which has "led to legislation" aiming to maintain agricultural land, "and a surge in both commercial and research interests in agrivoltaics systems.").

36 Jonathan Klavens et al., *Solar Project Development: The Special Case of Agrivoltaic Projects*, BOSTON B.J., 29 (Fall 2020) ("Any solar project where farmland is converted to exclusive solar use gives the landowner the opportunity to supplement farm income by renting out a portion of the land to a solar developer.").

37 *Id.*

38 The Michigan Technological University research found solar generated electricity coupled with shade-tolerant crop production created an over 30% increase in economic value for farms deploying agrivoltaic systems instead of conventional agriculture. *See* Harshavardhan Dinesh &

With a major shift away from small, distinct farming operations, many farmers struggle to maintain the viability of their businesses,[39] which the COVID pandemic exacerbated.[40] "High operating costs, low [food] prices, water scarcity," and a reduced demand for American crops has placed "tremendous financial pressure" on U.S. farmers.[41] In recent years many have turned to developers to lease a portion, or sell the entirety, of their land.[42] As farmland becomes a "rapidly vanishing commodity,"[43] disproportionally so for minority and Indigenous populations, it is increasingly important to find new sustainable farming techniques that help farmers diversify their income while maintaining the integrity of their agricultural roots.[44] With persistent discrimination against Black American and Native American farmers in the United States, the additional income and diversification of revenue agrivoltaics provides could help minority farmers reduce operational costs and protect their assets.[45]

Joshua M. Pearce, *The Potential of Agrivoltaic Systems*, 54 RENEWABLE AND SUSTAINABLE ENERGY REVIEWS, 299-308, 299 (2016).

[39] University of Maryland, *Trends in Consolidation of US Agriculture with 35 Years of Data: Data Show a Steady Shift to Fewer and Larger Farming Operations Across Crops, Dairy, and Livestock*, SCI. DAILY (July 23, 2020), www.sciencedaily.com/releases/2020/07/200723143702.htm. (showing results that production farming has "significantly shifted to larger farms" observed over a period of 35-years, and fewer distinct farming operations exist as "smaller farms going out of business and ultimately becoming unsustainable.").

[40] A survey in May 2020 projected that a third of independent, small farms would end operations due to lost revenue. *See* Karen Stabiner & Dan Barber, *Nearly a tThird of Small, Independent Farmers are Facing Bankruptcy by the End of 2020, New Survey Says*, THE COUNTER (May 18, 2020), https://thecounter.org/covid-19-dan-barber-resourced-small-farmer-survey/. While the impact of Covid-19 was "immediate and severe" for the farming community, aid from the CARES Act helped elevate stress on "farmers and ranchers to help them deal with the significant income losses they incurred during the pandemic." The impact of the pandemic remains uncertain as growing seasons and harvest seasons vary by farmer. *See* Robert Johansson, *America's Farmers: Resilient Throughout the COVID Pandemic*, U.S. Dep't of Agric. (Jul. 29, 2021) https://www.usda.gov/media/blog/2020/09/24/americas-farmers-resilient-throughout-covid-pandemic; *see also* USDA *2022 Farm Sector Income Forecast,* Economic Research Service (Feb. 2022), https://www.ers.usda.gov/topics/farm-economy/farm-sector-income-finances/farm-sector-income-forecast/ ("In inflation-adjusted dollars, 2022 net farm income is forecast to decrease by $9.7 billion (7.9 percent); net cash farm income is forecast to decrease by $2.9 billion (2.1 percent).").

[41] Tim McDonnell, *Can Farmland Fix Solar Power's Real Estate Problem?*, QUARTZ (Oct. 8, 2020), https://qz.com/1913868/why-agricultural-land-is-better-than-rooftops-for-solar-panels/.

[42] McLendon, *supra* note 11.

[43] McDonnell, *supra* note 41.

[44] Nadra Nittle, *Black-Owned Farms Are Holding on by a Thread*, EATER (Feb 23, 2021, 10:30am), https://www.eater.com/22291510/black-farmers-fighting-for-farmland-discrimination-in-agriculture (listing statistics from the National Young Farmers Coalition (NYFC) that state "[w]hite landowners possess 98 percent of all farmland, and 95 percent of farmers are white." The article further explains that "through 2020, Black farmers have fought to retain their farmland amid discrimination from the federal government, mass commercialization of agriculture, racial violence, economic instability, and, now, a pandemic.").

[45] Ruth Terry, *New Donations to Black-Led Food and Land Groups Aim for True Reparations*, CIVIL EATS (Feb. 23, 2021), https://civileats.com/2021/02/23/new-donations-to-black-led-food-and-land-groups-aim-for-true-reparations/, ("From the reversal of Reconstruction-era land

1. Black Farmers in the United States

The United States was built on the backs of enslaved Africans and people of color, propelling the American economy into the juggernaut it is today.[46] Black Americans' enslaved African ancestors were kidnapped and forced into labor in part because "of their agricultural acumen and ability to cultivate appropriated land for white colonizers."[47] This slave labor increased the cotton-picking industry's output in the south by over 400%, allowing the United States to become an economic world leader, benefiting white Americans.[48]

Since then, Black Americans have continued to face discrimination, and the farming industry is no exception. There is a long, documented history of the government discriminating against Black farmers. The USDA's Farm Service Agency office denied "Black, Latino, Native American and other socially disadvantaged farmers" from being considered for "loans needed for their farms, ultimately leading to dispossession of their land."[49] In the case *Pigford v. Glickman,*[50] Black American farmers filed a class action lawsuit against the USDA, alleging unconstitutional discrimination for a period spanning 25 years, denying them access to federal farm loans based on race.[51] A consent decree was entered in favor of the class members, which provided a "a two-track dispute resolution mechanism" allowing the plaintiffs to receive either loan forgiveness in the amount of $50,000 or uncapped relief with additional documentation.[52]

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grants to the USDA's blanket denial of Black farmers' loan applications until 1997 to food companies' ongoing exploitation of immigrant and incarcerated workers, there has been a perpetual loop of injustice and inequity.").

46 P.R. Lockhart, *How Slavery Became America's First Big Business*, VOX (Aug. 16, 2019, 9:00AM), https://www.vox.com/identities/2019/8/16/20806069/slavery-economy-capitalism-violence-cotton-edward-baptist, (stating that bodies of enslaved Africans served as "America's largest financial asset," being forced to maintain "America's most exported commodity," cotton.).

47 Terry, *supra* note 45 (clarifying that "Black Americans' connection to land and food systems is undeniably and understandably fraught" given the treatment of their ancestors. Africans were kidnapped and enslaved because of their "agricultural acumen and ability to cultivate appropriated land for white colonizers." Yakini further notes that the force labor of African slaves made "United States an economic superpower.").

48 Lockhart, *supra* note 46 ("In 60 years, from 1801 to 1862, the amount of cotton picked daily by an enslaved person increased 400 percent. The profits from cotton propelled the US into a position as one of the leading economies in the world, and made the South its most prosperous region. . . . The ownership of enslaved people increased wealth for Southern planters so much that by the dawn of the Civil War, the Mississippi River Valley had more millionaires per capita than any other region.").

49 *Understanding the Economic Crisis Family Farms are Facing*, FARM AID (Sept. 23, 2020), https://www.farmaid.org/blog/fact-sheet/understanding-economic-crisis-family-farms-are-facing, (With a persistent history of "racial discrimination at USDA Farm Service Agency offices", Black, Latino, Native American and other socially disadvantaged farmers were regularly denied the loans needed to maintain their farms, leading to "dispossession of their land.").

50 Pigford v. Glickman, 185 F.R.D. 82 (D.D.C. 1999).

51 *Id.* at 85-86.

52 *Id.* at 95.

However, this consent decree did not go far enough to protect Black farmers from future discrimination. Judge Friedman, in his 65-page opinion, stated that the consent decree does not "provide any forward-looking injunctive relief . . . [and] it does not require the USDA to take any steps to ensure" that the commissioners responsible for the discrimination were no longer in the position to approve or deny loans.[53] Additionally, no mechanism was set in place to investigate future complaints in a timely manner and prevent "the same discrimination against African American farmers that led to the filing of this lawsuit."[54]

These barriers to entry still exist today as young, Black farmers struggle to access funding and land[55] while continuing to face discrimination.[56] Farms owned by Black Americans make up less than 2% of the nation's agricultural land, in large part due to "decades of racial violence and unfair lending and land ownership policies."[57] It is estimated that rural land loss by Black Americans totals near $350 billion.[58] Establishing agriculture as a cornerstone of its agenda, the Biden administration has also pledged to "to tackle a legacy of discrimination that has driven generations of Black_Americans from their farms."[59] The administration has outlined plans to help Black and other minority farmers, which include "access to land, loans and other assistance, including "climate smart" production."[60] As discussed below, agrivoltaics is a climate-smart farming technique that would help advance the Biden administration's efforts to reduce carbon emission while providing income security for Black farmers.[61]

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53 *Id.* at 110.

54 *Id.*

55 Morning Edition, *'Make Farmers Black Again': African Americans Fight Discrimination To Own Farmland*, NAT'L PUBLIC RADIO (Aug. 25, 2020, 5:03 AM), https://www.npr.org/2020/08/25/904284865/make-farmers-black-again-african-americans-fight-discrimination-to-own-farmland (explaining that in the Northeast, there is a revitalized movement of young farmers, lead by people of color, who still face barriers in "accessing funding and land." Further, "Black farmers have historically faced race-based lending discrimination when applying for loans from the USDA, which often denied loan applications from Black farmers, delayed the loan process or allotted them insufficient funds. This systemic discrimination was the subject of the 1999 class-action lawsuit *Pigford v. Glickman*, which resulted in a $1.25 billion settlement to Black farmers.").

56 *See* Tabuchi & Popovich, *supra* note 4. ("As recently as 2015, Black farmers obtained only about $11 million in microloans designed for small farmers in 2015, or less than 0.2 percent of the roughly $5.7 billion in loans administered or guaranteed by the Agriculture Department that year.").

57 *Id.* (asserting that land historically owned by Black farmers has "fallen by an estimated 90 percent from the early 20th century peak, according to the Land Loss and Reparations Project, even as white-owned acreage shrank just 2 percent.").

58 *Id.* ("An initial estimate of the overall economic harm to Black Americans from the historical loss of rural landholdings, calculated by researchers including Thomas W. Mitchell, a professor of law at Texas A&M University, is $350 billion.").

59 *Id.*

60 *Id.*

61 *See* discussion *infra* Section I.C.

2. Native American Farmers in the United States

Indigenous farmers also faced a long history of discrimination in the United States. Beginning in 1887, the General Allotment Act,[62] more commonly known as the Dawes Act, was passed under the Cleveland administration and "allowed the federal government to break up tribal lands."[63] The act allowed the government to convert tribal land ownership into individual plots and reallocate the land to Native Americans, in an effort to assimilate them into mainstream United States society.[64] The act essentially forced Native Americans to surrender their "undivided interest in tribally owned common estate," which was then divided, granted back to individual Native Americans only after they registered as United States citizens, and the rest sold to non-Native Americans after a lapse of 25 years.[65] This policy was a profound failure that devastated Native American land ownership with the allocation of about 90 million acres of their land to non-Native Americans.[66]

In 1999, following the decision in *Pigford v. Glickman*, Native American farmers filed a class action lawsuit against the USDA in *Keepseagle v. Vilsack*.[67] The lawsuit asserted that from 1981-1999, Native Americans were discriminated against and denied access to "low interest government loans that white farmers were provided."[68] The USDA agreed to settle the lawsuit and to pay $680 million

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62 25 U.S.C. §§ 331-33.

63 *The Dawes Act*, NAT'L PARK SERV. (Nov. 10, 2020), https://www.nps.gov/articles/000/dawes-act.htm#:~:text=The%20Dawes%20Act.

64 *Id.*

65 Carcieri v. Kempthorne, 2008 WL 3895180 (U.S.), 4, ("The Dawes Act provided that "*in any reservation* created for [Indian] use," Congress or the President were authorized "to allot the lands in said reservation in severalty to any Indian located thereon." 49 Cong. Ch. 119 (emphasis added); 24 Stat. 388. This policy effectively forced tribal members "to surrender their undivided interest in tribally owned common estate."). FELIX S. COHEN, HANDBOOK OF FEDERAL INDIAN LAW § 16.03 (1982 ed.).

66 Indian lands that were alienated because of the General Allotment Act of 1887 (also called the Dawes Act) were sold or transferred to non-Indian parties but remained within reservation boundaries. *See Land Tenure History*, INDIAN LAND TENURE FOUNDATION, https://iltf.org/land-issues/history/ (last visited Apr 22, 2021) (noting that as a result of the General Allotment Act of 1887 (also called the Dawes Act), "90 million acres of Indian land" was seized from Indian ownership, leading to "60 million acres of 'surplus' Indian lands" being sold or transferred to non-Indian Americans between 1887 to 1934. Another "27 million acres were lost due to the 1906 Burke Act," which forced sales and other takings, creating a patchwork of broken ownership in throughout reservation boundaries, which remain today.).

67 Keepseagle v. Vilsack, 118 F. Supp. 3d. 98 (D.D.C. 2015); *see also* Michel Martin, *USDA Awards Native Americans Millions In Discrimination Suit*, NAT'L PUB. RADIO (Oct. 21, 2010, 2:00 PM), https://www.npr.org/templates/story/story.php?storyId=130723950, (discussing the settlement as a "latest effort to put to rest" numerous "class action discrimination lawsuits brought against the Agricultural Department in past decades."); *See generally* Pigford v. Glickman, 185 F.R.D. 82 (D.D.C. 1999).

68 *Keepseagle*, 118 F. Supp. 3d. at 98 n. 67

in damages to the class members and Native American farmers who were denied loans.[69]

But the damage from the loss of land and lack of support had a detrimental effect on Native American farmers. Today, Native Americans account for 59 million acres of operational farmland in the United States, which is about 6.5% of total American farmland.[70] The majority of that land is located in arid climates that struggle with irrigation management and heat stress.[71]

Because of the complications and costs associated with farming in the desert, agrivoltaics might help mitigate issues that farmers face in arid climates.[72] In the Southwest United States, U.S. Department of Energy's National Renewable Energy Laboratory ("NREL") researchers believe they can assist sustainable, locally sourced agriculture with an agrivoltaic model that will benefit customers and farmers.[73] The NREL experimental garden in Arizona promises to "radically reshape desert food production to meet the growing challenges posed by climate change" through relying on farming techniques employed by Native Americans for centuries.[74] The lab has already realized positive results in food production, reduced water requirements, and lower module temperature.[75] The researchers have been focusing on producing Indigenous, regional produce that is drought-

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[69] *Pigford,* supra note 50; *see also USDA Awards Native Americans Millions in Discrimination Suit,* Nat'l Pub. Radio (Oct. 21, 2010 12:00 PM), https://www.npr.org/templates/story/story.php?storyId=130723950 ("The United States Department of Agriculture has agreed to pay $680 million in damages to thousands of Native American farmers who say they were denied farm loans. The agreement also includes $80 million in farm debt forgiveness for the Indian plaintiffs, as part of the historic settlement of the class action law suit.").

[70] Native–operated farms accounted for 59 million acres of land, 6.5 percent of the U.S. total. The majority (73 percent) of these farms are less than 180 acres in size. *See Census of Agriculture,* U.S. DEP'T OF AGRIC., https://www.nass.usda.gov/Publications/Highlights/2019/2017Census_AmericanIndianAlaskaNative_Producers.pdf (last visited Apr. 22, 2021).

[71] *Id.*

[72] Barron-Gafford et al., *supra* note 8, at 849 (elaborating that arid lands of the Southwestern United States are premium real-estate for PV solar panels because of the "abundance of sunlight," but the ambient temperatures hinder the panels' ability to produce energy as extreme heat leads to degradation.).

[73] Climatewire, *Scientists Work to Reshape Desert Food Production,* E&E NEWS (Sept. 21, 2020), www-eenews-net.

[74] *Id.* ("'People have been growing food in the shade for 4,000 years in this region,' Barron-Gafford said.... For the right crops, the shade beneath the solar panels can produce healthier, more productive plants with as little as half the water, all while extending the length of the growing season. In turn, the plants provide a benefit to the solar array, cooling the air around it by as much as 12 degrees and improving the efficiency of the panels.").

[75] Barron-Gafford et al., *supra* note 8, (The NREL researchers calculated that for a traditional PV system in Tucson, AZ, the agrivoltaic systems temperature reductions documented in their research would, in the growing months of May–July, led to a 3% increase in generation over those months, and a 1% increase in generation annually."); *See also,* https://subscriber.politicopro.com/article/eenews/2020/09/21/scientists-work-to-reshape-desert-food-production-010712 ("Back at his outdoor laboratory at Biosphere 2, Barron-Gafford said pairing agriculture directly with solar generation could 'open the door to food production in marginal lands' by providing both a shady place to grow plants and the electricity needed to pump water to them.")

tolerant, nutrient dense, and helps reduce chronic human ailments exacerbated by heat stress.[76] Though researchers aim to revolutionize agriculture in arid environments with the addition of renewable energy production, they recognize this plan will require time and money to become a practice of scale.[77] Ultimately, researchers from the NREL study believe that agriculture will need to adapt as climate change continues to change our environment. [78] Planning for this adaptation will be less painful and a more profitable transition with the addition of sustainable, farming techniques.[79]

C. The Nexus of Water Retention, Food Production, and Energy Generation

As scientists, developers, and farmers revive interest in the practice of agrivoltaics, new studies and experiments promise positive results. Though each study differed in their PV array structures, plant variety, climate, rainfall, and physical geographical location, widely accepted trends emerged from the cumulative data. One such academic paper, published by researchers from Michigan Technological University, reviewed and summarized agrivoltaic experiments conducted prior to the spring of 2019. [80] The research results showed that the benefits from introducing agrivoltaic systems to conventional farming included water stress reduction, improved energy generation, resilient food production, and revenue diversification for farmers.[81]

In another novel study produced by the University of Arizona, in collaboration with the University of Maryland and NREL, similar results demonstrated the multiple additional benefits, which included "reduced plant drought stress, greater food production, and reduced PV panel heat stress." [82] The study argued that building resilience in both energy and food production allows greater security as the world experiences an increasingly uncertain climate and weather fluctuations.[83] In light of these positive results, agrivoltaics could provide the United States with more "sustainable agriculture, helping to meet current and

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[76] Climate Wire, *Scientists Work to Reshape Desert Food Production,* E&E NEWS (Sept. 21, 2020), www-eenews-net ("The team focused on desert plants that are as nutritious as they are drought-tolerant, with special emphasis on crops that can reduce or even prevent diabetes and other chronic diseases often exacerbated by heat stress. One key part will be convincing consumers to expand their palates to include wild, locally grown foods they might not have considered before.").

[77] *Id.* ("Transforming an entire agriculture sector won't be easy . . . 'there's a huge scaling piece that is going to have to be addressed.'").

[78] *Id.* (arguing that desert agriculture will be altered due to climate change and careful planning and adaptation "can make that transition profitable instead of painful.").

[79] *Id.*

[80] Dinesh & Pearce, *supra* note 38.

[81] *Id.* at 307.

[82] Barron-Gafford et al., *supra* note 8.

[83] *Id.*

prospective needs of energy and food production [while] simultaneously sparing land resources."[84]

1. Water Minimization and Desert Food Production

Water scarcity concerns are a driving factor in research surrounding agrivoltaics. As climate change continues to alter weather patterns and precipitation around the world, researchers project by the year 2025 "two-thirds of the world's population may be facing water shortages."[85] In fact, within the United States, water scarcity was a leading factor in the "conversion of more than 20,000 acres of former croplands in southern California to renewable energy development in a single year, as the lack of water was making agriculture non-economically viable."[86]

With the decrease of groundwater and increase in extreme weather events that reduce the reliability of energy generation, agrivoltaics presents an appealing solution for using farmland to produce both energy and food, as solar panels insulate crops, limit water evaporation, and minimize wind damage.[87] In a study published in Agronomy for Sustainable Development,[88] researchers concluded that "given the impacts of climate change and conditions in arid climates, potential benefits are likely for crop production through additional shading and observed improvements of water productivity."[89] Studies have shown, similar to cover crops, that shading from PV modules can help alleviate water evaporation and provide soil protection during dry seasons.[90] These benefits could be of significant value in areas experiencing severe droughts and arid conditions, which are increasingly exacerbated by climate change.[91]

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84 Axel Weselek et al., *Agrophotovoltaic Systems: Applications, Challenges, and Opportunities: A Review.* 39 AGRONOMY FOR SUSTAINABLE DEV. 5 (2019).

85 *Water Scarcity*, WORLD WILDLIFE FUND, https://www.worldwildlife.org/threats/water-scarcity#:~:text=Whenwatersrundry,people,andotherwater-borneillnesses, (last visited Apr. 22, 2021); *see also Water Scarcity*, UN WATER, https://www.unwater.org/app/uploads/2018/10/WaterFacts_water-scarcity_sep2018.pdf, (last visited Mar. 31, 2022), ("Around 700 million people in 43 countries suffer today from water scarcity. By 2025, 1.8 billion people will be living in countries or regions with absolute water scarcity, and two-thirds of the world's population could be living under water stressed conditions.").

86 Barron-Gafford et al., *supra* note 8.

87 *Id.*

88 *See* discussion *infra* Section III.B.

89 Axel Weselek et al., *supra* note 85.

90 H. Marrou, L. Dufour, and J. Wery,, *How Does a Shelter of Solar Panels Influence Water Flows in a Soil–crop System?*, 50 EUROPEAN J. AGRONOMY 38, (2013).

91 Dinesh & Pearce, *supra* note 38.

2. Increased Produce Production and Food Security

Food security has become more important than ever, highlighted by the disruption in operations during the COVID pandemic.[92] Agrivoltaics provides greater food security by allowing farmers to maintain their land's agricultural integrity while producing clean energy. In the NREL study, researchers found that many food crops, specifically those grown for human consumption, thrive under the shade of PV panels because plants can only absorb a certain amount of sunlight and begin to burn if exposed to direct light for a long duration.[93]

A major criticism of the "dual utilization" system is that certain highly profitable crops, such as corn, cannot be grown in shade.[94] Shade intolerant crops, which include high revenue vegetables and livestock feed, have reduced yield under PV modules.[95] However, further research involving shade intolerant crops in shaded conditions is needed because research has focused almost exclusively on shade tolerant crops.[96] Additionally, shade tolerance has proven to be unpredictable and depends on the type of vegetation, but there also seems to be a correlation between leaf structure and plant tolerance to environmental conditions.[97] Researchers continue to push the boundaries of shade intolerant crops and find that under the right conditions, agrivoltaics is a viable option with revolutionary benefits.[98]

Acclaimed agroecologists warn that the world has already hit the temperature limits of most conventional, edible crops.[99] In the southwest, some human consumption crop staples are already endangered due to global warming, such as "corn, dry beans, melons, chiles, and most vegetables."[100] Researchers observe

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92 Climatewire, *supra* note 73.

93 Barron-Gafford et al., *supra* note 8, at 850.

94 Dinesh & Pearce, *supra* note 38, at 300 (explaining that shading can cause a reduction in wheat yields, which typically cannot adapt to shaded conditions).

95 *Id.*

96 *Id.* at 307.

97 L. Hallik, Ü. Niinemets, and I. J. Wright, *Are Species Shade and Drought Tolerance Reflected in Leaf Level Structural and Functional Differentiation in Northern Hemisphere Temperate Woody Flora?*, 184 NEW PHYTOLOGIST 257, 268 (2009).

98 *Id.*; *see also* Dinesh & Pearce, *supra* note 38 (showing lettuce can adapt itself to shading by increasing its leaf area to maximize its ability to absorb the reduced solar radiation levels without significantly affecting yields. In the Michigan Technological University analysis, researchers found that the biomass of lettuce grown beneath stilt-mounted PV arrays in Montpellier (France) was 15–30% more than lettuce grown in full sun. Thus, the same area of land was used to produce both electricity and a superior crop yield. The U.S. could increase renewable solar generation through agrivoltaic resulting in a 40 to 70 gigawatt increase by installing over existing lettuce cultivation, without reduction in crop quality).

99 Henry Brean, *University of Arizona Researchers Unveil New Model for Desert Farming in Warming World,* Tucson (Sept. 12, 2020 Updated Jul 1, 2021), https://tucson.com/news/local/university-of-arizona-researchers-unveil-new-model-for-desert-farming-in-warming-world/article_2c9ecfdf-9128-53c2-b3c9-dd08eba3a832.html.

100 *Id.*

that some of these crops, when faced with harsh conditions, naturally gravitate and grow under the shade of nearby plants and "that's what agrivoltaics advocates [try to] imitate by growing crops in the shadows of solar panels."[101]

3. Increased Solar Production and Diversification of Income

Finally, a synergistic benefit of PV modules coexisting with crop vegetation is increased energy production.[102] Researchers from Michigan Technological University determined that using agricultural land for PV placement has a significant positive effect on energy output through decreased panel temperature, decreased dust accumulation, and increased sunlight access.[103] PV panels' efficiency diminishes as air temperature increases, hindering the panels' performance.[104] Planting vegetation below PV panels reduces heat stress and provides a cooling effect on the panels. [105] Likewise, the panels insulate crops grown below, keeping them warmer throughout the evening and delaying early frost onset.[106]

An Oregon State University study suggested that "the same factors that are greatest for solar panel production are similarly greatest for agricultural production; plentiful insolation, light winds, moderate temperatures, and low humidity."[107] Additionally, vegetation grown beneath the panels helps manage

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101 McLendon, *supra* note 11.

102 C.K Miskin, *et al. Sustainable Co-production of Food and Solar Power to Relax Land-use Constraints*. 2 NATURE SUSTAINABILITY 972 (2019), https://doi.org/10.1038/s41893-019-0388-x ("[A)djusting the intensity, spectral distribution and duration of shading allows innovative photovoltaic systems to achieve significant power generation without potentially diminishing agricultural output.").

103 Dinesh & Pearce, *supra* note 38; *see also* E.H. Adeh, et al., *supra* note 12 ("Results confirm that the PV panel efficiency is influenced by the insolation, air temperature, wind speed and relative humidity.").

104 E.H. Adeh, et al., *supra* note 12, at 2 ("Solar PV efficiency diminishes as a function of air temperature at a rate of approximately 0.5% per 10 °C [or every 18 degrees F]. This is consistent with literature observations of decreased efficiency with increasing ambient temperature.").

105 Brian Boyce, *Agrivoltaics Aroving a Responsible Way to Blend Solar Fields and Traditional Ag,* AG DAILY (July 22, 2020), https://www.agdaily.com/crops/agrivoltaics-blend-solar-fields-and-traditional-ag/.

106 Barron-Gafford et al., *supra* note 8, at 852. ("Economically, this novel microclimate may also extend growing seasons and protect against untimely frosts."). *See also* Harrison Dreves, *Beneath Solar Panels, the Seeds of Opportunity Sprout,* NAT'L RENEWABLE ENERGY LAB., https://www.nrel.gov/news/features/2019/beneath-solar-panels-the-seeds-of-opportunity-sprout.html (last visited Apr. 22, 2021) (In the NREL study, researchers found that traditional ground-mounted PV panels were substantially warmer during the day than those with the plant-based understory. The Agrivoltaics PV panels were cooler during daytime hours compared to the traditional panel array by approximately 9°C, allowing for better performance. Given inherent sensitivity of PV panels to temperature, any cooling of panels below current daytime temperatures >30 °C will positively impact its efficiency.).

107 Proctor, Murthy & Higgins, *supra* note 17.; *see* also Climatewire, *supra* note 73, ("Farms convert the sun to food, and solar panels convert the sun to energy, but ultimately it's the same process, so it makes sense to site them together.").

dust and debris accumulation, which blocks the panels and hinders PV output.[108] As barren terrains are sourced for solar, giving added value to the land, gravel or grass turf is traditionally placed beneath these installations.[109] But these traditional solutions worsen the energy production by causing "heat islands," raising the temperature of the PV array[110] and reducing the quality of the microclimate created beneath the panel.[111] The water used to clean the panels could in turn irrigate the crops below, adding another dimension to the synergy between water reduction, food production, and energy generation.[112]

Though actual savings need to be calculated on a case-by-case basis because of factors such as state incentives and utility tariffs, there is clear potential for farmers using agrivoltaics to realize increased revenue and save energy overall.[113] Increasing energy generation without sacrificing crop production results in more income for farmers deploying agrivoltaics.[114] Whether the farmer is producing energy for their own use, selling it to the utility, or partnering in a community solar program, the energy from the solar panels translates into energy savings while reducing carbon emissions.[115]

III. SUNSETTING INCENTIVES AND STATES' ZONING RESTRICTIONS HINDER THE IMPLEMENTATION OF AGRIVOLTAICS FOR COMMUNITIES LACKING UPFRONT CAPITAL

Despite the potential benefits agrivoltaics could provide, there are few incentives in place to help promote this carbon-reducing farming technique. Because of this, the addition of solar to traditional farming is often cost prohibitive and subsequently dismissed.[116] Though there is an existing federal incentive available to farmers who wish to deploy agrivoltaics, the incentive is sunsetting and poised to phase out by 2023.[117]

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108 *Id.*

109 McLendon, *supra* note 11; *see also* Barron-Gafford et al., *supra* note 8.

110 Boyce, *supra* note 105.

111 E.H. Adeh, et al., *supra* note 12, at 1 (explaining that Solar PV potential for generation is depended on "incoming solar radiation", which intern is "strongly dependent on geographic location." However, there are more factors that attribute to a system's efficiency such as "the temperature of the solar cells, and the temperature of the solar cells is a function of the local microclimate.").

112 *See* discussion *supra* Section I.C.1.

113 Brean, *supra* note 99.

114 *Id.*

115 *Id.* ("Ultimately, researchers argue, desert agriculture will be transformed by climate change whether we want it to be or not. Through careful planning and adaptation, we can make that transition profitable instead of painful.").

116 Solar Investment Tax Credit (ITC), SOLAR ENERGY INDUSTRIES ASS'N, https://www.seia.org/initiatives/solar-investment-tax-credit-itc (last visited Apr. 22, 2021).

117 Sunsetting is a legal provision automatiaclly terminating at the end of a fixed period unless renewed by legislative action. The ITC sunsetting date has been extended, from 2016 to 2023, due to the COVID-19 pandemic. Solar Investment Tax Credit (ITC), SOLAR ENERGY INDUSTRIES ASS'N,

Another obstacle for agrivoltaic installation is current state zoning and permitting designations. In certain municipalities, agricultural land has favorable zoning exemptions or incentives, designed to maintain the agricultural integrity of the land.[118] The addition of a large-scale solar array could place that zoning in jeopardy even if the array is paired primarily with agricultural use.[119] However, as the benefits of agrivoltaics are more widely acknowledged, states should be required to adopt their own incentive programs and relax zoning regulations.[120]

Without widespread regulatory changes, financially strapped farmers cannot afford to adopt agrivoltaics as a clean energy, carbon sequestering technique. The lack of incentives and fear of lost subsidies creates uncertainty around installation.[121] Though the additional income and energy generation would be beneficial to society, spending a substantial amount of savings without subsidized funding presents too great of a risk for farmers.[122] The discussion below details the hurdles that must be overcome with sunsetting incentives and zoning and permitting regulations.

A. Sunsetting Incentives and the Subsequent Effect on Development

The Renewable Energy Investment Tax Credit ("ITC") is a federal incentive that allows residential, commercial, and industrial customers to lower the overall cost of solar installation by placing credit against tax liability.[123] The ITC can be applied to installations nationwide, which makes solar viable in many states that do not carry their own incentives.[124] The ITC was originally meant to sunset in 2016, but environmental groups succeeded in lobbying for an extension of the tax

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https://www.seia.org/initiatives/solar-investment-tax-credit-itc (last visited Apr. 22, 2021); *See also* note *infra* 137.

118 Becky Blanton, *5 Zoning Issues You Need to Be Aware of Before Buying Farm Land,* HOMES (Jan. 7, 2021), https://www.homes.com/blog/2016/03/5-zoning-issues-need-aware-buying-farm-land. ("Agricultural or "Ag Zoning," refers to designations made by local jurisdictions that are intended to protect farmland and farming activities from incompatible non-farm uses. Usually designated as "A-1" land or zoning, the purpose of the zoning is to conserve and protect open land uses, foster orderly growth in rural areas and prevent urban agricultural land use conflicts.").

119 Amelia Josephson, *Understanding Agricultural Tax Exemptions,* SMARTASSET (Mar. 18, 2021), https://smartasset.com/taxes/understanding-agricultural-tax-exemptions.

120 *See also* discussion *supra* Section II.B.

121 Mike Carroll, *Considerations for Transferring Agricultural Land to Solar Panel Energy Production*, NCSU, https://craven.ces.ncsu.edu/considerations-for-transferring-agricultural-land-to-solar-panel-energy-production/ (last updated Mar. 23, 2020) (discussing incentives in North Carolina, where solar installations can be cost prohibitive without tax incentives and subsidies can be lost with solar installation if agricultural production and solar production are not maintained simultaneously).

122 *Id.*

123 *Solar Investment Tax Credit (ITC)*, *supra* note 118.

124 Solar Rebates and Incentives, ENERGYSAGE, https://www.energysage.com/solar/cost-benefit/solar-incentives-and-rebates/ (Oct. 25, 2021). (Some states offer additional tax credits for installing a solar panel system. With a state solar tax credit, a portion of the cost of a solar panel system is deductible from a ratepayer's state tax bill, similar to the federal ITC.).

credit, which, due to COVID, will now end in December of 2023.[125] Currently, the ITC is set as a 22% tax credit for solar systems on commercial properties, which will reduce yearly.[126] Because the incentive is only available in the tax year in which a project is placed in service, and was originally meant to phase out in 2016, there has been tremendous growth as developers and residents rush to take advantage of this credit.[127]

The Solar Energy Industry Association (SEIA) is one of the biggest ITC lobbyists and supporters, gathering the solar industries support for an ITC extension.[128] SEIA argues that the ITC has "proven to be one of the most important federal policy mechanisms to incentivize clean energy in the United States."[129] This dollar-for-dollar reduction in federal tax income has allowed individuals, as well as businesses, the ability to afford solar and receive the ITC deduction available in the year of installation.[130] Because of the inherent fluctuation in this relatively young sector, the ITC has provided long-term stability that has driven down the cost of solar.[131] As the ITC phases out, however, the future of solar growth, especially for low-income customers, remains uncertain. While some low-income households may not directly benefit from the ITC based on their tax bracket, many low-income families benefit from community solar projects that rely on the ITC and pass the savings along to their subscribers.[132] Community solar projects are typically commercial or utility scale

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125 *Solar Investment Tax Credit (ITC), supra* note 118.

126 Twenty-six percent for projects that begin construction in 2021 and 2022 and twenty-two percent for projects that begin construction in 2023. After 2023, the residential credit drops to zero, while the commercial credit drops to a fixed ten percent. *Id.*

127 *Id.* ("The Investment Tax Credit was set to expire at the end of 2016, but fortunately Congress voted to extend it to December of 2023. The extension is expected to nearly quadruple solar installations by the end of 2020 while doubling U.S. solar employment and stimulating $140 billion in economic activity.").

128 Billy Ludt, *SEIA Garners Industry Support and Lobbies for ITC Extension*, SOLAR POWER WORLD (Nov. 6, 2019), https://www.solarpowerworldonline.com/2019/11/seia-garners-industry-support-and-lobbies-for-itc-extension/.

129 *Id.*

130 *Id.*

131 *Id.* ("The ITC has proven to be one of the most important federal policy mechanisms to incentivize clean energy in the United States. Solar deployment, at both the distributed and utility-scale levels, has grown rapidly across the country. The long-term stability of this federal policy has allowed businesses to continue driving down costs. The ITC is a clear policy success story – one that has resulted in a stronger and cleaner economy.").

132 *Community Solar*, SOLAR ENERGY INDUSTRIES ASS'N, https://www.seia.org/initiatives/community-solar (last visited Apr. 22, 2021) (Community solar has been a major economic driver for the development of solar in the United States. Rural communities have also benefited from Community Solar, as construction and long-term land leases are adding jobs and income stability for locals.); *see also Shared Renewables*, ENVTL. PROTECTION AGENCY (Aug. 18, 2018), https://www.epa.gov/green-power-markets/shared-renewables (Community solar subscription or "subscription" refers to individuals who agreement to participate in a community solar project. Subscribers receive a bill credit for energy produced by the facility. Often, individuals sign up for community solar because their own homes are not suitable for the installation of photovoltaics panels.).

installations that enable customers, who cannot directly install on their own property, the ability to benefit from clean energy by giving them the opportunity to purchase or lease solar panels located on another's property.[133] These community solar subscribers receive an electric bill credit for electricity generated by their share of the community solar PV system.[134] When it comes to agrivoltaics, the energy generation would either be solely used by the farm on which the array is located or would act as a community solar project benefiting the surrounding area.[135] In both situations, the farmers or developers would benefit from the additional tax credit. When the ITC is eventually phased out, "solar power will need to compete on its own if it has any hope of continuing to provide power to the country."[136]

The Energy Information Administration conducted a study in 2015, when the ITC was originally scheduled to expire before the Covid-19 extension, that suggested that "if the 30% credit was not extended, rooftop solar PV installations would plunge 94% in 2017 ... and utility-scale projects would decline 100%, with neither recovering anywhere close to today's levels."[137] Bloomberg also predicted a stark future as their researchers determined "solar installations would drop by two-thirds in 2017."[138] SEIA estimates that the termination of the incentive in 2016 would have cost America 100,000 jobs.[139]

Due to delay in installation and activation from COVID-19, the 2020 extension of the ITC "has provided market certainty for companies to develop long-term investments that drive competition and technological innovation, which in turn lowers energy costs for consumers."[140] Without the financial stability the ITC provides, legislators will need to develop policy that weans dependency on the

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133 *Shared Renewables*, *supra* note 134.

134 *Id.*

135 Katie Siegner & Genevieve Lillis, *What Businesses Should Know About the Evolution of Rural Solar*, GREENBIZ (Jan. 23, 2020), https://www.greenbiz.com/article/what-businesses-should-know-about-evolution-rural-solar ("Connexus Energy in Minnesota was one of the first utilities in the United States to develop a pollinator-friendly solar garden, and Indiana-based Hoosier Energy has piloted a solar plus sheep grazing community solar project that is benefitting both co-op and farmer.").

136 Riley Adams, *How The Solar Tax Credit Makes Renewable Energy Affordable*, PANASONIC , https://na.panasonic.com/us/green-living/how-solar-tax-credit-makes-renewable-energy-affordable (last visited Apr. 22, 2021).

137 SCF News, *The ITC Cliff: Will Solar Be Economically Viable Without the ITC?*, Sustainable Capital (Nov. 15, 2017), https://scf.com/blog/itc-cliff-will-solar-economically-viable-without-itc/.

138 *Id.*

139 *Solar Investment Tax Credit (ITC)*, *supra* note 118. *Cf.* SCF News, *supra* note 139 ("However, there were other industry juggernauts that did not believe this was the fate of solar if the federal tax credit was eliminated. According to the Natural Renewable Energy Laboratory (NREL), the elimination of the ITC would not impact the industry growth because financiers, not developers, grab about half of the tax credit. The credit has proved an essential financing mechanism to getting solar built, even though some projects rely on complex tax-equity structures to monetize the credit.").

140 *Solar Investment Tax Credit (ITC)*, *supra* note 116.

credit.[141] The diversification of income and long-term stability benefits from agrivoltaics would allow farmers to rely on additional revenue to maintain their farms. Agrivoltaics will not be a "quick fix" for farmers who are currently struggling financially, as the process of solar installation permitting is lengthy depending on the state, but the potential benefits from the dual use technology could help fortify food security, energy production, and land ownership.[142]

B. Agricultural Zoning and Tax Exemptions.

Even though there is federal and state support for clean energy, municipalities and local governments hold the power to regulate zoning.[143] Renewable energy is slowly making its mark on those regulations, highlighting the role that local governments play in our national energy grid and climate crisis.[144] Zoning and permitting laws, including those regulating agrivoltaics, remain a challenge for farmers planning to install a commercial solar array on their property.[145] Though each municipality has unique zoning laws and regulations,[146] generally, agricultural land ("AG") zoning designates specific restrictions to protect and maintain agricultural integrity of land.[147] While facilities such as churches, schools, and single-family homes may be erected on AG land, zoning requirements are in place to conserve and protect open land uses.[148] Land categorized as AG zoning receives tax exemptions in most municipalities, though

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141 *Id.* ("The solar industry will then need to rely on margins earned through broader adoption and continued installation growth."); *see also* Riley Adams, *How The Solar Tax Credit Makes Renewable Energy Affordable*, Panasonic (2019). https://na.panasonic.com/us/green-living/how-solar-tax-credit-makes-renewable-energy-affordable. ("rely on margins earned through broader adoption and continued installation growth. . . Much like investing in index funds, the market has done well despite individual companies suffering poor financial results.").

142 McLendon, *supra* note 11 (reiterating that Agrivoltaics "may not be a quick fix for farmers who are struggling now.").

143 *See generally* U.S. CONST. AMEND. X.

144 John R. Nolon, *Mitigating Climate Change by Zoning for Solar Energy Systems: Embracing Clean Energy Technology in Zoning's Centennial Year*, 38 ZONING & PLAN. L. REP. 1, 6, 8 (2015) ("Adopting land use regulations that encourage solar and other clean energy systems is an essential strategy for promoting clean power and one that focuses on the essential role that local governments play in mitigating climate change.").

145 McDonnell, *supra* note 41 (explaining that since this idea is still new, "zoning laws remain a big impediment").

146 It is well established that "states and municipalities have the police power to zone land for designated uses." *Due Process of Law*, JUSTIA US LAW, https://law.justia.com/constitution/us/amendment-14/04-due-process-of-law.html (last visited Apr 22, 2021).

147 Becky Blanton, *5 Zoning Issues You Need to Be Aware of Before Buying Farm Land*, Homes.com (Mar. 3, 2016), https://www.homes.com/blog/2016/03/5-zoning-issues-need-aware-buying-farm-land ("Agricultural or 'Ag Zoning,' refers to designations made by local jurisdictions that are intended to protect farmland and farming activities from incompatible non-farm uses. Usually designated as 'A-1' land or zoning, the purpose of the zoning is to conserve and protect open land uses, foster orderly growth in rural areas and prevent urban agricultural land use conflicts.").

148 *Id.*

it varies from state to state.[149] The addition of a commercial solar array has the potential to recategorize the AG zoning designation, removing tax exemptions and increasing overall taxes, despite the land's intended agricultural use.[150] However, many states have not addressed regulatory schemes affecting the addition of agrivoltaics to active farms because the practice is relatively new in the United States.

Of the states that have addressed agrivoltaics, some allow farms to maintain their AG zoning status, creating agricultural exemptions and taxes based on farmland use. [151] In Maryland's Montgomery County, for example, a law called the Zoning Text Amendment ("ZTA") was proposed to allow farmers to maintain their zoning under the agricultural reserve while integrating solar into their farming practice.[152] This amendment created an Agrivoltaic Pilot Program, recommending "that real property taxes remain . . . 'agricultur[al]' and not 'commercial' and that personal property taxes be reduced by 75%."[153] Massachusetts, one of the leaders in agrivoltaics in the United States, also allows farmland to maintain its AG zoning status along with the agricultural tax exemption if "the majority of the power from a solar energy system (or a wind turbine) is integral to farm production, construction and operation."[154] In North Carolina, "Present Use Value (PUV), defers commercial tax rates on agricultural lands as long as the use of the land remains agricultural."[155]

Conversely, other states elect to either remove agricultural exemptions, even when the land remains in agricultural use, or ignore the topic until further research has been conducted.[156] This presents a problem, as farmers may be unable to keep

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[149] *See* Amelia Josephson, *Understanding Agricultural Tax Exemptions,* SMARTASSET (Mar. 18, 2021), https://smartasset.com/taxes/understanding-agricultural-tax-exemptions.

[150] *See generally Id.*

[151] States leading the way for the implementation of agrivoltaics through relaxed zoning regulations are "Massachusetts, Michigan, Colorado, Maine, Illinois, and Virginia." *See* McDonnell, *supra* note 41.

[152] *Why We Support the Solar Zoning Text Amendment (ZTA) in Montgomery County*, SIERRA CLUB (Aug, 21, 2020), https://www.sierraclub.org/maryland/montgomery-county/blog/2020/08/why-we-support-solar-zoning-text-amendment-zta-montgomery.

[153] Planning, Housing, and Economic Develop. Committee Trans. and Environ. Committee, *Zoning Text Amendment 20-01,* SOLAR COLLECTION SYSTEM – AR ZONE STANDARDS (Jan. 11, 2021), https://www.montgomerycountymd.gov/council/Resources/Files/agenda/cm/2021/20210114/20210114_PHEDTE1.pdf.

[154] § 210-36 SOLAR AND WIND ENERGY SYSTEMS, TOWN OF UNION VALE, NY, HTTPS://ECODE360.COM/7977512.

[155] Mike Carroll, *Considerations for Transferring Agricultural Land to Solar Panel Energy Production*, NC COOPERATIVE EXTENSION NEWS (2021), https://craven.ces.ncsu.edu/considerations-for-transferring-agricultural-land-to-solar-panel-energy-production/.

[156] Pete Pichaske, *Maryland Counties Grapple with Controlling Growth of Solar Farms*, THE DAILY RECORD (July 23, 2021), https://thedailyrecord.com/2021/07/23/maryland-counties-grapple-with-controlling-growth-of-solar-farms/ (discussing the inconsistent solar law from county to county in Maryland.); *see also* Cassandra Profita, *Oregon Restricts Solar Development On Prime Farmland*, OPB (May 23, 2019), https://www.opb.org/news/article/solar-development-farmland-oregon-ban/

the agricultural tax exemption, limiting research to grant funded or wealthy individuals rather than active farms.[157] For example, the New York Farm Bureau released guidance for addressing the installation of solar on farmland.[158] The Bureau stated that "[e]ven if the land is used for dual purposes - i.e. low-impact farming activities and renewable energy production, you may still lose your agricultural exemption on that land."[159] If the land is reclassified, farmers can expect their property taxes to increase along with an additional conversion fee.[160]

In California, which is a solar friendly state, Alameda County officials "weren't willing to roll forward with agrivoltaics [in] the county's new solar policy," stating that "the field of agrivoltaics is really in its infancy," and the committee would be premature to incorporate agrivoltaics into their regulations.[161] Oregon, another environmentally conscious state, introduced a measure that challenged two of the states' priorities, "protection of agricultural land and environmental stewardship."[162] The Oregon Land Conservation and Development Commission approved new laws that restrict commercial solar development on farmland across the state.[163] Similarly in Michigan, if a solar installation is placed on agricultural land, it would no longer hold an AG zoning classification.[164] For farmers, this could mean an increase in property taxes due to the loss of AG zoning.[165]

(identifying Oregan as an example of a state that would make it difficult for farms to apply for solar permits.); *see also* Liam Niemeyer, *KY Bill Would Allow Ban On Large Solar Projects On Farmland*, WFPL (Feb. 24, 2021) https://wfpl.org/ky-bill-would-allow-ban-on-large-solar-projects-on-farmland/.

157 *See generally* Pichaske, *supra* note 156; *see also* Profita, *supra* note 156; *see also* Niemeyer, *supra* note 156.

158 *See generally* Farm Bureau N.Y., *Leasing Your Farmland For Wind & Solar Energy Development*, NYFB LEGAL AFFAIRS DEPARTMENT (Dec. 2016), http://www.nyfb.org/application/files/2014/9780/6349/file_y349d211hx.pdf.

159 *Id.*

160 *Id. at 6.* "Whether you will lose your agricultural assessment will be determined on a case-by-case basis by your local tax assessor. If the land is reclassified, not only will your property taxes increase, you will also have to pay a conversion fee."

161 *See* Larry Altman, *Solar Policy Work Remains a Focus For Ag Commission,* THE INDEPENDENT (Feb. 25, 2021). Other officials on the committee rightfully stated that the "concept was nearly 40 years old with extensive research in Germany", yet the proposed policy integrations did not pass. https://www.independentnews.com/news/solar-policy-work-remains-a-focus-for-ag-commission/article_fd50d824-76d3-11eb-9cc9-d3448890bb91.html.

162 Cassandra Profita, *Oregon Restricts Solar Development on Prime Farmland,* OREGON PUBLIC BROADCASTING, (Aug. 3, 2020), https://www.opb.org/news/article/solar-development-farmland-oregon-ban/.

163 OR. ADMIN. R. 660-033-0130(38)(c)(B)(ii)(2020).

164 Gov. Whitmer, *MDARD to Allow Commercial Solar Panels on Michigan Farmland*, MDARD (June 3, 2019), https://www.michigan.gov/whitmer/0,9309,7-387-90499_90640-498861—,00.html.

165 *Policy for Allowing Commercial Solar Panel Development on PA 116 Lands*, MICHIGAN DEPARTMENT OF AGRICULTURE AND RURAL DEVELOPMENT (Oct. 26, 2021), https://www.michigan.gov/-/media/Project/Websites/mdard/documents/environment/farmland/mdard_policy_on_solar_panel_and_pa116_land.pdf?rev=bac9bcabe2a54878a76bfbe9fa8b9b06.

These laws add an additional barrier for farmers who want to produce clean energy while maintaining their farmland's agricultural integrity, making it difficult for farmers to diversify their income. Additionally, the irregularities and lack of cohesiveness among states' regulations can add additional time requirements for research and permitting, creating financial uncertainty for developers.[166] Many states have goals of lowering carbon emissions and maintaining farmland, but few create legislation that would empower farmers to add clean energy generation to their property. [167]

IV. INTEGRATING AGRIVOLTAICS INTO THE BIDEN ADMINISTRATION'S PLANS TO REVIVE RURAL AMERICA AND REDUCE CARBON EMISSIONS

The Biden administration has promised to address America's racist history of discrimination against minority populations, and more specifically in the agricultural community.[168] The administration has also pledged to combat climate change with a goal of 100% carbon pollution-free electricity by 2035.[169] Accomplishing these substantial tasks will be difficult but neglecting to creatively integrate agriculture and clean energy undermines both agendas. This administration's ambitious goals are necessary to achieve a stable future, and instituting mechanisms to make this achievable will be imperative. With financial pledges to both clean energy and minority farmers, and the understanding that such communities lack energy grid resilience, creating an incentive program that allows farmers access to grants and funding will encourage clean energy infrastructure in rural areas and income diversity for farmers.[170] This section discusses why the Biden administration should create a funding mechanism for agrivoltaics and how a carbon bank could help compensate farmers for sustainable farming practices. It will also review state agendas to promote agrivoltaics and offer recommendations on how to improve their programs.

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166 Rebecca R. Hernandez et al., *Environmental impacts of utility-scale solar energy*, 29 RENEWABLE & SUSTAINABLE ENERGY REV. 766–779 (Jan. 2014). From the perspective of energy development, possible delays from unresolved permitting requirements and regulatory inconsistencies may have a negative effect on financial returns.

167 *See infra* note 207.

168 Ximena Bustillo, *'Rampant issues': Black farmers are still left out at USDA*, Politico (Jul. 05, 2021), https://www.politico.com/news/2021/07/05/black-farmers-left-out-usda-497876. *See also Black Farmers Look To Next Congress, Biden To Dismantle 'Culture Of Discrimination', supra* note 3. ("The Biden administration is trying to make up for decades of racial discrimination in U.S. farm assistance by forgiving loans to farmers of color.").

169 *See* Briefing Room, *FACT SHEET: President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies*, (Apr. 22, 2021), https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on-clean-energy-technologies.

170 Proctor, Murthy & Higgins, *supra* note 17.

A. Incorporating Agrivoltaics into the Biden Administration's Build Back Better Act

The Biden administration plans to reduce carbon emissions, invest in agriculture, help rural marginalized communities, and build rural infrastructure.[171] In 2019, when President Biden initiated his run for office, merely "11% of U.S. energy came from renewable sources," and only 2% was produced by solar.[172] The administration campaigned on plans for the "U.S. to move to clean electricity by 2035."[173] In order to reach the goals set by the administration, there must be further investment in renewable energy.

The administration announced the American Jobs Plan, which outlined its proposal to invest $2 trillion in infrastructure in addition to environmental protections.[174] The plan also included clean energy standards and "a focus on low-income communities hit hardest by climate change."[175] Since the proposed American Jobs Plan, a new bill incorporating many of the same agendas was modified on October 28, 2021, entitled the Build Back Better Act.[176] The BBB Act has set aside $555 billion for climate and infrastructure[177] with an additional $90 billion for agriculture and rural America, with a mission to "mitigate climate change, reduce the risk of wildfires, provide debt relief for economically distressed farmers, and encourage rural economic growth."[178]

Climate change disproportionately impacts Indigenous, minority, and poor communities.[179] Moreover, agricultural communities are predominantly "rural, low income, and migrant communities."[180] In the United States, "one in five rural residents are people of color, and they are two to three times more likely to be

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171 Chris Malloy, *Transforming Farms and Food Production With Solar Panels*, Governing (Apr. 9, 2021), https://www.governing.com/next/transforming-farms-food-production-with-solar-panels.html.

172 *Id.*

173 *Id.*

174 Danielle Kurtzleben, *Within Biden's Infrastructure Plan Lies An Agenda To Address Climate Change*, NAT'L PUBLIC RADIO (Apr. 8, 2021), https://www.npr.org/2021/04/05/984387402/within-bidens-infrastructure-plan-lies-an-agenda-to-address-climate-change.

175 *Id.*

176 Steven Mufson & Sarah Kaplan , *New Budget Deal Marks the Biggest Climate Investment in U.S. History*, WASH. POST (Oct. 28, 2021) https://www.washingtonpost.com/climate-environment/2021/10/28/climate-biden-build-back-better/.

177 *Id.*

178 Chuck Abbott, *'Build Back' Bill has Nearly $90 Billion for Ag and Rural America*, Successful Farming (Nov. 4, 2021), https://www.agriculture.com/news/business/build-back-bill-has-nearly-90-billion-for-ag-and-rural-america.

179 Juliet Eilperin et al., *Biden To Place Environmental Justice At Center Of Sweeping Climate Plan*, WASH. POST (Jan. 27, 2021), https://www.washingtonpost.com/climate-environment/2021/01/26/biden-environmental-justice-climate/.

180 Proctor, Murthy & Higgins, *supra* note 17 at 3.

poor than rural whites."[181] These same individuals are "significantly more likely to live in impoverished areas that have been described as rural ghettos."[182] But by investing in agrivoltaics, the administration can take a "step towards greater sustainability and mitigation of some climate impacts," enabling communities to source their own energy, food, and additional income.[183] The construction of agrivoltaic systems in rural parts of the country may "incentivize other infrastructural investment such as grid connection lines."[184] However, one prohibitive hurdle for rural and minority farmers is the upfront capital required to purchase a PV solar system.[185] Incentivizing and installing agrivoltaics systems in rural farming communities, particularly those owned and operated by people of color, could achieve the administration's goals to reduce emissions through solar, invest in agriculture, help marginalized communities diversify their income, and build rural infrastructures such as electric grids.

In an article published in Sustainability and Political Agroecology, researchers "present[ed] a reduced-order analysis of the upper-bound cost for widescale adoption of [agrivoltaic] systems in the United States and [found] that if approximately 1% of the U.S. annual federal budget is invested in rural infrastructure, significant progress . . . can be achieved" in emission reduction.[186] Though some funding is expected to come from private sector investing, the federal government can contribute in the form of rebates, grants, subsidies, and other incentives.[187]

Agrivoltaics addresses many of the objectives set forth in the BBB Act.[188] It has the potential to create "green" jobs, produce more food, generate more energy, reduce agricultural water use, expand the electrical grids' infrastructure, and sequester carbon dioxide ("CO_2") through soil rehabilitation, all while providing additional income to rural and minority farmers.[189] The installation of these systems supports every primary goal in the BBB Act and allows the US to "bolster their renewable energy portfolio while simultaneously using land more efficiently and supporting the US' rural economy."[190]

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[181] Ann Eisenberg, *5 Ways Biden Can Help Rural America Thrive and Bridge The Rural-Urban Divide*, THE CONVERSATION, (Jan. 21, 2021) https://theconversation.com/us.

[182] *Id.*

[183] Proctor, Murthy & Higgins, *supra* note 17 at 3.

[184] *Id.*

[185] *See* discussion *supra* Section II.A.

[186] Proctor, Murthy & Higgins, *supra* note 17 at 2.

[187] *Id.* at 7.

[188] Build Back Better Act, H.R. 5376, 117th Cong. (2021).

[189] Proctor, Murthy & Higgins, *supra* note 17 at 8-9; *see also* Ragna Schmidt-Haupt, *Building PV for the Future*, PV MAG. (Jan. 16, 2021), https://www.pv-magazine.com/magazine-archive/building-pv-for-the-future/ ("The least-known fact about ground-mounted PV projects is their carbon sequestration potential from regenerating soil underneath the panels.").

[190] *Id. See also* Tod A. Ontl, *Soil Carbon Storage*. 3 NATURE EDUCATION KNOWLEDGE 35 (2012), https://www.marvista.org/docs/34486025-10556.pdf.

B. Create a Carbon Bank: Providing Compensation for Farmers Who Sequester Carbon Within Their Soil

In the Biden administration's first 100-day plan, new agriculture policies placed farmers at the "forefront of the fight against climate change." [191] The administration's transition team proposed the idea of a "carbon bank," designed to offer credits "to farmers for carbon they sequester in the soil through sustainable farming methods." [192] A carbon bank would compensate farmers for regenerative farming and environmentally conscious techniques that sequester CO_2 from the atmosphere into the soil.[193] Isolating CO_2 in soil primarily takes place through the process of photosynthesis, with carbon stored in the form of "soil organic carbon."[194] Forests, grasslands, and soil are all natural sinks for carbon sequestration.[195] Additionally, cover crops can help sequester carbon, through photosynthesis and reduction of soil erosion.[196] Soil erosion can lead to carbon loss and later dissolve carbon into groundwater, rivers, and streams.[197]

The proposal called for the USDA to initiate investment in natural climate solutions using the "Commodity Credit Corporation to finance large-scale investments in climate smart land management practices; prioritize climate smart practices in implementation of Farm Bill conservation programs; and identify opportunities to invest in natural infrastructure."[198] The intent is to establish a carbon bank to "incentivize and reward carbon sequestration activities by farmers, ranchers, and forest landowners; leveraging the nation's crop insurance programs to encourage climate-smart agriculture practices."[199] Similar to Renewable Energy Credits,[200] the idea of creating "market-driven opportunities" such as

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191 Tabuchi & Popovich, *supra* note 2.

192 *Id.* ("The plan would allocate $1 billion to purchase carbon credits from farmers at $20 per ton of carbon they trap in the soil. The Biden transition team claimed it could reduce annual emissions of greenhouse gases by 50 megatons, equivalent to the emissions from more than 10 million cars driven for a year.").

193 Ontl, *supra*, note 190.

194 *Id.*

195 Carbon sink, Oxford Reference Dictionary, https://www.oxfordreference.com/view/10.1093/oi/authority.20110928154323412 (last visited Apr. 22, 2021).

196 Robert J. Zomer et al., *Global Sequestration Potential of Increased Organic Carbon in Cropland Soils*, 7 SCI. REP. (Nov. 14, 2017), https://www.nature.com/articles/s41598-017-15794-8.

197 Ontl, *supra* note 190.

198 Robert Bonnie, Leslie Jones & Meryl Harrell, United States Department of Agriculture (USDA), *USDA - Climate 21 Project Transition Memo* 2, *available at* https://climate21.org/usda/ (last visited Apr 22, 2021).

199 *Id.* at 8.

200 *Renewable Energy Certificates (RECs)*, ENVTL. PROTECTION AGENCY (May 13, 2019), https://www.epa.gov/green-power-markets/renewable-energy-certificates-recs, ("A renewable energy certificate ("REC") is a market-based instrument that represents the property rights to the environmental, social and other non-power attributes of renewable electricity generation. RECs are issued when one megawatt-hour (MWh) of electricity is generated and delivered to the electricity grid from a renewable energy resource.").

carbon trading would incentivize developers' participation and the "carbon bank [would] set a floor price for carbon sequestration in the soil."[201]

The creation of a carbon bank would be an innovative way to federally incentivize farmers to integrate agrivoltaics into their farming practice. The most effective ways to sequester CO_2 from the atmosphere include "forestry, improving vegetative cover, enhancing water use efficiency, reducing soil erosion and adopting better farming systems."[202] While agrivoltaics lacks the photosynthesis aspects of carbon sequestration, the technique does improve vegetative cover with solar panels, enhances water use efficiency through the reduction in evaporation and transpiration, and reduces erosion by protecting soil from harsh winds and heavy rain.[203]

C. Applying States' Current Successful Incentive Programs

Finally, there are a handful of states that have relaxed zoning regulations for agrivoltaics, hoping to provide farmers with economic stability while meeting their Renewable Portfolio Standard goals.[204] It is encouraging to see states adopt innovative regulations to support farmers and clean energy, however, developers likely will not attempt business in states with inconsistent and uncertain policies.[205] "Most states are not willing to preempt local control of solar and other clean energy systems," which results in local legislators holding the power to determine which renewable energy systems are permitted.[206] These localized, inconsistent policy decisions add an additional hurdle for solar installation.

The Intergovernmental Panel on Climate Change published a report outlining the impacts of global warming of 1.5°C above pre-industrial levels, detailing the projected negative outcomes on crop production.[207] "Every fraction of additional warming beyond 1.5°C will result in increasingly severe and expensive impacts [on our environment]," and incentivizing agrivoltaics now, could help reduce

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201 Abbott, *supra* note 15.

202 Chandra Bhushan, *Best Way to Remove Carbon: Sequestering It in Its Natural Sinks*, DOWN TO EARTH (Sept. 7, 2019), https://www.downtoearth.org.in/blog/climate-change/best-way-to-remove-carbon-sequestering-it-in-its-natural-sinks-66492.

203 Barron-Gafford et al., *supra* note 8.

204 *Renewable Portfolio Standards*, NAT'L RENEWABLE ENERGY LAB., https://www.nrel.gov/state-local-tribal/basics-portfolio-standards.html (last visited Apr. 22, 2021) ("A renewable portfolio standard (RPS) is a regulatory mandate to increase production of energy from renewable sources such as wind, solar, biomass and other alternatives to fossil and nuclear electric generation. It's also known as a renewable electricity standard.").

205 Evan Halper, *Rules Prevent Solar Panels In Many States With Abundant Sunlight*, L.A. TIMES (Aug. 9, 2014, 7:16 PM), https://www.latimes.com/nation/la-na-no-solar-20140810-story.html.

206 Nolon, *supra* note 144.

207 THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, https://www.ipcc.ch/ (last visited Apr. 22, 2021) (stating we need to reduce our emission production, and limit global temperature rise to 1.5°C. To achieve that goal, emissions must drop rapidly to 25 gigatons by 2030).

reactionary spending later.[208] While it is important for states and local governments to maintain their autonomy, the climate crisis facing our country requires immediate action.[209] One solution to state uncertainty is federal intervention. Though the federal government may not change municipalities' zoning laws, it has proven, with the ITC, that federal incentives have a significant impact in promoting solar development.[210] Driven by state regulatory inconsistency, the federal government should develop a climate plan that incentivizes implementation of agrivoltaics with a focus on low-income communities.

It is necessary to have standardized incentives to reduce carbon emissions through clean energy while simultaneously strengthening food security. A state program that could be modeled federally and has proven successful statewide was created in Massachusetts.[211] This incentive plan could be applied to states like Arizona and Maryland, where marginalized farmers could benefit from an agrivoltaics system and the diversification of income the energy production provides.[212]

1. Massachusetts

In 2018, Massachusetts became an early adopter of agrivoltaic technology due to the state's renewable energy policy and renewable portfolio standard goals.[213] The state addressed three main issues that commonly attach to the installation of solar over farmland: zoning, incentives, and taxation.[214]

Massachusetts legislators have started to define where solar is permissible in regard to municipal zoning, though more clarity is required.[215] Many zoning laws do not specifically mention solar energy, leading to confusion surrounding the limitations and permissibility of solar installations.[216] In recent years, Massachusetts has created legislation broadening the scope of solar permissibility, stating that "[n]o zoning ordinance or by-law shall prohibit or unreasonably regulate the installation of solar energy . . . except where necessary to protect the

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208 *Emissions Gap Report 2019*, UN ENV'T PROGRAMME (2019), https://wedocs.unep.org/bitstream/handle/20.500.11822/30797/EGR2019.pdf (last visited Apr. 22, 2021).

209 *Id.*

210 *See* discussion *supra* Section II.A.

211 *See* discussion *infra* Section III.A.1.

212 *See* discussion *infra* Section III.A.1I-II.

213 Gellerman, *supra* note 123 ("In 2008 the state passed the Global Warming Solutions Act, making it one of the first in the nation to set strict targets for reducing climate-disrupting greenhouse gas emissions. [In 2018], the state instituted the Solar Massachusetts Renewable Target program (SMART), offering developers a subsidy to expand conventional solar and jump start dual-use technology.").

214 Klavens et al., *supra* note 36.

215 *Id.*

216 *Id.*

health, safety or welfare."[217] This regulation has been narrowly interpreted by courts prohibiting the unreasonable denial of solar permits.[218] Though more guidance from the legislation would further help solar permitting, the trend currently is in favor of solar development.

In fact, Massachusetts further incentivizes the development of solar through a new program that offers a subsidy[219] for dual use projects that combine solar with agricultural production.[220] Under the Solar Massachusetts Renewable Target ("SMART") program, panels must be installed on "property officially defined as Land in Agricultural Use or Prime Agricultural Farmland" principally used for agriculture and horticulture.[221] With the SMART program, Massachusetts recognized the need for additional clean energy, enabling farmers to afford solar without sacrificing or destroying farmland and forests.[222] The SMART program offers incentives known as "adders," establishing six "location based Compensation Rate Adders," one of which is the Agricultural Solar Tariff Generation Unit ("ASGTU").[223] The ASGTUs promote the installation of solar on active farmland, requiring every possible square foot of land to be maintained as continuous agricultural production.[224] In addition to incentivizing preferred projects, the SMART program disincentivizes installations on greenfields.[225]

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217 *Id.*

218 *Id.* at 30.

219 Univ. Mass. Amherst, *Dual-Use: Agriculture and Solar Photovoltaics Center for Agriculture, Food and the Environment*, UMASS (2019) ("In the state of Massachusetts, specific kinds of dual-use systems are known as 'Agricultural Solar Tariff Generation Units,' and can qualify for financial incentives under the SMART program.").

220 Gellerman, *supra* note 123 (remarking that in 2018, Massachusetts introduced the Solar Massachusetts Renewable Target program (SMART), "offering developers a subsidy to expand conventional solar and jump start dual-use technology.").

221 *See* Univ. Mass. Amherst, *supra* note 221.; *see also* Klavens, *supra* note 36, at 32 (Section 1 states that land shall be considered to be in agricultural use when "primarily and directly used in raising animals, including, but not limited to, dairy cattle, beef cattle, poultry, sheep, swine, horses, ponies, mules, goats, bees and fur-bearing animals, for the purpose of selling such animals or a product derived from such animals in the regular course of business." Section 2 states that land shall be considered to be in horticultural use when "primarily and directly used in raising fruits, vegetables, berries, nuts and other foods for human consumption for the purpose of selling these products in the regular course of business.").

222 John Fitzgerald Weaver, *Agrovoltaics: A Solar-Powered Safety Net for Massachusetts Farmers*, PV MAG. (Sept. 18, 2018), https://pv-magazine-usa.com/2018/09/18/agrovolatic-solar-power-on-farms-in-massachusetts-smart-program/.

223 Klavens et al., *supra* note 36.

224 *See* Univ. Mass. Amherst, *supra* note 221.

225 Greenfields are new, undisturbed pieces of land that are green, as the name suggests. Greenfields are in contrast to Brownfields, which have already been developed, graded, or abandoned. An example of a green field is forested area or undisturbed field, where brownfield sites refer to previously used industrial or manufacturing plants, previous solar sites, dumps, carports, and generally disturbed land. The main issue with installing on brownfield sites is the condition of the property, where existing substances, pollutants of containments can exist. *See generally* Muhammad Rafiq. et

Some environmentalists view solar installation on greenfield sites, such as open space, forested land, farmland, as less desirable than development on "rooftops, parking lots, brownfields, and other previously developed sites."[226] The SMART Program created "greenfield subtractors," which reduce the incentive payments for solar facilities located on greenfield sites, as brownfields are preferred installation locations. [227] ASTGUs are exempt from this subtractor because the land will be maintained as an active farm. [228]

Finally, the SMART program addresses tax exemptions that are applied to land actively used for agriculture or horticulture, entitling the property to reduced tax rates.[229] Farmers without solar qualify for this reduced property tax, and Massachusetts legislators agreed that if the land was still being used primarily for farming, even with the addition of solar, the property should maintain the reduced rate.[230] If the tax exemption was removed upon the installation of solar, the increased property taxes would negate the incentive applied to agrivoltaics sites, "potentially reducing benefits to the farmer."[231]

The SMART program is a complex plan to increase solar in Massachusetts. While the program has experienced some growing pains, SMART has also proven to be so successful the state doubled the program's capacity while "expand[ing] eligibility criteria for low-income solar projects."[232]

Presently, Massachusetts solar stakeholders, such as Vote Solar, feel the program does not go far enough to serve "low-income, environmental justice and other disadvantaged communities."[233] "Low-income customers in Massachusetts have the highest energy burden of any electric customer in the commonwealth," spending a higher percentage of their monthly income on their electric bill compared to wealthy populations in the state.[234] To truly achieve energy equity in Massachusetts, the state needs to focus more resources on low-income energy

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al., *Brownfield, Greenfield, and Renewable Energy Consumption: Moderating Role of Effective Governance*, 31 ENERGY & ENV'T 405 (May 2020) https://doi.org/10.1177/0958305X19872936.

226 Klavens et al., *supra* note 36.

227 *Id.*

228 *Id.*

229 *See generally* MASS. GEN. LAWS ANN. ch. 61A (2021).

230 Klavens et al., *supra* note 36.

231 *Id.* at 32.

232 Colin A. Young, *New State Rules Aim To Double Solar Power Capacity*, WBUR (Apr. 15, 2020), https://www.wbur.org/news/2020/04/15/massachusetts-rules-solar-power.

233 *Id.*

234 Nathan Phelps, *Eversource, Solar and Low-income Advocates Submit New Guidelines for Solar Program*, VOTE SOLAR (July 2, 2020), https://votesolar.org/eversource-solar-and-low-income-advocates-submit-new-guidelines-for-solar-program/.

customers, which includes minority farmers, who represent 3.3% of total producers in the state.[235]

2. Arizona

"Long before Arizona was incorporated into the United States, agriculture thrived in the region."[236] Archeologists have discovered remnants of "Indigenous people growing gardens to sustain their families" dating back more than 4,000 years.[237] Agriculture was one of Arizona's original leading exports, remaining significant in rural areas of the state.[238]

Native Americans comprise 5.47% of Arizona's total population, which is far greater than the proportion of Native Americans among the United States population as a whole, estimated at 0.9%-1.7%.[239] Arizona has the highest percentage of Native American principal farm operators, with 53.9% of the population owning and operating farms, making agriculture an "economic mainstay of resident Native Americans."[240] According to the USDA National Agricultural Statistics, Navajo Nation counties, including Apache, Coconino, and Navajo, account for 62% of the state's total farms, and 95% are family owned.[241] However, even with representation in the agricultural industry, the USDA reported that 25% of Native American children struggled with food insecurity, while the food scarcity statistic of the total Arizona population was closer to 12.4%.[242]

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235 Univ. Mass. Amherst, *Demographics of Primary Producers: Race Center for Agriculture, Food and the Environment*, UMASS (Jan, 27, 2020), https://ag.umass.edu/resources/massachusetts-agricultural-data/farm-operators/demographics-of-farm-operators-gender-0.

236 ARIZ. DEP'T. OF AGRIC., *GUIDE TO AGRICULTURE*, 8 (2018).
https://agriculture.az.gov/sites/default/files/AZDA_GuideToAZAg-R5.pdf.

237 *Id.*

238 *Id.* ("Today, agriculture in Arizona contributes more than $23.3 billion to the state's economy. One study puts the number of jobs supported by agriculture at approximately 138,000, and the number of workers employed at 162,000.").

239 ARIZ. DEPT. OF COM., ARIZ. ECON. PROFILE (2010), https://www.doleta.gov/Programs/2008ReportsAndPlans/Economic_Analysis_Reports/AZ.pdf.; *see generally* U.S. CENSUS BUREAU, C2010BR-10: 2010 Census Briefs: The American Indian and Alaska Native Population: 2010 (Jan. 2012). However, this data might be inaccurate as Native Americans are usually underrepresented on government census data.

240 Debaleena Majumdar, et al., *Dual use of agricultural land: Introducing 'agrivoltaics' in Phoenix Metropolitan Statistical Area, USA*, 170 LANDSCAPE & URBAN PLANNING 150 (Feb. 2018), https://doi.org/10.1016/j.landurbplan.2017.10.011.

241 Lee Allen, *USDA reports Arizona has the largest concentration of Indian farms,* INDIAN COUNTRY TODAY (Feb. 20, 2020), https://indiancountrytoday.com/culture/usda-reports-arizona-has-the-largest-concentration-of-indian-farms.

242 *Id.*

Along with food scarcity, Arizona is faced with water shortages as the fastest warming state in the United States.[243] Arizona has an arid climate, consisting of mostly desert regions.[244] Because of Arizona's biosphere, water scarcity remains a concern for farmers, putting conventional agriculture at risk, which is projected to worsen with climate change.[245] "Irrigated agriculture is the largest user of water in Arizona, consuming about 74 percent of the available water supply," according to the Arizona Department of Water Resources.[246] As the lakes and rivers providing water to the region drain faster than they can refill, Arizona could reach a "critical stage within the next few years."[247]

An agrivoltaic system would be a practical solution to water scarcity, food insecurity, and revenue diversification in this region.[248] In fact, the NREL study "found that many of our food crops do better in the shade of solar panels because they are spared from the direct sunlight."[249] NREL researchers further explained many agricultural crops struggle to adapt to desert climates, and successful cultivation requires intensive irrigation.[250] Alternatively, instead of using copious amounts of water, mimicking some of the natural adaptations used by dry-climate plants would help reduce water usage and create crop resiliency.[251] One example of natural adaptation in harsh habitats is seen when crops grow in the shade of other cover plants, a harmonious occurrence agrivoltaics imitates.[252]

While Arizona does not currently have regulations involving agrivoltaics, it is the host state to one of the most influential agrivoltaic studies in the United States.[253] With the research conducted at the University of Arizona, in partnership

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243 CLAUDIA TEBALDI ET AL., THE HEAT IS ON: US TEMPERATURE TRENDS (2012), https://www.climatecentral.org/wgts/heat-is-on/HeatIsOnReport.pdf.

244 JAMES W. BYRKIT, *Arizona*, ENCYCLOPEDIA BRITANNICA, https://www.britannica.com/place/Arizona-state (last updated Feb. 18 2022)

245 Barron-Gafford et al., *supra* note 8.

246 ARIZ. DEP'T. OF WATER RES., *Conservation* https://new.azwater.gov/conservation/agriculture (last visited March 27, 2022).

247 ARIZONA'S WATER FUTURE: COLORADO RIVER SHORTAGE, INNOVATIVE SOLUTIONS, LIVING WELL WITH LESS (2017), https://westernresourceadvocates.org/publications/arizonas-water-future-colorado-river-shortage-innovative-solutions-living-well-less/ ("Arizona and the Southwestern United States are facing perhaps their greatest challenge since the settlement of the region and development of modern cities, agriculture, and industry. Arizona's "bank" for 40% of its water – Lake Mead on the Colorado River – is being drained faster than it can be filled. Projections show that if no action is taken to address the gap between supply and demand, Lake Mead could reach a critical stage within the next few years, triggering progressively larger, mandatory restrictions on Colorado River water use that could have a devastating impact on Arizona's communities, agriculture, environment, and economy.").

248 Majumdar, *supra* note 242 ("The premise of agrivoltaics comports well with the intentions of many metropolitan areas around the world that have started to promote local farming.").

249 *See Benefits of Agrivoltaics Across the Food-Energy-Water Nexus, supra* note 5.

250 *See generally* Barron-Gafford et al., *supra* note 8.

251 *See generally Id.*

252 *See generally Id.*

253 *See generally Id.*

with NREL, agrivoltaics is proven to be a beneficial, synergistic solution to clean energy and food production.[254] Creating an affordable path to the purchase and implementation of an agrivoltaics system is crucial to mitigate the negative effects of climate change.

3. Maryland

Agriculture remains the largest commercial industry in Maryland, and accounts for the largest single land use.[255] The eastern shore of Maryland holds the majority of crop and agricultural land, with 48% of total land use identified as agricultural, followed by woodland and coastal wetlands.[256]

In 1910, census data shows that at their peak number, there were 6,382 Black farmers in the state of Maryland.[257] Today, there are only 277 Black farmers reported in the Maryland Census.[258] Black farmers represent 1.3% of the farmer population in the state,[259] a number well below the 29.72% of Black citizens that make up the state's population.[260] While Maryland has a higher average of people identifying as Black or African American, in comparison to the 13.4% shown in the United States census, that population is underrepresented in the farming industry.[261] With "legal loopholes that made it possible for land to be taken from Black farmers and discrimination in laws that make it more difficult to pass down land," Black farmers in Maryland have lost the majority of their land. [262]

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254 *See* Brean, *supra* note 81.

255 *Maryland at a Glance*, MARYLAND AGRICULTURE & FARMING, https://msa.maryland.gov/msa/mdmanual/01glance/html/agri.html (last visited Apr. 22, 2021), ("Agriculture is the largest commercial industry in Maryland, employing some 350,000 people, including nearly 6,000 full-time farmers, and contributing some $8.25 billion annually to the economy. Agriculture also remains the largest single land use in the State, 2 million acres, or roughly 32 percent of total land area used for farming in 2021.").

256 JUDITH M. DENVER, ET AL., WATER QUALITY IN THE DELMARVA PENINSULA DELAWARE, MARYLAND, AND VIRGINIA, 1999-2001: USGS CIRCULAR 1228 (2013).

257 6 U.S. DEPT. OF AGRIC. CENSUS 699, 725 (1910)

258 1 U.S. DEPT. OF AGRIC. MD. CENSUS 62, 62 (2017).

259 *Id.*

260 *Maryland Population*, POPULATIONU, http://www.populationu.com/us/maryland-population (last visited 3/11/2022).

261 *QuickFacts*, U.S. CENSUS BUREAU (July 1, 2019), https://www.census.gov/quickfacts/fact/table/US/RHI225219#RHI225219.

262 Hannah Himes, *'This Is for Us': A Look at Inequity in Local Agriculture*, FREDERICK NEWS POST, July 21, 2020, https://www.fredericknewspost.com/news/economy_and_business/this-is-for-us-a-look-at-inequity-in-local-agriculture/article_025ec764-61c7-5c28-b774-267c6cf131e3.html. (specifically stating that "as recently as 1997, the Agriculture Department determined that in the southeastern U.S., loan applications from Black farmers took three times as long to be processed as for white farmers.").

Additionally, the lack of infrastructure and access to capital has caused many Black and minority farmers to lose their acreage.[263] Due to price fluctuation and a decreased demand for American crops, many farmers are forced to switch to commodity crops and animal husbandry.[264] This is true for the eastern shore, which once grew "a diversity of staple produce crops, or 'truck crops,' including sweet potatoes, tomatoes, green peppers, snap beans, lima beans, and more."[265] Today, most farmers on the Eastern Shore grow corn, soy, or raise poultry.[266]

With the introduction of agrivoltaics, farmers could continue to raise chickens under the panels or return to more profitable crop production with the added financial stability the solar production provides. Studies have shown that certain truck crops, such as tomatoes and green peppers, have thrived underneath solar panels.[267] By creating a federal incentive allowing minority farmers the ability to afford energy infrastructure and in turn diversify their income, farmers would have higher retention of landownership.[268]

Maryland is currently considering legislation to "Promote Complementary Practices Like agrivoltaics and Pollinator Habitat," but require further research into "other states/regions in order to better understand the feasibility of dual-use farming in Maryland."[269] Maryland's acknowledgment of agrivoltaics is encouraging, but progress to lower carbon emissions in our atmosphere requires urgency.[270] Creating a national incentive would provide the immediate funding required to implement agrivoltaics systems while allowing states time to refine their individual incentive programs.

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263 Hannah Jo. King, NEEDS ASSESSMENT OF BLACK FARMERS ON THE DELMARVA PENINSULA: NEW RESEARCH TO RECOMMEND INTERVENTION PRIORITIES, 17-18 (2016), https://www.thecommonmarket.org/assets/uploads/reports/Needs-assessment-of-black-farmers-on-the-delmarva-peninsula-screen-publication.pdf.

264 *Id.* at 8, ("On the Eastern Shore today, poultry operations are concentrated on fewer and larger farms, while corn, wheat and soybeans have grown up as the most common commodity crops.").

265 *Id.*

266 *Id.*

267 *See generally* Barron-Gafford et al., *supra* note 8.

268 King, *supra* note 264, at 18 ("Interview respondents also noted the need to have access to debt-free capital and infrastructure. Given the history of loan discrimination towards the African American community, particularly in agriculture, the hesitation for black farmers to take on debt is not surprising . . . .").

269 GOVERNOR'S TASK FORCE ON RENEWABLE ENERGY DEVELOPMENT AND SITING, FINAL REP., 56 (Aug. 14, 2020), https://governor.maryland.gov/wp-content/uploads/2020/09/REDS-Final-Report.pdf.

270 *See generally* Chris Carnevale, *New Report Shows Urgency of Picking Up Pace of Climate Action*, CLEAN ENERGY (Nov. 29, 2019), https://cleanenergy.org/blog/new-report-shows-urgency-of-picking-up-pace-of-climate-action/.

V. CONCLUSION

The Biden administration has set ambitious goals to combat systemic racist practices against minority farmers and bolster rural energy and food security, while reaching carbon neutrality by 2035. Agrivoltaics has the potential to enable the achievement of many of the Biden administration's goals while supporting minority communities, clean energy infrastructure, and food security. While more research is warranted to perfect this technique, there is strong support for the colocation of PV modules and agricultural or horticultural production.

With so many potential benefits, incentives and clear regulations are needed to allow farmers the opportunity to diversify their income and generate clean energy while maintaining farming practices. The prohibitive up front capital cost is a main hurdle to the achievement of agrivoltaics. As sunsetting incentives and state zoning restrictions obstruct innovation through the application of agrivoltaics, it will be important for the Biden administration to offer additional financial help to struggling farmers, especially Black and Native American farmers who have historically been discriminated against.

New and creative methods of incentivizing carbon reducing farming practices could help support the implementation of agrivoltaics. With grants, subsidies, and incentives, the administration could jump start installations. The government has been successful with the introduction of the ITC, and a similar incentive for carbon sequestration such as a carbon bank could accomplish the same result focused on the agricultural community.

Finally, state guidance around agrivoltaic incentive programs could help standardize the incentives, allowing for more stability in investment. With more predictable incentive structures, developers can forecast the future of projects. This stability would allow for increased investment, benefiting farming communities. Where some states, such as Massachusetts, have shown significant accomplishments, there remains a lack of focus on low-income and marginalized communities. With states like Maryland and Arizona holding the majority of Black and Indigenous farming land, it is important for these states to adapt to our changing climate and empower these communities to achieve stability, electricity, and food security.

As the climate crisis continues to threaten our planet, new techniques to ensure food security and energy production are required, and agrivoltaics presents a revolutionary way to achieve those goals. With support from the Biden administration, rural and minority communities could be part of the solution with clean energy infrastructure and carbon reducing farming practices.