# Climate Advantage CP-NWG 2024

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## Strategy

Hello! This CP is an advantage CP to solve for AFFs terminal impacts without linking to most core negative generics. The CP does not engage in “decarbonization”- i.e. reduce the production of CO2 by electricity generation. Albeit decarbonization is a vague term, it most certainly necessitates the reduction of carbon production. This strategy enables negatives to read fossil fuel, clean energy, or politics disadvantages to decarbonization while claiming to solve for the affirmatives impacts. 1NC Ou et al. ’22 out the gate states the CP is a “non-CO2 mitigation action.”

## 1NC

### 1NC- CP

#### Text: the United States should substantially

#### Increase investment plant-based protein to reduce livestock emissions, and

#### increase global reforestation investments.

#### A shift toward plant-based protein reduces methane emissions and promotes global environmental biodiversity without linking to decarbonization

Ou et al. ’22 (Yang Ou 1, Gokul Iyer 1, Allen Fawcett 2, Nathan Hultman 3, Haewon McJeon 1, Shaun Ragnauth 2, Steven J. Smith 1, James Edmonds, “Role of non-CO2 greenhouse gas emissions in limiting global warming”, <https://www.sciencedirect.com/science/article/pii/S2590332222005887>, December 16, 2022)

One way to facilitate non-CO2 mitigation actions is leveraging the synergetic benefits of non-CO2 abatement with other non-climate goals for sustainable development. Some non-CO2 abatement measures can be aligned with multiple sustainable development goals (SDGs). For example, reducing methane emissions will reduce background ozone levels, which not only reduces climate warming but also will reduce ozone-related impacts on human health (SDG 3) and agricultural productivity (SDG 2).19 Studies have also shown that excess meat consumption is associated with elevated risks of cardiovascular diseases,20 which is the leading cause of death globally. Thus, a diversified diet shifting toward plant-based protein would reduce livestock emissions (about half of which are methane emissions) and promote global public health and human wellbeing (SDG 3), and help preserve natural land for biodiversity (SDG 15). Furthermore, transitions away from fossil fuels, especially phasing out the incomplete combustion of coal/biomass used in heating/cooling in low-income countries, will not only reduce non-CO2 emissions (e.g., nitrous oxide, methane) but also reduce co-emitted air pollutants, which will further help offset the loss of aerosol-driven climate cooling forces, engendering greater climate and health benefits (SDG 13 and SDG 3).

#### And- reforestation operates as a “carbon sink” to ensure net zero while kick-starting economic funding initiatives

Denis and Hamilton ’22 (Nicolas Denis, Nicolas is a partner in McKinsey’s Brussels office. He supports clients in the fields of sustainable agriculture and fisheries, land use, and biotech, and also works on topics involving biofuels, biochemicals, and bioenergy. In addition, Nicolas advises government bodies on sustainable economic development, agriculture, and food security, especially in developing and emerging countries. He works on these issues globally, but with a special focus on the Middle East and North and East Africa. Within McKinsey, Nicolas is a leader of our Sustainability Practice and our Social Sector Practice, Alastair Hamilton, Alastair is a partner in McKinsey’s London office and serves public- and private-sector clients on sustainability and energy transition topics, “Forestry”, <https://www.mckinsey.com/capabilities/sustainability/our-insights/spotting-green-business-opportunities-in-a-surging-net-zero-world/transition-to-net-zero/forestry-and-other-land-use>, August 1, 2022)

Stopping deforestation will be critical to halting climate change. Natural climate solutions could provide new lines of revenue as the world’s carbon markets mature. Every year, about ten million hectares of land—an area roughly the size of South Korea—are deforested, mainly to clear land for commercial or subsistence agriculture. Forestry and other land use accounts for nearly 14 percent of annual global CO₂ emissions, 5 percent of methane emissions, and 5 percent of nitrous oxide emissions.¹ Deforestation primarily effects the world in four ways: it raises emissions, it reduces carbon-capture capacity, it results in further decline in biodiversity, and it impacts millions of people who make their living in and around forests. While reforestation will be important, halting, reducing, and avoiding deforestation can prevent emissions immediately, compared with the climate benefits of reforestation, which can take, on average, over 25 years. Opportunities that could be derived from forest protection, restoration projects, and diversification may include the sale of carbon credits in carbon markets, including voluntary carbon markets. Based on net-zero commitments today from more than 700 of the world’s largest companies, there have already been pledges of around 0.2 gigatons of CO₂ in carbon credits by 2030². In addition, businesses may find opportunities from the sale of biomass for construction or as feedstock, and from the rise in ecotourism. For more on how eight industries may transition in a 2050 net-zero scenario, see “Spotting green business opportunities in a surging net-zero world.” Market opportunities Forests can provide biomass, and reforestation and conservation may create new opportunities in industries such as ecotourism. McKinsey analysis reveals land and water conservation could support 30 million jobs in ecotourism if efforts doubled by 2030. $40 billion annual average capital spending in avoided deforestation and land restoration 90 percent of deforestation is driven by expansion of agricultural land. Improved agricultural practices to aid food production without expanding agricultural land area would grow Investment in natural climate solutions on the rise Investing in nature via reforestation, conservation, and land-management actions that increase carbon storage offers a way to reduce emissions, preserve nature, and strengthen the carbon-credit marketplace. Investment As a core component of corporate climate mitigation, natural-climate solutions (NCS) are becoming mainstream, if not yet commonplace. While undersized overall, NCS now account for around 40 percent of retired carbon credits in voluntary carbon markets, up from only 5 percent in 2010. Leaders are also beginning to invest directly in nature through protecting and restoring large expanses of land and ocean. Challenges Challenges to scaling NCS investment include building trust, creating regulatory clarity, enforcing and aligning stakeholders around standards and infrastructure, and more rigorous measurement and verification practices. Opportunities Commercial opportunities to unlock NCS potential exist. For example, enabling technologies such as enhanced tree-planting technologies, or software that can improve the effectiveness and monitoring of NCS. Regional economic opportunities for NCS can also foster capital flows to forest-rich countries in the Global South in support of sustainable development. For example, by 2030 capital flows greater than $100 billion could go to countries in the Global South from close to 7 gigatons of CO₂ captured in annual potential. ³

## 2NC

### 2NC- Overview

#### The CP solves 100% of case…. [insert explanation of how it solves each AFF advantage/terminal impact] without engaging in reducing carbon output from electricity generation.

#### 2 framing issues:

#### 1---Sufficiency Framing – a tiny risk of a net benefit outweighs an unquantifiable impact to a deficit – process cultivates better decision-making

#### 2---Judge Kick---if we lose the counterplan, then kick it for us---it’s a logical extension of conditionality

#### The internal net benefit outweighs and turns case- [insert explanation]

#### Decarbonization alone fails- methane operates as an alt cause to AFF solvency

Kuylenstierna et al. ’21 (Johan C.I. Kuylenstierna, Eleni Michalopoulou, Frances Dixon, “Why we must reduce methane emissions now to solve the climate crisis”, <https://www.sei.org/features/why-we-must-reduce-methane-emissions-now-to-solve-the-climate-crisis/>, May 12, 2021)

The launch of the new Global Methane Assessment﻿ last week identifies an important opportunity to reduce the rate of global warming and achieve significant health and development benefits by reducing methane emissions from human sources. / Published on 12 May 2021 waterlogged rice paddy Photo: Yaorusheng / Getty Images﻿. The importance of methane has been underestimated and overshadowed by the urgent need to reduce carbon dioxide emissions. Climate actions to reduce methane are often included as ‘CO2 equivalents’ in national climate plans, like in commitments made by countries in the Paris Climate Agreement. But the impact of methane and carbon dioxide are not equivalent. While the focus to reduce climate change has rightly been placed on carbon dioxide, methane is the second most important greenhouse gas that has given rise to the warming experienced to date, and is also a major precursor of ground-level ozone formation, a pollutant that negatively impacts health and crop yields. The atmospheric concentration of methane is increasing faster now than at any time since the 1980s, with more than 50% of global methane emissions stemming from human activities in the fossil fuel, waste and agriculture sectors. Compared to carbon dioxide, methane however is relatively short-lived in the atmosphere, with a lifetime of about 12 years. This means that taking action now can quickly reduce methane concentrations, resulting in a similarly rapid reduction in warming of the climate. By using five state-of-the-art modelling tools, the new Global Methane Assessment﻿﻿ identifies important opportunities to reduce the rate of global warming and achieve significant health and development benefits by specifically reducing methane emissions from human sources. The conclusion? Now is the time for methane reduction to be a high priority. Here are three reasons why. 1. Reducing methane now will avoid nearly 0.3oC of warming by 2045 More than half of global methane emissions arise from human activities and 95% of these emissions come from three sectors: 35% from fossil fuels (23% from oil and gas, and 12% from coal) 20% from waste (including the waste sector, landfills and waste water) 40% from agriculture (32% from livestock, and 8% from rice cultivation) The implementation of methane reduction measures on human sources of methane now could reduce methane emissions by as much as 45% by 2030. According to the Assessment, this would avoid nearly 0.3oC of warming after 2040, contributing significantly to keeping the 1.5oC Paris Agreement target within reach. To limit warming to 1.5oC at the lowest cost, methane emissions need to be reduced across the three main emitting sectors by 2030 as follows: Limiting warming to 1.5°C at the lowest cost by 2030: methane emissions need to be reduced in each of the three main emitting sectors: fossil fuels, 60%; waste, 30 to 35%; agriculture, 20 to 25% (reductions relative to 2020 emissions). Image: CCAC. All rights reserved. Reduction in methane emissions required per sector, as a percentage of total sector methane emissions. 2. Reducing methane now will protect human health and crop yields As methane not only warms the atmosphere as a greenhouse gas, but is also a major precursor in the formation of ground-level ozone, there are significant additional health, economic and development benefits from acting on methane now. A 45% reduction in human-caused methane emissions by 2030 equates to a reduction of 180 million tonnes of methane emissions per year. This would vastly reduce the formation of and exposure to ground-level ozone. Each year after 2040, this would globally prevent: 255 000 premature deaths 775 000 asthma-related hospital visits 26 million tonnes of crop losses globally, and 73 billion hours of lost labour from extreme heat. Ground-level ozone is the most potent air pollutant affecting crop yields and forest productivity, by suppressing plant growth and yield. Reducing methane to reduce ozone concentrations could avoid the loss of a combined 26 million tonnes of wheat, maize, soybeans and rice each year. This is roughly 1-2% of the global yield of these four staple crops in 2020. Given the increasing global population, and demand for food and land to produce it, this benefit is also highly significant. soybean farming in US Photo: John P Kelly / Getty Images﻿. 3. Reducing methane now is cost-effective and the tools are readily available Reducing human-caused methane emissions is one of the most cost-effective strategies to rapidly reduce the rate of warming and contribute significantly to global efforts to limit temperature rise to 1.5oC. Implementing already known methane reduction measures in the fossil fuel, waste and agriculture sectors are cost-effective and can be implemented quickly. Implementing existing measures in these sectors would reduce methane emissions by 120 million tonnes per year, making up nearly 70% of the total 180 million tonnes per year reduction required by 2030, to avoid 0.3oC warming by 2045. \*Mt/yr = million tonnes per year Around 35% of this 180 million tonnes per year reduction comes from implementing existing measures in fossil fuel management: oil and gas sector: 29–57 Mt/yr\* e.g. recovery and utilization of vented gas, improved control of unintended emissions from the production of oil and natural gas coal sector: 12–25 Mt/yr e.g. pre-mining degasification, flooding abandoned coal mines Around 18% of the reduction comes from implementing existing measures in waste: waste sector: 29– 36 Mt/yr e.g. in solid waste management: no organic waste in landfill, source separation with recycling/reuse; in wastewater treatment: upgrade to two-stage treatment with biogas recovery Around 17% of the reduction comes from implementing existing measures in agriculture: rice: 6–9 Mt/yr e.g. intermittent flooding and draining, direct wet seeding, use of hybrid species livestock: 4– 42 Mt/yr e.g. feed changes and supplements, selective breeding to improve productivity and animal health/fertility. Around 30% of the reduction comes from implementing additional measures not focused primarily on methane: 60 million tonnes per year up to 2030 are assumed to come from measures related to: energy e.g. implementing renewable energy for power generation, improved energy efficiency waste e.g. reduced food waste, reduce food loss and waste healthy diets e.g. reduced consumption of red meat and dairy Roughly 60% of readily available reduction measures that need to be implemented to achieve the 45% reduction by 2030 have low or ‘negative’ costs. 82 million tonnes of methane emissions per year could be reduced by low-cost measures (at a cost of less than US$600 per tonne). ‘Negative’ cost measures (measures that pay for themselves over their lifetime) can reduce emissions by about 40 million tonnes of methane per year. Most of these ‘negative cost’ measures are in the oil and gas industry. 60-80% of oil and gas measures could be implemented at negative or low cost 55-98% of coal measures could be implemented at negative or low cost 30-60% of waste measures could be implemented at negative or low cost Case study 1: Cote d’Ivoire SEI and others engaged in the Climate and Clean Air Coalition’s SNAP﻿ initiative have been supporting countries to develop their methane reduction scenarios. At the national scale, by working with practitioners from environment ministries or universities, it is possible to understand how national development plans will affect methane emissions in the future. One example of this is from working with the Ministry of Environment in Cote d’Ivoire. Rice is an important staple crop and at the moment a significant amount is imported. The plan is to satisfy future demand for rice through national production in paddy fields. This will increase methane emissions, but if this expansion is done by using intermittent flooding and draining techniques, the increase in methane emissions can be controlled. If applied to existing rice growing, it can lead to a net reduction in methane emissions from this source in Cote d’Ivoire. Case study 2: Bangladesh In Bangladesh, SEI has supported the development of an officially endorsed National Action Plan for reducing short-lived climate pollutants (like methane). The Plan identified five priority measures to reduce methane, which included: bringing 20% of irrigated land under intermittent flooding and draining techniques by 2030, and 100% of irrigated land by 2040; reducing emissions from livestock by 25% through manure management and biogas development; reducing methane from wastewater by improving the management of human waste; reducing methane from ruminant animals by changing diets; and reducing methane from municipal waste, by diverting and composting organic matter, and using landfill gas to produce electricity. Where do we go from here? The drive for decarbonization to cut global greenhouse emissions is critical, and as we move away from fossil fuels, we will inevitably reduce methane emissions too. But decarbonization alone will not be able to reduce methane emissions to the extent we need. We must also put methane at the forefront of climate action this decade. By starting now, over the next decade, we have a huge opportunity to help limit global warming to 1.5°C above pre-industrial levels and reduce health and crop impacts from ozone, through targeted and rapid reductions in methane emissions. If this is to become reality, we need to establish the goal of reducing methane emissions by 45% by 2030, as the scientific benchmark for policymaking on methane regulation.

### 2NC- CP Solves Climate/ Environment

#### Both planks solve climate crisis and environmental collapse-

#### First- A shift toward plant-based protein reduces methane emissions and promotes global environmental biodiversity – that’s Ou et al. ‘22

#### More evidence- Plant based protein investments are the best investment to combat climate change and agricultural methane production

Morach et al. ’22 (Benjamin Morach Managing Director & Partner Zurich Malte Clausen Partner & Associate Director Copenhagen Jürgen Rogg Managing Director & Senior Partner Zurich Michael Brigl Managing Director & Senior Partner Munich Ulrik Schulze Managing Director & Senior Partner, Global Sector Leader, Biopharmaceuticals Zurich Nico Dehnert Alumnus Markus Hepp Alumnus Veronique Yang (杨立) Managing Director & Senior Partner Shanghai Torsten Kurth Managing Director & Senior Partner Berlin Elfrun von Koeller Managing Director & Senior Partner Denver Jens Burchardt Managing Director & Partner Berlin Björn Witte Managing Partner & CEO, Blue Horizon Przemek Obloj Managing Partner, Blue Horizon Sedef Koktenturk Managing Partner & COO, Blue Horizon Friederike Grosse-Holz Director, Blue Horizon Olivia Stolt-Nielsen Meinl Director, Blue Horizon, “The Untapped Climate Opportunity in Alternative Proteins”, <https://www.bcg.com/publications/2022/combating-climate-crisis-with-alternative-protein>, July 8, 2022)

Alternative Proteins Can Contribute to a More Sustainable Food System. More emissions are prevented per dollar invested into alternative (or non-animal) proteins than in any sector—three times greater than investing in transportation or buildings. Give credit to the consumer. Our latest research shows that people around the world are buying into alternative proteins—and are very happy with what they find. The market share projections that we made in our first Food for Thought report in 2021 are bearing out: current forecast models indicate that alternative proteins will represent 11% of all protein consumption by 2035, and with some help from technology, investors, and regulators, alternative proteins could command 22% of the global market over this time frame. This is good news for everyone involved in the global effort to combat climate change. The food system accounts for 26% of current global greenhouse gas (GHG) emissions. Animal agriculture, the largest GHG emitter within the food system, is responsible for 15% of global emissions, roughly matching the emissions from the transportation sector. If we remain on track for an 11% share for alternative proteins by 2035, we will see a reduction of 0.85 gigaton of CO2 equivalent (CO2e) worldwide by 2030—equal to decarbonizing 95% of the aviation industry. In comparison with other solutions, such as flying less or retrofitting existing housing stock, the economic and individual consumer tradeoffs involved in shifting to alternative proteins are relatively small. Our survey shows that consumers understand this: more than 30% of consumers consider having a major positive impact on climate to be a primary reason to switch to alternative proteins. And this is exactly what alternatives proteins do. Investing in the segment has the highest CO2e savings per dollar of invested capital of any sector. The emission savings can be translated into a financial gain when assessed in terms of the market value of avoided CO2e emissions per dollar invested in mitigation efforts. To borrow a concept from finance, we call this impact return on capital employed, which Blue Horizon has coined as IoCE, or impact on capital employed. Given an estimated emissions value of $50 to $80 per ton of CO2e, a total addressable market (TAM) transformation would yield emission savings worth $303 billion to $484 billion. The resulting IoCE of $221 billion to $354 billion per trillion dollars of invested capital is at least three times greater than anything corresponding abatement investments in other high-emitting sectors of the economy, such as transportation or buildings, can achieve. (See Exhibit 1.) The protein transformation is one part of a broader remodeling of the food system. As value pools form around new technologies and processes that help address such critical issues as taste, health, and cost, the need for some long-standing processes, such as animal slaughtering and meat packing, will decline. Every stakeholder along the value chain is likely to feel the impact of the transformation, and many will find big opportunities in contributing to building a sustainable food system. Consumers Are Enticed Alternative proteins have made substantial strides with consumers, who are broadly aware of this emerging food category and are favorably impressed when they try available products. (See Exhibit 2.) A 2022 survey by BCG and Blue Horizon, encompassing more than 3,700 respondents in seven countries, reveals that consumers in most markets appreciate the product attributes of taste, nutritional value, and health the most. We also found that improvements in three key areas—health, taste, and price—are key to boosting demand. Approximately 75% of respondents said that having a healthier diet is the primary motivator for them to start consuming alternative proteins. When it comes to making a purchasing decision between several products, though, taste emerges as a key criterion. Price remains a sticking point in all markets. Consumers are not prepared to pay a premium for a product that offers only taste parity with animal-based products. Since almost a third of consumers say that they would switch their diets to alternative proteins if doing so would have a major positive impact on climate, there is a clear need for more active positioning and consumer education. Consumers in all markets express a strong willingness to shift their consumption patterns further if their biggest inhibitions regarding the products—health and nutrition, taste, and safety—are addressed. In that case, the share of respondents who consume mostly or only alternative proteins would double (from 13% to 27%), and the number of people who balance consumption between alternative and conventional proteins would increase by almost a third. Other Stars Align Multiple factors have been fueling progress. Venture capital invested in alternative proteins rose at an annual rate of 124%, from $1 billion in 2019 to $5 billion in 2021, according to the Good Food Institute. Investment in fermentation-based and animal-cell-based companies, two newer technologies, is soaring. From 2019 to 2021, the former rose more than 137%, from $300 million to $1.7 billion, and the latter rose more than 425%, from $50 million to $1.4 billion. Many traditional food companies are investing in alternative proteins as well. In 2020, corporations participated in about 60% of funding rounds. Although this figure fell in 2021 because of the rapid growth in investments in cell- and fermentation-based proteins—which attract more venture capital and less corporate funding—corporations are continuing to make valuable non-cash investments. Brewers, for example, not only invest in startups, but also give partners access to their production facilities and skilled employees. The overall growth in alternative protein investments is consistent with a broader focus on sustainable investing globally, which is growing three to five times faster than traditional investing, with a focus on solutions to the climate crisis. Advances in technology have occurred along the entire alternative protein value chain and are helping bring new products to market. Costs are falling, drawing them closer to parity with conventional animal protein products, and hybrid products are emerging as a way for fermentation- and animal-cell-based ingredients to reach consumers more quickly. Regulators worldwide are facilitating progress. Since 2015, when Israel announced that its novel framework for regulating food safety would apply to alternative proteins, other regulators have followed suit. New and revised procedures address issues ranging from biotech hubs (Middle East and Singapore) to the evolving needs of startups (US and Israel) to resource scarcity, supply security, and independence (Middle East, Singapore, and China) to protein deficiency (India) to food safety (China) to climate goals (Europe). Approval procedures for plant-based products are generally well established, and procedures for fermentation-based and cell-based products are accelerating. A Big Climate Impact All of this progress comes at a critical time. Reducing animal agriculture in the food value chain is an exceptionally high-impact solution to the global climate crisis. The UN has projected that GHG emissions will reach 55 gigatons by 2030, absent any change in current government policies. In our 2021 Food for Thought report, we estimated that the shift to alternative beef, pork, chicken, and egg alternatives will save more than 1 gigaton (Gt) of CO2e by 2035—or about 0.85 Gt CO2e in 2030. This is equal to decarbonizing most of the aviation or shipping industries or about 22% of the building industry. In our upside scenario (which envisages alternative proteins capturing 22% market share), we see decarbonization of 2.2 Gt CO2e, or 4% of emissions under the UN’s current policies scenario, by 2030. If alternative proteins were to replace the total addressable market of animal proteins with like-for-like alternatives, building on current technology, global emissions would fall by 6.1 Gt CO2e —11% of projected current emissions in 2030. (See Exhibit 3.) There’s also a climate bonus. Any significant overall change in diets toward more alternative proteins will have an immediate cooling effect on the planet, since GHG emissions from animal farming include a substantial portion of methane—as much as 50%. Methane has a much higher global warming potential than CO2 and a much shorter atmospheric lifetime. Consequently, reducing methane levels in the atmosphere doesn’t just prevent further warming; it comes with a cooling effect. Subscribe to our Climate Change and Sustainability E-Alert. A Sustainable Food System Means Big Changes Learn More Learn More Close-up of a chicken sandwich and French fries on a plate Report Food for Thought: The Protein Transformation The shift to alternative proteins based on plants, microorganisms, and animal cells is just beginning to pick up speed. The market will hit $290 billion by 2035. Given the opportunity, the key question becomes, how can each player make the most of doing well by doing good? The shift to alternative proteins means big changes—and big opportunities—for all food industry players. New processes and approaches will transform multiple long-standing paradigms, and certain steps along the value chain will change radically. Players in all segments—farmers, suppliers, manufacturers, and investors—must assess how quickly the transformation will roll out and what the risks and opportunities are for them. The biggest shifts will involve value pools migrating upstream toward the production and processing of new protein sources. In each case, the speed and extent of impact will depend on the type of protein (meat, fish, dairy, or eggs) and the type of alternative (plant-, fermentation-, or animal-cell-based) at issue. Value pools will remain dynamic, however. For instance, the value of improved extraction methods for plant-based proteins will likely increase over time. In fermentation-based and animal-cell-based proteins, further value shifts toward improved strains and cell lines are likely if new techniques can materially reduce the need for costly culture media inputs or enable the shift to cheaper carbon sources. Upstream enablers of new protein sources and products, as well as technologies that remove key bottlenecks, will realize superior returns and act as multipliers enabling higher impact. Protein sources, ingredients, and processes that contribute to taste and texture parity or to nutritional value will continue to sustain high value shares regardless of where they fall in the chain.

#### Reducing methane emissions from agriculture necessary and sufficient to solve climate change

Grossi et al. ’18 (Giampiero Grossi, Pietro Goglio, Andrea Vitali, and Adrian G. Williams, “Livestock and climate change: impact of livestock on climate and mitigation strategies”, <https://academic.oup.com/af/article/9/1/69/5173494#198779969>, Animal Frontiers, Volume 9, Issue 1, January 2019, Pages 69–76, https://doi.org/10.1093/af/vfy034)

The livestock sector requires a significant amount of natural resources and has an important role in global greenhouse gas emissions. The most important greenhouse gases from animal agriculture are methane and nitrous oxide. Mitigation strategies aimed at reducing the emission intensity of this sector are needed to meet the increasing demand for livestock products driven by population growth. To increase the effectiveness of mitigation strategies, the complex interactions among the components of livestock production systems must be taken into account to avoid environmental trade-offs. Introduction According to the United Nations (UN, 2017), the world population increased by approximately 1 billion inhabitants during the last 12 years, reaching nearly 7.6 billion in 2017. Although this growth is slower than 10 years ago (1.24% vs. 1.10% per year), with an average increase of 83 million people annually, global population will reach about 8.6 billion in 2030 and 9.8 billion in 2050. Population growth, urbanization, and income rise in developing countries are the main driver of the increased demand for livestock products (UN, 2017). The livestock sector requires a significant amount of natural resources and is responsible for about 14.5% of total anthropogenic greenhouse gas emissions (7.1 Gigatonnes of carbon dioxide equivalents for the year 2005; Gerber et al., 2013). Mitigation strategies aimed at reducing emissions of this sector are needed to limit the environmental burden from food production while ensuring a sufficient supply of food for a growing world population. The objectives of this manuscript are to 1) discuss the main greenhouse gas emissions sources from the livestock sector and 2) summarize the best mitigation strategies. Impact of Livestock on Climate Change The most important greenhouse gases from animal agriculture are methane and nitrous oxide. Methane, mainly produced by enteric fermentation and manure storage, is a gas which has an effect on global warming 28 times higher than carbon dioxide. Nitrous oxide, arising from manure storage and the use of organic/inorganic fertilizers, is a molecule with a global warming potential 265 times higher than carbon dioxide. The carbon dioxide equivalent is a standard unit used to account for the global warming potential (IPCC, 2013). Figure 1 was adapted from the Global Livestock Environmental Assessment Model (GLEAM) developed by FAO (FAO, 2017) and shows in carbon dioxide equivalents the greenhouse gas incidences that enteric fermentation and manure storage have across the main livestock species raised worldwide. Greenhouse gases incidence of enteric fermentation and manure storage by animal type, expressed as Gigatonnes of carbon dioxide equivalents. Data referred to 2010 (FAO, 2017). Figure 1. Greenhouse gases incidence of enteric fermentation and manure storage by animal type, expressed as Gigatonnes of carbon dioxide equivalents. Data referred to 2010 (FAO, 2017). Open in new tabDownload slide In addition to greenhouse gases arising from enteric fermentation and manure storage, feed production together with the related soil carbon dioxide and nitrous oxide emissions is another important hot spot for the livestock sector. Soil carbon dioxide emissions are due to soil carbon dynamics (e.g., decomposing plant residues, mineralization of soil organic matter, land use change, etc.), the manufacturing of synthetic fertilizers and pesticides, and from fossil fuel use in on-farm agricultural operations (Goglio et al., 2018). Nitrous oxide emissions are emitted when organic and inorganic fertilizers are applied to the soil. As shown in Figure 2, feed production and processing contribute about 45% of the whole sector (3.2 Gigatonnes of carbon dioxide equivalents). Enteric fermentation producing about 2.8 Gigatonnes (39%) is the second largest source of emissions. Manure storage with 0.71 Gigatonnes accounts for about 10% of the total. The remaining 6% (0.42 Gigatonnes of carbon dioxide equivalents) is attributable to the processing and transportation of animal products (Gerber et al., 2013).

#### Second- reforestation operates as a “carbon sink” to ensure net zero while kick-starting economic funding initiatives – that’s Denis and Hamilton ‘22

#### More evidence- Increasing forestation efforts increases carbon sequestration

Domke et al. ’20 (Grant M. Domke, Forest Service Northern Research Station, US Department of Agriculture, St. Paul, MN 55108; Sonja N. Oswalt Forest Service Southern Research Station, US Department of Agriculture, Knoxville, TN 37919; Brian F. Walters Forest Service Northern Research Station, US Department of Agriculture, St. Paul, MN 55108; Randall S. Morin, Forest Service Northern Research Station, US Department of Agriculture, York, PA 17402, Edited by James A. Estes, University of California, Santa Cruz, CA, and approved August 18, 2020 (received for review June 1, 2020, “Tree planting has the potential to increase carbon sequestration capacity of forests in the United States”, <https://www.pnas.org/doi/full/10.1073/pnas.2010840117>, September 21, 2020)

Abstract Several initiatives have been proposed to mitigate forest loss and climate change through tree planting as well as maintaining and restoring forest ecosystems. These initiatives have both inspired and been inspired by global assessments of tree and forest attributes and their contributions to offset carbon dioxide (CO2) emissions. Here we use data from more than 130,000 national forest inventory plots to describe the contribution of nearly 1.4 trillion trees on forestland in the conterminous United States to mitigate CO2 emissions and the potential to enhance carbon sequestration capacity on productive forestland. Forests and harvested wood products uptake the equivalent of more than 14% of economy-wide CO2 emissions in the United States annually, and there is potential to increase carbon sequestration capacity by ∼20% (−187.7 million metric tons [MMT] CO2 ±9.1 MMT CO2) per year by fully stocking all understocked productive forestland. However, there are challenges and opportunities to be considered with tree planting. We provide context and estimates from the United States to inform assessments of the potential contributions of forests in climate change mitigation associated with tree planting. Sign up for PNAS alerts. Get alerts for new articles, or get an alert when an article is cited. Forest ecosystems are the largest terrestrial carbon (C) sink on Earth (1), and their management has been recognized as a cost-effective strategy for mitigating greenhouse gas emissions. In the United States, forestland represents nearly one-third of total land area (Fig. 1 A and B), and forests store more than three decades of carbon dioxide (CO2) emitted from economy-wide fossil fuels (2). The contribution of forestland to emissions offsets in the United States has remained relatively stable since 2005 despite steady declines in economy-wide CO2 emissions over that period (2). This suggests that the forest C sink in the United States, which is driven in large part by forest regrowth following harvest and natural disturbance (3, 4), is slowly diminishing (4–7). Fig. 1. Estimates (with 95% CI) of (A) forestland area, number of trees, CO2 stocks, and annual flux by tree size class in the CONUS, and distribution of (B) forestland in the CONUS, (C) approximate locations of national forest inventory plots with at least one forested condition (n = 130,250) in the CONUS used in the study, and (D) total greenhouse gas emissions and removals on forestland by US state in 2018. Negative estimates indicate net C uptake (i.e., a net removal of C from the atmosphere). Recently proposed afforestation and reforestation activities may accelerate live-tree sequestration of C stocks in forests (7, 8) and accumulation of C in soils (9), and potentially expand forestland (10), providing a multitude of ecosystem services (8). However, practical constraints and social and economic competition with other land uses and management objectives may limit implementation (5, 7). While uncertainty remains around climate change mitigation strategies, carbon markets have the potential to influence the priority placed on land management to promote forest C storage (5). We use data from more than 130,000 national forest inventory (NFI) plots (Fig. 1B) to empirically describe the contribution of nearly 1.4 trillion trees on forestland in the conterminous United States (CONUS) to emissions offsets as well as opportunities and challenges to further enhance sequestration capacity. Specifically, we 1) describe the current status and extent of forestland in the CONUS, 2) characterize the current forestland C sink in the CONUS relative to economy-wide CO2 emissions (non-CO2 gases were not included in this study), and 3) highlight opportunities and challenges for increasing C sequestration capacity on existing forestland. This work provides context and estimates for assessments of the potential contributions of trees and forests to mitigate forest loss and climate change through tree planting in the United States. Results There are an estimated 1.38 trillion live trees (±8.71 billion live trees, 95% CI) across all size classes on 256.3 Mha of forestland (±0.65 Mha) in the CONUS (Fig. 1A). Collectively, there are an estimated 71,808 million metric tons (MMT) carbon dioxide (CO2) (±901.19 MMT CO2) stored in all live trees (aboveground and belowground) and they sequestered an estimated 546.7 MMT CO2 (±31.6 MMT CO2) in the year 2018 (Fig. 1 A and D). The CONUS-wide estimates translate to 280 MT CO2 stored per hectare across forestland in the CONUS with annual net sequestration of 2.13 MT CO2⋅ha−1⋅y−1. There are opportunities on existing forestland to increase the contribution of forests to climate change mitigation. Nearly 33 Mha (±0.47 Mha) of productive forestland (i.e., timberland) is classified as nonstocked or poorly stocked (<35% of the forestland area is occupied by trees; hereafter referred to as understocked) with live trees and seedlings (Fig. 2A). A disproportionate amount (44%, 14.5 Mha) of the understocked timberland is in the western states, which only represents 24% (49.1 Mha) of the total timberland land area in the United States. The understocked timberlands in the United States store less than 30% of the aboveground live-tree CO2 per unit area that fully stocked forests store (Fig. 2 B and C), and the sequestration capacity is substantially diminished—less than 20% of fully stocked forests—due to the limited area occupied by trees (Fig. 2 B and C). Fig. 2. Distribution of (A) understocked timberland by ownership in the CONUS, (B) tree density by ownership and all live stocking on timberland in the CONUS (number of trees), (C) aboveground live-tree CO2 density and mean annual net CO2 flux by ownership and all live-tree stocking in the CONUS, and (D) reforestation area and CO2 sequestration potential—based on current tree planting capacity in the CONUS—when increasing stocking on timberland from nonstocked to poorly stocked, medium stocked, or fully stocked. Error bars represent the 95% CI. Negative estimates indicate net C uptake (i.e., a net removal of C from the atmosphere). Currently, there is federal infrastructure to produce and plant ∼65 million seedlings per year, and state and private capacity is ∼1.1 billion tree seedlings per year (11). Collectively, the estimated 1.2 billion trees planted on forestland sequester between 16 MMT CO2 and 28 MMT CO2 each year (Fig. 2D). Spatially concentrating current tree planting capacity to fully stock nonstocked timberland, rather than planting the same number of trees over larger areas, provides the greatest potential to increase C sequestration capacity, particularly on private timberland (Fig. 2D). In addition, increasing tree planting capacity to fully stock timberlands can potentially reduce the current reforestation backlog on federal forestland, increase total forestland sequestration capacity, and contribute to C storage (Fig. 2). Discussion The contribution of existing forestland and harvested wood products to climate change mitigation in the United States is unmistakable (1, 5, 6); however, the sink has remained relatively stable, while total economy-wide CO2 emissions in the United States have declined (2). Considering trends in natural and anthropogenic disturbances (5), declines in forest regrowth are likely to continue in the absence of forest management (5, 10). Tree planting may accelerate live-tree sequestration of C stocks in forests (7, 8) and the accumulation of C in soils (9). However, infrastructural constraints (e.g., planting stock availability), as well as social and economic competition with other land uses and management objectives (5, 7), natural disturbances (e.g., wildfire), and climate change (4, 5), have limited and may continue to limit implementation. Approximately 1% of understocked federal timberland is reforested each year, despite mandates requiring reforestation (7). Current tree planting efforts contribute ∼3 to 5% to live-tree C sequestration each year in the United States. If all understocked timberland were fully stocked in the United States, potential C sequestration capacity would increase by ∼20% (−187.7 MMT CO2 ±9.1 MMT CO2) per year, and immediate opportunities exist to build infrastructure and use resources from tree planting initiatives to restore and improve forest ecosystems (7).

### 2NC- CP Solves Economy

#### Reforestation initiatives provide massive economic boost – especially in the green economy sector

Rudee ’20 (Alex Rudee, Senior Program Manager, Nature-Based Solutions at Amazon, World-Resource Institute, “Want to Help the US Economy? Rethink the Trillion Trees Act”, <https://www.wri.org/insights/want-help-us-economy-rethink-trillion-trees-act>, April 6, 2020)

As the spread of COVID-19 sickens thousands of Americans and pushes the U.S. economy into recession, Congress is working around the clock to provide resources to healthcare workers and relief to workers and industries facing economic hardship. That remains our collective first priority. Once the worst of this public health crisis has passed though, the United States will need an even greater stimulus package to jumpstart job growth and economic expansion. When that time comes, Congress can lead not just by addressing immediate economic needs, but also by delivering common-sense solutions for a long-term economic threat: climate change. Federal climate policy must include not only ambitious measures to reduce greenhouse gas emissions, but also investments to remove carbon already in the atmosphere. Trees are nature’s own carbon removal engines, and restoring them to ecologically appropriate areas while protecting existing trees and forests is critical to keeping the U.S. on a path to avoid the most dangerous impacts of climate change. Investing in planting and sustainably managing trees could remove gigatons of carbon dioxide while creating hundreds of thousands of jobs (many more jobs per dollar spent than in carbon-intensive industries like aviation or oil and gas, which have previously been the focus of stimulus discussions). Many Republican policymakers have recognized the importance of trees as a climate solution. President Trump committed the United States to participating in the global Trillion Trees Initiative in January. Shortly after, Rep. Bruce Westerman (R-AR) and nine co-sponsors introduced the Trillion Trees Act in the House of Representatives. In early March, Sen. Mike Braun (R-IN) said he would propose a version of the Trillion Trees Act in the Senate. But the Trillion Trees Act as written would not provide the stimulus the U.S. economy desperately needs. Nor would it be a win for the climate — some of the bill’s provisions could even result in a net loss of trees, increasing carbon emissions. It’s time lawmakers on both sides of the aisle came together to lay out a more robust, ambitious plan for tree restoration that would help put Americans back to work, revitalize local economies and create a healthier climate. Why Congress Should Invest in Growing Trees New jobs growing and managing trees won’t materialize on a large scale without action from Congress. Landowners and small businesses need federal subsidies to take on upfront costs like preparing land, buying saplings, paying planting crews’ wages, and hiring trained foresters to develop sustainable management plans. WRI research shows that an annual federal investment of $4-4.5 billion extended over 20 years could restore up to 60 billion trees, mostly on private lands. This funding estimate would cover costs across a variety of practices, from restocking forests to creating agroforestry systems, that could each restore billions of trees — and collectively create hundreds of thousands of jobs. Read our Tree Restoration 2-pager to learn more. Creating jobs is imperative as the coronavirus causes unemployment to skyrocket, and tree restoration is a particularly cost-effective way for Congress to put Americans back to work. Researchers have found that every $1 million invested in reforestation and sustainable forest management can support nearly 40 jobs, including foresters, botanists to grow saplings in nurseries, technicians to operate machinery, and laborers to transport and plant new trees. That translates to over 150,000 jobs per year with an annual federal investment of $4 billion — three times as many jobs as logging currently supports in the United States, and many more jobs per dollar invested than other industries Congress has considered in stimulus talks. An incentive for growing trees would contribute to exactly the sort of economic stimulus the United States badly needs. Every dollar the federal government gives landowners and tree-planting contractors multiplies economic activity in communities that plant trees and manage forests, including underserved urban and rural communities. Rural communities are already more vulnerable to certain impacts of the coronavirus pandemic due to an ongoing trend of rural hospital closures and the scarcity of high-speed internet access for remote work. An annual federal investment of $4-4.5 billion in tree restoration could help these communities recover by bringing in $6-12 billion per year in economic growth. That investment could also fight climate change cost-effectively, removing nearly 10% of annual U.S. emissions at less than $10 per ton of carbon dioxide. Tree restoration incentives wouldn’t require new congressional authority, either. Lawmakers could expand successful programs like the Environmental Quality Incentive Program (EQIP) and the Conservation Stewardship Program (CSP) with new dedicated funding for planting trees and restocking forests. For types of land not covered under EQIP or CSP (such as urban areas or undeveloped suburban land), Congress could issue grants for state and local governments to boost tree restoration using their own policy tools. State and local tree-planting grants are especially important to put people to work growing urban and suburban forests in metropolitan areas that have suffered massive job losses in industries like transportation and tourism. Growing trees can help cities build back better with cleaner air and water, more recreational opportunities and fewer greenhouse gas emissions. Why the Trillion Trees Act Needs to Change The Trillion Trees Act as written would not actually result in a trillion new trees. In fact, the Act may result in a net loss of trees in the near term by disproportionately promoting timber harvests while offering minimal incentives for growing new trees or maintaining healthy forests. It would establish a task force to recommend increasing harvests on federal lands and relax environmental reviews of harvests near urban areas or critical infrastructure. It would direct the EPA to consider bioenergy from forests a carbon-neutral energy source — legislating away complex carbon accounting that changes significantly if bioenergy plants burn sawn timber (which could store carbon in long-lived wood products) rather than lower-grade wood. These provisions do not provide safeguards to protect mature forests and restock forests after harvesting, meaning that the Trillion Trees Act may actually cause the United States to lose trees and increase carbon emissions. Meanwhile, the Trillion Trees Act provides only $55 million per year in new funding to support reforestation, including just $25 million for private lands — less than 1% of what an all-in program for tree restoration jobs would provide. Moreover, many promising tree-planting practices, like urban reforestation and silvopasture, would not be eligible for the new funding. With little funding for growing trees and broad allowances for cutting them down, the Trillion Trees Act in its current form would move the United States in the wrong direction on both carbon emissions and job growth. Tree Planting Could Help the U.S. Economy and Fight Climate Change The coronavirus pandemic and the climate crisis both require massive public investments in sustainable economic opportunities. The current Trillion Trees Act fails to benefit out-of-work and economically squeezed Americans while threatening to increase carbon emissions, moving U.S. climate action in the wrong direction. That does not meet the needs of this moment, but a different kind of tree restoration program could. The right policy would invest in people to grow trees and restore forests across the United States — putting Americans back to work in the process, and ensuring a healthier climate for future generations.

### AT: Perm do Both

#### Perm do both fails- It links to the net benefit- still engages in decarbonization- the CP is a non-CO2 alternative method- that’s Ou et al. ‘22

#### And- decarbonization is the process of reducing CO2 output – the CP does not decrease CO2 output from electricity

TWI no date [The Welding Institute; Leading engineering institution supporting welding and joining professionals with welding, joining and allied technologies; “What is Decarbonization?” https://twi-global.com/technical-knowledge/faqs/what-is-decarbonisation]

What Does Decarbonisation Mean? ‘Decarbonisation’ tends to refer to the process of reducing ‘carbon intensity’, lowering the amount of greenhouse gas emissions produced by the burning of fossil fuels. Generally, this involves decreasing CO2 output per unit of electricity generated. Reducing the amount of carbon dioxide occurring as a result of transport and power generation is essential to meet global temperature standards set by the Paris Agreement and UK government.

### AT: Perm do CP

#### Perm do CP severs- CP does not result in the AFF- severance is a voting issue- causes the AFF to be a moving target and undermines stable neg links to offense

## ---Affirmative---

### 2AC- Advantage CP

#### 1] Perm do both

#### 2] Perm do CP

#### 3] Counterplan does not solve

#### A] It does not access the AFFs internal links- [insert explanation]

#### B] Plant based fails foods do not solve climate crisis- lack of transparency and data and production still carbon intensive

Creswell ’23 (Julie Creswell, business reporter covering the food industry for The New York Times, New York Times, “Plant-Based Food Companies Face Critics: Environmental Advocates”, <https://www.nytimes.com/2021/10/15/business/beyond-meat-impossible-emissions.html>, Updated June 23, 2023)

Some analysts say they cannot determine if plant-based foods are more sustainable than meat because the companies are not transparent about their emissions. An Impossible Burger has 21 ingredients, including soy, according to its maker, Impossible Foods.Credit...Con Poulos for The New York Times Consumers and investors alike have gobbled up Beyond Meat’s burgers, sausage and chicken in recent years, thanks at least in part to the company’s message that its plant-based products are good for the environment. But some aren’t so sure. One investor tracking firm gives Beyond Meat a zero when it comes to sustainability measures. Another rates it a “severe risk,” putting it on a par with the beef and chicken processing giants JBS and Tyson. “We don’t feel we have sufficient information to say Beyond Meat is fundamentally different from JBS,” said Roxana Dobre, a manager of consumer goods research at Sustainalytics, a firm that rates the sustainability of companies based on their environmental, social and corporate governance impact. At first glance, it seems logical that plant-based food companies like the publicly traded Beyond Meat and its privately held competitor, Impossible Foods, would be better for the environment than meat processors like JBS. Those processors slaughter and package millions of heads of cattle each year, a significant contributor to methane released into the atmosphere. The problem, critics say, is that neither Beyond Meat nor Impossible Foods discloses the total amount of greenhouse gas emissions across all of its operations, supply chains or consumer waste. They also do not disclose the effects across all of their operations on forests or how much water they use. But on its website Beyond Meat claims that consumers who switch from animal to plant-based protein can “positively affect the planet, the environment, the climate and even ourselves.” Impossible Foods says that switching to plant-based meats “can be better than getting solar panels, driving an electric car or avoiding plastic straws” when it comes to reducing your environmental footprint. “The dominant narrative from the plant-based industry and the venture capitalists supporting it is that these companies are better for the environment, they’re better for health, they’re better for this and better for that,” said Ricardo San Martin, the research director of the alternative meats program at the University of California, Berkeley. “But it is really a black box. So much of what is in these products is undisclosed. “Everybody has a supply chain, and there is a carbon footprint behind that chain.” By some estimates, the agriculture industry produces a third of the world’s greenhouse gases linked to human activity, is a primary driver of deforestation and uses as much as 70 percent of the world’s fresh water supply. Image Environmentalists say food companies that make plant-based products don’t disclose enough information about their operations.Credit...Evan Sung for The New York Times Yet it is lax in terms of tracking and disclosing not only its greenhouse gas emissions, but also the effect it has on forests and water use. An examination of 50 North American food companies this year by Ceres, a nonprofit investor network, found that the majority did not disclose emissions from crops and livestock used in their products nor did it disclose emissions from converting forests into agricultural use. In response to growing investor concerns about the risks of climate change on corporations, the Securities and Exchange Commission is weighing a rule that would force companies to report their emissions, although it remains unclear whether the agency would also have companies account for emissions that came from supply chains and consumer waste. Even as consumers and investors move to hold Big Food more accountable for its emissions, the fact that two of the leading plant-based food companies don’t offer these disclosures is a source of frustration for watchdogs. Beyond Meat, which went public in the spring of 2019 and whose shares have fallen 16 percent this year, said it had completed a comprehensive greenhouse gas analysis that would be released in 2022 and planned to update its environmental, social and governance goals by the end of the year. But Patrick Brown, the founder and chief executive of Impossible Foods, echoed some of the arguments made by big food companies around the current accounting and reporting standards for emissions and other climate data, saying it doesn’t reflect the total impact of a company like his. The environmental, social and governance reporting that currently exists “simply doesn’t contemplate something of the magnitude that we’re doing,” he said. “We are as transparent as it is reasonably possible to be about our environmental impact, but the existing framework doesn’t recognize, doesn’t appreciate, the overall majority of our impact, which is massive.” Image Patrick Brown of Impossible Foods argues that much of the soy grown in the world is used to feed animals and that his company uses the soy more efficiently than the animals do.Credit...Dane Rhys/Reuters A spokeswoman for Impossible Foods added that the company had a working group that completed a full greenhouse gas inventory, was planning to set targets to reduce emissions and was preparing for environmental, social and governance reporting. Both Beyond Meat and Impossible Foods have commissioned studies by academics or third parties that compare how their plant-based burgers or sausages stack up to beef or pork products. A 2018 study by researchers at the University of Michigan concluded that a quarter-pound Beyond Burger generated 90 percent less greenhouse gas emissions than its beef burger equivalent. Likewise, an analysis by a third-party firm done for Impossible Foods concluded that its plant-based burger used significantly less water and land and created fewer emissions than the meat equivalents. For other food products, Impossible Foods has commissioned similar analysis that also include details on its supply chains and land and water use for the individual products. But those reports, say analysts, may not tell the whole story about how the production of plant-based burgers, sausage and chicken may be affecting the climate. An Impossible Burger has 21 ingredients, according to the company’s website, including soy. “The problem with plant-based products, generally speaking, is that while they may be fixing one problem, combating the fact that growing meat is very carbon intensive and emits a lot of carbon dioxide, depending on the ingredients and where they are sourced from, you could still be involved in deforestation issues,” said Ms. Dobre of Sustainalytics. “You still need the space to grow the soy that is in many of these products.”

#### C] Reforestation programs insufficient- emission reductions key

Rohatyn et al. ’22 (Shani Rohatyn\*, Faculty of Civil and Environmental Engineering, The Technion–Israel Institute of Technology, Haifa 3200003, Israel. Roles: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Software, Validation, Visualization, Writing - original draft, and Writing - review & editing. Dan Yakir\* Earth and Planetary Sciences, Weizmann Institute of Science, Rehovot 7610001, Israel. Roles: Conceptualization, Funding acquisition, Methodology, Project administration, Supervision, and Visualization. View all articles by this author Eyal Rotenberg https://orcid.org/0000-0002-7214-9897 Earth and Planetary Sciences, Weizmann Institute of Science, Rehovot 7610001, Israel. Roles: Conceptualization, Investigation, Methodology, Supervision, and Validation. View all articles by this author Yohay Carmel https://orcid.org/0000-0002-5883-0184 Faculty of Civil and Environmental Engineering, The Technion–Israel Institute of Technology, Haifa 3200003, Israel. Roles: Conceptualization, Formal analysis, Funding acquisition, Methodology, Project administration, Supervision, Validation, and Writing - review & editing., Science, Limited climate change mitigation potential through forestation of the vast dryland regions, <https://www.science.org/doi/10.1126/science.abm9684>, , September 22, 22)

Forestation of **the global drylands has been suggested to be a way to decrease global warming**, but how much promise does it actually have? Rohatyn et al. found that the climatic benefits are minor. Although drylands have considerable carbon sequestration potential, which could be used to lower the amount of carbon dioxide in the atmosp**here and thereby slow warming, the reduction of albedo caused by forestation would counteract most of that effe**c**t.** So, although forestation is clearly important, it cannot **substitute for reducing emissions. —HJS** Abstract Forestation of the vast global drylands has been considered a promising climate change mitigation strategy. However, its actual climatic benefits are uncertain because the forests’ reduced albedo can produce large warming effects. Using high-resolution spatial analysis of global drylands, we found 448 million hectares suitable for afforestation. This area’s carbon sequestration potential until 2100 is 32.3 billion tons of carbon (Gt C), but 22.6 Gt C of that is required to balance albedo effects. The net carbon equivalent would offset ~1% of projected medium-emissions and business-as-usual scenarios over the same period. Focusing forestation only on areas with net cooling effects would use half the area and double the emissions offset. Although such smart forestation is clearly important, its limited climatic benefits reinforce the need to reduce emissions rapidly. Leveraging the ability of forests to sequester carbon is considered a promising approach to mitigating global climate change (1–3). Forestation (including afforestation to create new forests and reforestation to restore depleted forests) is also known to cool the local climate by increasing evaporation and inducing increased cloud formation (4, 5). A rich body of scientific research supports tree planting as an effective approach to mitigating global warming. Griscom et al. (2) calculate that reforestation of ~700 Mha in temperate and tropical zones would result in sequestration of almost three billion tons of carbon per year (Gt C year−1). Bastin et al. (3) refer to tree restoration as “among the most effective strategies for climate change mitigation.” They estimate that reforesting 1700 Mha could potentially sequester 205.7 Gt C (133.2 to 276.2 Gt C) over the lifetime of the forests (6). Trees sequester atmospheric CO2, and thus planting has a cooling effect by lowering its atmospheric concentration (7). Forestation also reduces the reflectance of shortwave radiation (albedo) more than most other forms of land coverage and thus increases net radiation and sensible heat flux, creating local and, potentially, global warming effects (8). These contrasting effects have long been recognized (9–11). However, this warming effect is largely confined to boreal regions. Recognition of this phenomenon is evident in recent publications supporting reforestation as a climate mitigation tool (2, 12), wherein the albedo effect was avoided by excluding the boreal biome from the analysis to obtain maximal climatic benefits. However, there are recent indications that albedo warming effects are also substantial in temperate zones and hot drylands (13, 14). In some dryland regions, the albedo warming effect of afforestation may strongly outweigh the cooling effect of carbon sequestration owing to the change from bright desert land to darker dense forest cover (15). …. **Previous estimates of the potential to mitigate climatic warming through large-scale forest restoration projects predicted a mitigation effect much larger than the results of this study.** Using the restoration opportunities map of Potapov et al. (20), Griscom et al. (2) estimated that over an 80-year forest lifetime, the global reforestation of 700 Mha globally (~30% in drylands) could mitigate climatic warming to a maximum of 200 Gt C, which is nearly twice the value we obtained. This translates to a forestation sequestration potential per unit area of ∼300 t C ha−1 over that period. Similarly, Bastin et al. (3) estimated a potential carbon stock density of ∼200 t C ha−1 for the restoration of deserts, xeric shrublands, and Mediterranean forests. Both estimates are considerably higher than those of the present study. **These differences likely arise from the additional consideration in the present study of two main factors: (i) the potential sequestration of current vegetation cover before reforestation; and (ii) the warming effect arising from the reduced albedo of forested drylands. Our results demonstrate the importance of assessments of climatic warming mitigation plans including the warming effect arising from the reduced albedo of global dryland forestation.** Accounting for albedo and avoiding foresting drylands where forestation would have a net warming effect (NESC < 0, Table 1) almost doubles the overall expected effect on climate. In contrast, forestation actions over negative-NESC areas would risk exacerbating, rather than ameliorating, global warming. Our analysis does not include additional effects that can further complicate a climate mitigation assessment of forestation, such as climate change–related effects on atmospheric temperature, clouds, or the extent of radiative cooling (from upwelling of long-wave radiation). Such effects influence both productivity and albedo and can move the aridity of some land areas to values outside the forestation suitability range considered here (0.2 < AI ≤ 0.65) [e.g., (33)]. A detailed climate change impact analysis is well beyond the scope of this Report, but for a first approximation, we performed a cross-analysis by superimposing maps of the expected AI in 2100, considering a BAU scenario [+4°C (33)] over our forestation map. We found that ~3% of the potential forestation land (~10 Mha) will shift to a drier aridity value, below our minimum AI threshold of 0.2, by 2100. This analysis indicates that future climate change has only minor effects on our estimates of the land available for forestation and does not alter our conclusions. Here we demonstrate, therefore, that it is critical that forestation opportunities be assessed with respect to their potential to mitigate climatic warming, and that doing so can greatly improve the cooling effect of forestation opportunities (both per-hectare and in terms of total land area used) of forestation opportunities. Forestation efforts, focusing on the limited areas with the potential for net climatic cooling, could benefit from high-resolution (1-km) maps, such as those developed in the present study. **Overall, we estimate the total contribution toward offsetting CO2 emissions obtainable from all dryland forestation actions to be limited, emphasizing the need to reduce emissions rapidly to meet climate targets.**

#### 4] CP links to the net benefit-[insert explanation]

### ---1AR- Alternative Protein Doesn’t Solve

#### Alternative protein subsidies fail- still carbon intensive and does not reduce consumption in meat

Howard ’22 (Phil Howard, Phil Howard is a member of the IPES-Food panel, a professor in the Department of Community Sustainability at Michigan State University, and an expert in food system changes and the visualization of these trends. He has authored prominent contributions to the public debate on concentration and power in food systems. He has analyzed increasing consolidation in numerous industries, including processed organic foods, beer and commercial seeds; and is the author of Concentration and Power in the Food System: Who Controls What We Eat? (2016, 2021, Bloomsbury Academic). His work has been featured extensively in media outlets, including The New York Times, Washington Post, Chicago Tribune, Forbes, and more. He conducted research at the Center for Agroecology and Sustainable Food Systems at the University of California, Santa Cruz from 2002 to 2006, was a visiting scholar in the Division of Nutrition at the University of Utah in 2013-2014, and a visiting research fellow at Lund University in Sweden in 2021, “Fake meat won’t solve the climate crisis”, IPES Food, <https://ipes-food.org/op-ed-fake-meat-wont-solve-the-climate-crisis/>, July 4, 2022)

When you’re told there’s a simple solution to a very complex problem, you’re probably not getting the whole story. Today’s meat consumption is a good example. Meat and dairy are increasingly under the world’s microscope as livestock—which rely on huge quantities of feed crops and occupy nearly 80 percent of global farmland —accounts for between 14 percent and 30 percent of global greenhouse gas (GHG) emissions. It’s also the source of more frequent antimicrobial-resistant pathogens , and much of the global livestock and seafood industries have been exposed for unsafe and abusive working conditions. This complex web of problems requires more than one answer. And yet “alternative proteins”—from plant-based to lab-grown “fake” meat and dairy—are being promoted as a simple solution. Products like the Impossible Burger, with its 15-plus ingredients, are now in supermarkets and fast food establishments worldwide. Lab-grown chicken has been on the market in Singapore since late 2020 and will likely soon be approved in the U.S. and elsewhere. These products are being sold as a “win-win-win” for animals, people, and the planet. According to Patrick Brown, the outspoken CEO of Impossible Foods, livestock is “the most destructive technology on earth,” and meat substitutes are “the last chance to save the planet.” Dramatic claims about plant-based meat, lab-grown meat, and “cellular agriculture” have already succeeded in drawing billions of dollars to the sector, including from big-name investors like Bill Gates and Richard Branson. Governments are now paying attention as well. China is readying major investment in lab-grown meat as part of its latest Five-Year Agricultural Plan, and the U.S. government is ploughing $10 million into a National Institute for Cellular Agriculture . Denmark is also backing alternative proteins through a $98 million plant-based food fund. But these products and their sustainability credentials rest on shaky ground, as I show in a new report out today, “ The Politics of Protein ,” from the International Panel of Experts on Sustainable Food Systems (IPES-Food). Firstly, the idea that these alternative proteins can save the planet is highly speculative. These claims are based on a narrow assessment of which products can deliver the most protein for the least CO2. But that doesn’t tell the whole story. Products like the Impossible Burger and Beyond Burger source their ingredients from chemical-intensive (and therefore fossil fuel-intensive) monocultures and rely on heavy processing—all of which has major impacts on human health, biodiversity, and climate change. Factory farming clearly has huge impacts of its own, but the environmental and social impacts of livestock vary massively. In some parts of the world, raising animals helps to use limited land and resources efficiently, buffer against food shocks, and provide livelihoods where few options are available. Livestock contributes to the livelihoods of 1.7 billion smallholder farmers in the Global South, and plays a crucial economic role for approximately 60 percent of rural households in developing countries. Highly processed alternative proteins may therefore be more harmful than animal source foods in some contexts, depending on how they are produced. Secondly, the idea that these products can “disrupt” the status quo and challenge the power of the corporate food industry is highly misleading. Start-ups may have initiated the boom, but nearly all of the world’s meat and dairy giants have now rolled out their own “fake meats” or bought up existing players. Nestlé, for example, has acquired Sweet Earth , while Unilever has bought up The Vegetarian Butcher . JBS, the world’s largest meat processor, has snapped up another market-leading meat-free brand, Vivera , adding to its portfolio of more than 100 brands—including organic meat lines. Many of these corporations are also investing heavily in lab-grown meat and seafood manufacturers in the hope that these products will soon be market-ready. These are the exact same firms that dominate sales of conventional (factory-farmed) meat and dairy, i.e., the products that alternative proteins are supposed to replace. As a result, it is becoming increasingly difficult for consumers to know who is behind the brands, and increasingly hard to avoid the world’s agribusiness giants—even when opting for a so-called alternative product. Thirdly, plant-based and lab-grown meats are being promoted on the basis that they are the only alternatives that people are willing to eat. In reality, eating habits can and do change dramatically, as evidenced by the fact that meat and fish consumption has doubled over the last half century. Another major dietary shift—toward more diverse diets and less processed foods—is now possible, and urgently needed. But rather than accelerate this change, alternative proteins are likely to reinforce “center of the plate” diets that are insufficiently varied and heavy on processed foods (whether that central item is conventional meat or an imitation). So far, rising consumption of alternative protein purchases has not led to a reduction in meat and dairy sales . The food industry in fact has a long history of reshaping eating habits not for the good of society but for their own bottom line–e.g., it invented fish sticks to dispose of large blocks of frozen fish, and high-fructose corn syrup in response to a rapid increase in U.S. corn production. Finally, these products promise to get people more protein with less damage, but do we really need more protein or new sources of it? Although we’ve been told for decades that more protein is needed to feed a growing population, most people in the Western world eat much more protein than their bodies can use there is no global protein shortage. Even most children in low-income countries are getting enough high-qualty protein. Protein deficiencies are rare, but are most prevalent in parts of the world that have insufficient access to food more generally. In other words, what we see is not a protein gap, but a food gap. But by framing the debate so narrowly, companies have helped focus attention on simplistic silver bullet solutions—which are not simple at all. The hype around alternative proteins also diverts our attention away from solutions that are already working on the ground: shifting to diversified agroecological production systems, strengthening territorial food chains and markets, and building “food environments” which increase access to healthy and sustainable diets. These pathways respond holistically to challenges whose breadth and depth have been well-evidenced. They entail transformative behavioral and structural shifts. They require sustainable food system transitions, not merely a protein transition. Yet without a consolidated set of claims and claim-makers behind them, these pathways are systematically sidelined. How do we move toward systemic change instead? We can reclaim public resources from Big Protein and address concentration of power across the food system, including through new approaches to antitrust and competition law. We can also strengthen alternative supply chain infrastructures as a means to build up and support existing independent producers—not just those who start companies with the intention to sell them to the existing industry giants. And we can build regional food strategies that reconnect crops and livestock, use land and resources efficiently—and deliver on the multiple aspects of sustainability. The rise of highly processed alternative proteins is symptomatic of broader problems in the way we approach food systems: looking through a narrow lens, focusing on breakthrough technologies, and listening to those who shout the loudest. It is time for governments to stop subsidizing the largest food processors in the world and further reinforcing their power, based on claims that are dubious at best and highly misleading at worst. Ultimately, we don’t just need to change the products we’re eating—we need to change the entire system.

### ---1AR- Reforestation Doesn’t Solve

#### Reforestation initiatives fail to solve climate change

Jones & Hockley ’23 (Julia P G Jones, Professor of Conservation Science, Bangor University, Senior Lecturer in Environmental Economics & Policy, Bangor University, 8-24, 23, Worthless’ forest carbon offsets risk exacerbating climate change, https://theconversation.com/worthless-forest-carbon-offsets-risk-exacerbating-climate-change-211862 , 8-24, 23)

In early 2023, **the Guardian published an article suggesting that more than 90% of rainforest carbon offsets are worthless. These credits are essentially a promise to protect forests and can be bought as a way to “offset” emissions elsewhere**. Verra, the largest certifier of these offset credits, said the claims were “absolutely incorrect” but the story still shook confidence in the billion-dollar market. Soon after, Verra’s CEO stood down. The claims in the Guardian article rested heavily on analysis which had been published as a preprint (before peer review). Now t**he research has been fully peer-reviewed and is published in the journal Science. It shows unequivocally that many projects which have sold what are known as REDD+ (reducing emissions from deforestation and degradation) credits have failed to reduce deforestation.** REDD+ projects aim to slow deforestation (for example, by supporting farmers to change their practices). They quantify the carbon saved through reducing deforestation relative to what would have happened without the project, and sell these emission reductions as credits. Such REDD+ credits are widely used to “offset” (that is, cancel out) emissions from companies (who may use them to make claims that their operations are carbon neutral) or by people concerned about their carbon footprint. For example, if you were planning to fly from London to New York you might consider buying REDD+ credits that promise to conserve rainforest in the Congo Basin (with added benefits for forest elephants and bonobos). Offsetting your return flight would appear to cost a very affordable £16.44. However, while previous analysis showed that some REDD+ projects have contributed to slowing deforestation and forest degradation, **the central finding from the new study is that many projects have slowed deforestation much less than they have claimed and, consequently, have promised greater carbon savings than they have delivered. So that guilt-free flight to New York probably isn’t carbon neutral after all.** The finding that many REDD+ carbon credits have not delivered forest conservation is extremely worrying to anyone who cares about the future of tropical forests. We spoke to Sven Wunder, a forest economist and a co-author of the new study. He told us that: “To tackle climate change, tropical deforestation must be stopped. Forests also matter for other reasons: losing forests will result in loss of species, and will affect regional rainfall patterns. Despite the evidence that REDD+ has not been delivering additional conservation, we cannot afford to give up.” Deforestation could simply move elsewhere **Carbon credits also face other challenges, one of the biggest being “leakage” or displacement of deforestation. Leakage may occur because the people who were cutting down the forest simply relocate to a different area. Alternatively, demand for food or timber that was fuelling deforestation in one place may be met by deforestation elsewhere – perhaps on the other side of the world. Another problem is ensuring that the forests are protected in perpetuity so that reduced deforestation represents permanent removal of carbon from the atmosphere.**