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Senate Democrats' Special Committee on the Climate Crisis
United States Senate
722 Hart Senate Office Building
Washington, DC 20510

SUBMITTED ELECTRONICALLY TO RURAL_CLIMATEINPUT@SCHATZ.SENATE.GOV

RE: Request for Input on Impact of Climate Change on Agricultural Economy

Thank you for the opportunity to submit these comments in response to your May 18, 2020 request. GFI is a 501(c)(3) nonprofit organization dedicated to building a sustainable, healthy, and just food system. We support science and policy that accelerate progress on alternative proteins, including plant-based proteins and cultivated meat.¹

We believe a key component to a federal response to climate change and its impact on America's farm families is to invest in open-access research to advance alternative proteins. To provide critical resiliency to the agricultural sector and foster prosperity in rural communities, we respectfully request that the Committee work to establish an interagency Alternative Protein Initiative modeled after the National Nanotechnology Initiative.² This initiative would support rural America by enabling open-access research by companies and universities, providing revenue to farmers, and diversifying and strengthening our food system to make it more resilient as we confront the impacts of climate change.

Canada, the European Union, and other governments around the world have recognized the value of investing in research and development for alternative proteins. Canada is spending \$52.7 million on plant protein research and training over a four-year period from 2019-2023. Similarly, the European Commission unveiled its *Farm to Fork* sustainable food strategy last month, which creates a policy plan to “create more efficient, climate-smart systems that provide healthy food,

¹ Sometimes called cell-based meat, cultured meat, or clean meat, cultivated meat is produced by starting with the basic building block of all life: the cell. Beginning with a small sample of animal cells, cells are grown into meat, poultry, and fish. A tank called a cultivator facilitates the same biological process that happens inside an animal by providing warmth and the basic elements needed to build muscle: water, proteins, carbohydrates, fats, vitamins, and minerals. The result is meat, identical to conventional meat at the cellular level. It looks, tastes, and cooks the same.

² Nat'l Sci. & Tech. Council, Comm. on Tech., Subcomm. on Nanoscale Sci., Eng'g, & Tech., *National Nanotechnology Initiative Supplement to the President's 2020 Budget 3* (Aug. 2019), <https://bit.ly/2oV3kDh>.

while securing a decent living for EU farmers and fishermen.”³ The report specifically includes provisions which call for increasing the availability of alternative proteins including plant-based meats.⁴

If successfully implemented, a food system based on alternative proteins would have the potential to grow the U.S. economy and sustainably feed 9.7 billion people globally by 2050 without accelerating climate change.⁵ An interagency Alternative Protein Initiative would help diversify the national research portfolio and better reflect the diversity that consumers are increasingly demanding from our food supply.⁶

Key components of this initiative would be:

- Intramural research at federal agencies;
- Extramural grant programs explicitly for alternative proteins research;
- Establishment of alternative protein research centers and academic majors at universities;
- Workforce training to support workers;
- A nationwide network connecting research nodes, with multidisciplinary funding mechanisms that cut across existing agency boundaries; and
- A deep collaborative effort with industry.

Interagency coordination would improve efficiency, minimize duplication of effort, and grow workforce talent across the country for this important endeavor.

I. Investing in Alternative Protein Research Would Support Rural Economies While Reducing Impacts on the Climate.

As noted in your request, the function and prosperity of our nation depends on the work of America’s farm families and rural economies. Alternative proteins offer a viable, sustainable,

³ European Commission, *Sustainable food – ‘farm to fork’ strategy* (2020), <https://bit.ly/2AIOGun> (last visited June 18, 2020).

⁴ European Commission, *Farm to Fork Strategy* 16 (2020), <https://bit.ly/37bEyAb>.

⁵ Alternative proteins have a pivotal role to play in realizing the U.S. Department of Agriculture’s Agricultural Innovation Agenda key goal of “increasing [U.S. agricultural] production by 40 percent while cutting the environmental footprint of U.S. agriculture in half by 2050.” USDA, Press Release, *Secretary Perdue Announces New Innovation Initiative for USDA* (Feb. 20, 2020), <https://bit.ly/3cCXRni>.

⁶ “Plant-based foods are a booming business. Food manufacturers ranging from startups to leading CPG companies to the world’s largest meat companies are innovating rapidly in this category. These next-generation plant-based meat, egg, and dairy products are increasingly competitive with animal products on the key drivers of consumer choice: taste, price, and accessibility. As a result, a growing number of mainstream consumers are buying plant-based options.” The Good Food Institute, *Plant-based Market Research* (Mar. 2020), <https://www.gfi.org/marketresearch>.

and economically promising way to support these communities. Investing in alternative protein research would mitigate the impacts and reduce the frequency of extreme weather events caused by climate change, such as drought and wildfire, while simultaneously boosting farmers' bottom lines.

Benefits for the U.S. Economy, Including for Rural Communities

Former Secretary of Agriculture Tom Vilsack has recognized the economic benefit of investing in public research: “Studies have shown that every dollar invested in agricultural research creates \$20 in economic activity.”⁷ Very few government or private programs have a return on investment of 20x.

First, this kind of research would benefit farmers because plant-based and cultivated meat production methods process otherwise inexpensive commodity feedstocks such as legumes, grains, sugars, and amino acids into high-quality meat, creating opportunities for farmers to grow crops for a higher-value market. For example, instead of selling crops for animal feed at commodity prices, farmers would have the option of selling inputs for plant-based products at greater profit. As research is funded and alternative proteins become more established, a diversity of products would be developed to match local preferences from available ingredients.

Second, supporting the creation of physical research centers dedicated to this kind of alternative protein research at land-grant universities would embed deep wells of talent and economic potential in the state and local communities.

Third, publicly funded research would employ and provide essential workforce training to Americans performing the research and lead to the employment of researchers and workers at the companies that use and build on the publicly funded science, making Secretary Vilsack's prediction a reality. At present, alternative protein industries are predicted to generate more than 200,000 new jobs in the long-term.⁸

Alternative protein product formulation and manufacturing require valuable high-skill workers — such as engineers (bioengineers, chemical engineers, mechanical engineers, and tissue engineers), biologists (cell biologists, molecular biologists, and plant biologists), food scientists, nutritionists, and biochemists (specializing in protein chemistry) — who would be expected to live and contribute to the economic areas where these jobs are located to perform the initial research as well as to work for the industries that develop around the publicly funded work.

Finally, given the right incentives, local facilities — similar to other sectors, such as craft beer breweries — would become more viable for the production of alternative protein-based foods and could be located in rural and semi-rural areas. Such a system of smaller, more widely

⁷ USDA, Press Release, *USDA Secretary Announces Creation of Foundation for Food and Agricultural Research* (July 23, 2014), <https://bit.ly/2V4s8G5>.

⁸ Saloni Shah & Dan Blaustein-Rejto, *Federal Support for Alternative Protein for Economic Recovery and Climate Mitigation*, The Breakthrough Institute (May 12, 2020), <https://bit.ly/3cKxkVf>.

distributed production and supply networks would safeguard American jobs in both farming and food technology and keep money flowing through local economies. A distributed system would also create an overlapping network of food protein production to protect against supply chain issues such as storms, droughts, wildfires, and flooding. Additional manufacturing plants would be required for the production of the tools and equipment involved throughout this supply chain.

With many such food and manufacturing facilities operating in close proximity to both their crop inputs and their end consumers, costs can be decreased while simultaneously creating sustainable jobs and economic growth in rural, agricultural communities. Indeed, USDA-funded research at the University of Missouri was the foundation of the technology that is now used in Beyond Meat's plant-based Beyond Burger to help it take on the texture of meat.⁹ Beyond Meat now employs hundreds of workers at the two production facilities it opened in the state and consumers can buy climate-friendly Beyond Burgers in restaurants and supermarkets across the United States and on six continents.¹⁰

Benefits to Climate and the Environment

Making meat from plants or directly from cells is significantly more efficient than conventional methods. Indeed, using cropland to grow food for human consumption instead of for feedstocks that are fed to animals would allow American farmers to feed more than twice as many people,¹¹ increasing the food supply three times as much as recovering all the food that spoils or gets thrown away before it can be eaten.¹² This ability to produce more food while using less land and water offers an especially substantial benefit to regions that face water shortages and loss of crops and pastures caused by dry conditions, droughts, or wildfires.

Additionally, alternative proteins have a lighter environmental footprint. In contrast to meat produced by conventional means, both the primary ingredients and production methods for plant-based meats produce fewer emissions and less pollution, and additional processing accounts for only 13 to 26 percent of plant-based meat's relatively light climate impact.¹³

⁹ Stephen J. Bronner, *With \$72 Million in Funding, the Entrepreneur Behind Beyond Meat Pursues Innovation Over Profit*, Entrepreneur (Jan. 22, 2018), <https://bit.ly/37xesr6>.

¹⁰ Ashley Williams, *Beyond Meat opens second Missouri facility to fuel plant-based demand*, Global Meat News (July 2, 2018), <https://bit.ly/2YAb6A8>; Beyond Meat, Press Release, *Beyond Meat is Going Global* (May 8, 2018), <https://bit.ly/2BdV8nn>.

¹¹ Christian J. Peters et al., *Carrying Capacity of U.S. Agricultural Land: Ten Diet Scenarios*, Elementa Sci. Anthropocene (2016), <https://bit.ly/2OAt9Hz>; Alon Shepon et al., *The Opportunity Cost of Animal Based Diets Exceeds All Food Losses*, PNAS (2018), <https://bit.ly/2rhTf3U>.

¹² Alon Shepon et al., *The Opportunity Cost of Animal Based Diets Exceeds All Food Losses*, PNAS (2018), <https://bit.ly/2rhTf3U>.

¹³ Martin C. Heller & Gregory A. Keoleian, *Beyond Meat's Beyond Burger Life Cycle Assessment: A Detailed Comparison between a Plant-based and an Animal-based Protein Source*, Univ. Mich. Ctr. Sustainable Sys. (2018), <https://bit.ly/2XIk11I> (hereinafter "Beyond Meat LCA"); Jon Dettling et al., *A Comparative Life Cycle Assessment of Plant-based Foods and Meat Foods*, Quantis USA & MorningStar Farms (2016), <https://bit.ly/2AtV5E0> (hereinafter "MorningStar Farms LCA").

Life-cycle analyses of plant-based burgers produced by Impossible Foods and Beyond Meat conclude that they reduce greenhouse gas emissions by approximately 89 percent compared to conventional ground beef.¹⁴ Additional benefits are explained in Table 1.

Table 1: Environmental Benefits of Plant-Based Meat Products¹⁵

Eating this plant-based meat	instead of this conventional meat	reduces this environmental impact by this much.			
		Land use	Greenhouse gas emissions	Water use	Aquatic eutrophication potential
		m ² -y/kg	kg-CO ₂ -eq/kg	L/kg	g-PO ₄ ³⁻ -eq/kg
Impossible Burger 2.0 ¹⁶	Beef burger*	96%	89%	87%	91%
Beyond Burger ¹⁷	Beef burger**	—	89%	99%	—
Grillers Original Burger ¹⁸	Beef burger*	93%	85%	95%	77%
Spicy Black Bean Burger ¹⁸	Beef burger*	97%	89%	96%	76%
Roasted Garlic & Quinoa Burger ¹⁸	Beef burger*	93%	88%	98%	73%
Grillers Crumbles ¹⁸	Ground beef**	99%	90%	96%	—
Original Sausage Patties ¹⁸	Pork sausage patties*	47%	30%	81%	51%
Original Chik Patties ¹⁸	Breaded chicken patties*	84%	36%	72%	75%

*Sold frozen. **Sold fresh.
Impact reductions are calculated as follows: $(\text{impact of conventional meat} - \text{impact of plant-based meat}) \div (\text{impact of conventional meat})$.

¹⁴ Sofia Khan et al., *Comparative Environmental LCA of the Impossible Burger with Conventional Ground Beef Burger*, Quantis USA & Impossible Foods (2019), <https://bit.ly/2D6oVMb> (hereinafter “Impossible Foods LCA”); Beyond Meat LCA.

¹⁵ This table represents the results of all English-language comparative life cycle assessments of plant-based meat conducted as of June 18, 2020. Because each study differs slightly in its methodology, the results from different studies cannot be precisely compared.

¹⁶ Impossible Foods LCA.

¹⁷ Beyond Meat LCA.

¹⁸ MorningStar Farms LCA.

While cultivated meat is not yet on the market, three environmental studies of cultivated meat published so far show very promising results. Cultivated chicken is projected to use 35 to 67 percent less land than current chicken production while reducing nutrient pollution by 70 percent. The positive impact of cultivated beef is even greater, reducing land use by over 95 percent, climate change emissions by 74 to 87 percent, and nutrient pollution by 94 percent.¹⁹

II. Public Investment in Alternative Protein Research Would Make the United States a Global Leader in Sustainable Food Production.

To establish the United States as a global leader in sustainable food production and ensure the economic health and stability of our nation, we must invest dedicated funding into plant-based and cultivated meat research and development. U.S. leadership in this sector cannot be taken for granted, as our country has invested less than \$1 million total in public funds in alternative protein research to date, representing less than a thousandth of one percent of the federal budget for research and development for a single year.²⁰

Meanwhile, other governments are beginning to recognize alternative proteins' value for their national security, economy, and environmental sustainability and are already investing in its technological and scientific advancements. The United States can and must invest in these technologies to keep our rural and agricultural economies competitive on the world stage and not be left behind.

The European Union's aforementioned *Farm to Fork* strategy builds on initial funding announced last year directing approximately \$15.5 million for plant protein research (including research into mycoproteins, which are fungi).²¹ Additionally, the Netherlands spent \$2.3 million on cultivated meat research from 2005 to 2009 and is currently spending \$6.6 million on a five-year research project to improve plant-based meat manufacturing technology.²² Singapore is investing \$144 million into a variety of next-generation technologies intended to bolster its

¹⁹ The Good Food Institute, *Growing Meat Sustainably: The Cultivated Meat Revolution 2* (Oct. 2019), <https://bit.ly/2XCITaQ>. GFI is preparing an additional life-cycle assessment that we expect to complete later in 2020.

²⁰ This estimate is based on a review of U.S. state and federal funding over the last fifteen years directed toward open access plant-based and cultivated meat research.

²¹ \$5 million (€4.5 million) for a large-scale biorefinery project to produce mycoprotein and \$10.5 million (€9.6 million) for the Smart Protein project, primarily funded by the European Union to develop protein-rich foods from plants and fungi. Katie Askew, *Affordable and scalable: 3F Bio's 'first-of-its-kind' mycoprotein biorefinery*, FoodNavigator-USA (July 23, 2019), <https://bit.ly/2V1ZpBI>; Mary Allen, *This \$10.5 Million Initiative is Dedicated to Developing Alternative Proteins*, The Good Food Institute (Oct. 3, 2019), <https://bit.ly/34wuCA5>.

²² Elie Dolgin, *Sizzling interest in lab-grown meat belies lack of basic research*, Nature (2019), <https://go.nature.com/2K3mmhs>; Ariette Matser, *PPP Project Annual Report 2018*, Wageningen Univ. (2018), <https://bit.ly/3hzYtxL>.

bioeconomy, including cellular agriculture.²³ Germany, India, Israel, and Japan are making similar investments.²⁴ Equivalent investment by the United States would return significant dividends in the form of rural jobs and regional economic growth.

Recognizing the promise of alternative proteins, many meat companies are diversifying their portfolios to include alternative proteins. Tyson (recently rebranded as “a protein company”) and Cargill Protein (formerly Cargill Meat Solutions) have invested in cultivated meat companies,²⁵ and Smithfield Foods (one of the world’s leading pork producers) now offers a Pure Farmland line of plant-based sausages and meatballs.²⁶

Currently, the vast majority of alternative protein research in the United States (especially related to plant-based and cultivated meat) occurs in the private sector — and at such low levels that *New Scientist* wrote an editorial concluding that investment in cultivated meat research and development has been “chicken feed for a technology that could change the world for the better.”²⁷ While the results of private research can sometimes be licensed for a fee to other companies, private-sector research is generally proprietary, primarily benefiting only the company that conducts it.

In comparison, publicly funded research would have a significantly broader impact, inspiring additional research and creating new opportunities to feed Americans and the world. Research funded by the government can take on longer-term, more basic questions with higher risk but also potentially higher, broader, and more long-term value to the economy. In this way, public research acts as a catalyst and force multiplier, inspiring further investments in private research by addressing foundational issues and making the solutions available to everyone, improving overall efficiency by ensuring that the same work is not performed repetitively by each company behind closed doors.

²³ Yoolim Lee & Joyce Koh, *Singapore Backs Lab-Grown Meat, Robots in \$535 Million Push*, Bloomberg (Mar. 27, 2019), <https://bloom.bg/2XAHJ1F>.

²⁴ See *Plant-Based Proteins for Meat Lovers*, Karlsruhe Institute of Technology (Nov. 28, 2018), <https://bit.ly/3hF3x3H>; Ramya Ramamurthy, *Indian Government Grants Over \$600,000 to Cell-based Meat Research*, GFI (Apr. 26, 2019), <https://bit.ly/2Le2Sdv>; Niamh Michail, *Aleph Farms CEO on its 3D cultured beef: ‘Unlike other companies, our meat grows together like real meat’*, FoodNavigator (May 2, 2018), <https://bit.ly/2DXQkT5>; Helen Marvell, *Japanese Government Part of \$2.7 Million Investment in New Clean Meat Brand*, LiveKindly (June 5, 2018), <https://bit.ly/2FJdr2r>.

²⁵ Chase Purdy, *The world’s biggest meat companies are betting on cell-cultured meat*, Quartz (Jan. 30, 2018), <https://bit.ly/3eiLhew>; Rebekah Schouten, *Cargill invests in slaughter-free meat start-up*, Food Business Review (May 14, 2019), <https://bit.ly/2Bne4Ac>.

²⁶ Aidan Fortune, *Smithfield Foods enters plant-based market with Pure Farmland range*, Global Meat News (Aug. 13, 2019), <https://bit.ly/3hPL9Wa>.

²⁷ “Lab-grown meat could change the world for the better, but relying on the free market to develop it is a recipe for disaster. Governments must step up.” *The Leader: Cultured meat needs a lot more government backing – for all our sakes*, New Scientist (Feb. 19, 2020), <https://bit.ly/2YazsA4>.

III. Open-Access Alternative Protein Research Would Help Create a Resilient Food System.

Research into alternative proteins would allow us to diversify the food supply so that it is resilient to crises caused by climate change, such as extreme weather events, as well as protect against the emergence of crop diseases and pests. These technologies would also provide much needed stability to the food system and enhance food producers' abilities to respond swiftly to changes in consumer demand.

Benefits to Food Security

Global demand for meat is expected to increase by more than 50 percent by 2050 relative to 2012.²⁸ However, our current meat production system is vulnerable. As we have seen, a single disease outbreak in humans (like Covid-19) or animals (like African swine fever or avian flu) can result in massive damages to the food supply that hurt farmers' bottom lines and food security, including the need to cull millions of animals despite widespread hunger.²⁹ Disease outbreaks are expected to become more common as a result of climate change as mosquitos and other animals increase their habitat range or undergo migratory changes. These shifts in habitat and migration can bring animal-borne pathogens with them.³⁰

In part due to the demand for inexpensive feed crops for livestock, four crops currently dominate U.S. agriculture: corn, soybeans, wheat, and cotton. This lack of diversity creates fragility in the food supply, as a single adverse event threatens widespread effects. Because plant-based and cultivated meat can be made from a wide variety of different, high-value crops, a shift to these methods of protein production would allow the country to diversify the crops it grows, making us more resilient to extreme weather, crop diseases, and pests. For example, yellow peas are more resilient than corn, soybeans, and wheat because they "require less water [and] are drought tolerant."³¹ These peas are currently used in certain plant-based meats, with demand already expected to quadruple by 2025.³² Regardless of the benefits of any particular crop, having a greater variety of plants grown in American fields would provide an insurance policy against circumstances that would devastate just one.

²⁸ *The Future of Food and Agriculture: Alternative Pathways to 2050*, FAO 8 (2018), <https://bit.ly/3dfCIzV>.

²⁹ Sophie Kevany, *Millions of US farm animals to be culled by suffocation, drowning and shooting*, Guardian (May 19, 2020), <https://bit.ly/2N4rmUL>.

³⁰ Daisy Dune, *Q&A: Could climate change and biodiversity loss raise the risk of pandemics?*, Carbon Brief (May 12, 2020), <https://bit.ly/2XKPwcS>.

³¹ Larissa Zimmeroff, *The Rise of the Pea: How an Unassuming Legume Emerged as a Frontrunner in the Race to Replace Meat and Dairy*, TIME (Aug. 15, 2019), <https://bit.ly/2Xw08wB>.

³² Deena Shanker & Lydia Mulvany, *The Mighty Pea Is Everybody's New Favorite Plant-Based Protein*, Bloomberg (May 14, 2019), <https://bloom.bg/2BUhpHf>.

Additionally, the inputs for plant-based and cultivated meat can generally be stored until needed, allowing production of these foods to rise if conventional meat production plummets. And of course, plant-based meat is completely insusceptible to zoonotic disease because it is free of animals, and cultivated meat will be grown in a closed system where any contamination can easily be contained, adding security to the supply chain.³³

Benefits to Food System Stability

Alternative protein production methods are adaptable in a number of different ways that would help protect the domestic food supply from disruptive volatility. For example, plant-based and cultivated meat inputs and production platforms are versatile enough to be used to produce different kinds of meat, which allows them to adapt more quickly to changing consumer preferences. The same peas used to make plant-based burgers, for example, can be used to make plant-based chicken or pork. Similarly, the types and cuts of meats can be produced in exactly the proportion that consumers demand.³⁴ For example, if the market of the future pays more for chicken breast than chicken feet (as it does now), cultivated meat producers can grow only chicken breasts.

Finally, alternative protein production cycles require mere days or weeks to produce the same quantity of meat that requires months or years via conventional methods, meaning production can be throttled up or down in essentially real-time response to consumer demand.³⁵ These production advantages would improve the ability of our food system to remain stable in times of volatile supply or demand that would otherwise wreak havoc on America's farmers and agricultural producers.

IV. Conclusion

Recent events have exposed vulnerabilities in our domestic and global food systems that are compounded by climate change. We must find a way to mitigate these threats and reduce the incidence of their impacts. Alternative proteins offer a path forward that promises prosperity for farmers and rural communities, grows the national economy, strengthens our food supply, and sustains the long-term health of our planet. We respectfully submit that the Committee should provide leadership and support to rural and agricultural economies by establishing a federal interagency initiative for the alternative protein sector to identify and perform critical research and development and ensure interagency coordination.

³³ Liz Specht, *Modernizing Meat Production Will Help Us Avoid Pandemics*, Wired (Mar. 13, 2020), <https://bit.ly/37HIjhl>.

³⁴ Liz Specht, *Alt-Meat Trounces Animal Meat's Massive Inefficiencies*, Wired (Aug. 19, 2019), <https://bit.ly/3abxLGU>.

³⁵ *Id.*

We would welcome the opportunity to work with you to promote American prosperity and ensure the security of our food supply against the current and future impacts of climate change. Please let us know if you would like to discuss further by emailing jessicaa@gfi.org.

Sincerely,



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