

Recommendations for Reducing Methane Emissions from Agricultural Sources in the United States

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I. INTRODUCTION

In October 2018, the Intergovernmental Panel on Climate Change (“IPCC”) reported that if greenhouse gas emissions continue at the current rate, the atmosphere will likely warm by 2.7 degrees Fahrenheit above preindustrial levels by 2040.¹ This amount of warming is predicted to cause increased food shortages, violent wildfires, mass biodiversity loss, and sea level rise.² To prevent this level of warming, the IPCC states that greenhouse gas emissions must be reduced by forty-five percent of 2010 levels by 2030 and one hundred percent by 2050.³

Global and national leaders should focus on decreasing short-lived climate pollutants (“SLCPs”) including methane, black carbon, and fluorinated gases to attain this reduction. SLCPs are powerful climate pollutants that remain in the atmosphere for a shorter amount of time than other pollutants; SLCPs have an approximate twenty-year atmospheric lifespan compared to carbon dioxide’s one hundred-year lifespan.⁴ The climate potential of SLCPs is estimated to be tens to thousands of times greater than carbon dioxide.⁵ Reducing SLCPs can thus have a significant impact on the atmosphere with improvements that are observable in a shorter time period than reductions in carbon dioxide.

Methane is a particularly prevalent greenhouse gas. It is the second largest contributor to climate change after carbon dioxide, and is estimated to be twenty-five times as potent as carbon dioxide.⁶ Methane is emitted from the production and transportation of coal, natural gas, and oil, as well as from decaying organic waste in landfills, and from agricultural sources.⁷ Agricultural sources represent about half of the global emissions of methane.⁸

In the agricultural sector, methane emissions generally result from enteric fermentation and manure decomposition. Enteric fermentation occurs in the digestive systems of ruminants, where methane produced in the animal’s stomach

¹ Coral Davenport, *Major Climate Report Describes a Strong Risk of Crisis as Early as 2040*, N.Y. TIMES (Oct. 7, 2018), <https://www.nytimes.com/2018/10/07/climate/ipcc-climate-report-2040.html>.

² *Id.*

³ *Id.*

⁴ Hyunok Lee, *State Regulation on Livestock Methane and Challenges Faced by the California Dairy Industry*, 20 GIANNINI FOUND. OF AGRIC. ECON., U.C., Nov. 2016, at 1.

⁵ CAL. AIR RES. BD., SHORT-LIVED CLIMATE POLLUTANT REDUCTION STRATEGY, at 17 (Mar. 14, 2017), https://ww2.arb.ca.gov/sites/default/files/2018-12/final_slcp_reduction_strategy_w_appx_march2017%20Final%202017.pdf.

⁶ See *Overview of Greenhouse Gases*, U.S. ENVTL. PROT. AGENCY, <https://www.epa.gov/ghgemissions/overview-greenhouse-gases> (last visited Mar. 26, 2020); *Methane Emissions*, U.S. ENVTL. PROT. AGENCY, <https://www.epa.gov/ghgemissions/overview-greenhouse-gases#methane> (last visited Mar. 26, 2020).

⁷ *Id.*

⁸ CLIMATE & CLEAN AIR COAL., ANNUAL REPORT 2016-2017, at 40 (2017).

during fermentation is released by the animal, often through belches.⁹ Methane is also released when manure decomposes under anaerobic conditions in manure piles and open pit lagoons.¹⁰ Existing technologies, including anaerobic digesters, can reduce agricultural methane emissions. Studies indicate that if these technologies are implemented and used broadly, global methane emissions could decrease by forty percent.¹¹ Other industries such as landfills and wastewater treatment facilities already effectively use these technologies to capture and repurpose methane as natural gas source.¹²

A growing population and shifting dietary preferences are increasing the demand for animal products which will, in turn, increase methane emissions. It is estimated that there will be a fifty-seven percent increase in global meat demand by 2020, mostly in developing countries in Southeast Asia and Sub-Saharan Africa, and a resulting sixty percent increase in livestock-related methane emissions.¹³ Meeting the growing meat demand while decreasing methane emissions is a significant challenge that demands global, national, and local action.

Methane in the agricultural system presents a valuable and virtually untouched arena for addressing climate change in the United States. This paper analyzes the potential of regulating methane emissions in the United States agricultural sector to combat climate change. Since there is currently no federal law limiting methane from agricultural sources, this paper evaluates actions initiated by California and the international community to propose recommendations for future federal action.

II. CALIFORNIA POLICY INITIATIVES

In 2016, California became the first state to pass legislation addressing methane emissions in the agricultural sector with Senate Bill (“SB”) 1383—“The Short-Lived Climate Pollutants Act.”¹⁴ While implementation and enforcement of livestock manure regulations will not take effect until at least January 1, 2024,¹⁵ SB 1383 provides a useful case study for federal action.

⁹ Lee, *supra* note 4, at 2.

¹⁰ *Id.*

¹¹ CAL. AIR RES. BD., *supra* note 5, at 19.

¹² *Id.* at 56.

¹³ See Pete Smith et. al, *Agriculture*, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE [IPCC], 502, 504 (2007), <https://www.ipcc.ch/site/assets/uploads/2018/02/ar4-wg3-chapter8-1.pdf> (last visited Mar. 26, 2020).

¹⁴ *Implementing California’s New Dairy Methane Reduction Efforts*, DAIRY CARES, (Apr. 2017), <https://www.dairycares.com/dairymethanereduction> (last visited Mar. 26, 2020).

¹⁵ CAL. HEALTH & SAFETY CODE § 39730.7(b)(4) (2017).

A. Senate Bills 605 and 1383

Through SB 605 and SB 1383, California is implementing SLCP limits for agricultural sources within the state. SB 605 directed the California Air Resources Board (“CARB”) to develop a comprehensive SLCP strategy in conjunction with state agencies and local air quality management and air pollution control districts.¹⁶ SB 1383 then prompted CARB to approve and begin implementing this plan by January 1, 2018.¹⁷ SB 1383 tasks CARB with developing emission reduction targets for methane, hydrofluorocarbons, and anthropogenic black carbon, adopting policies with the California Public Utilities Commission and California Energy Commission to increase renewable gas production, implementing at least five dairy bio-methane pilot projects, and forming a Dairy and Livestock Working Group (“Working Group”).¹⁸

The Working Group, comprised of the California Department of Food and Agriculture (“CDFA”), partner agencies, stakeholders, and experts, held its kickoff meeting in May 2017 and its final meeting in December 2018.¹⁹ The purpose of the Working Group was to identify barriers to implementing methane reduction projects and recommend means of reducing methane emissions while supporting the sustainability of California’s dairy and livestock industry.²⁰ At its first meeting, three subgroups formed to develop policy recommendations in specific areas: (1) fostering markets for non-digester projects, (2) fostering markets for digester projects, and (3) creating a dairy air research prospectus to achieve California’s SB 1383 goals.²¹

The Working Group presented its findings and recommendations for advancing methane emission reductions at California dairy and livestock operations at its final meeting. The first subgroup concluded that non-digester projects are integral for meeting California’s methane reduction targets because they can reduce methane, achieve co-benefits, and are feasible for a wide range of California dairy operations.²² As such, the subgroup recommended that California agencies cooperate on a two-pronged strategy: (1) advance non-digester practices already known to reduce methane and (2) actively work to evaluate and advance lesser

¹⁶ *Reducing Short-Lived Climate Pollutants in California*, CAL. AIR RES. BD., <https://ww2.arb.ca.gov/our-work/programs/short-lived-climate-pollutants/about> (last visited Mar. 20, 2020).

¹⁷ Lee, *supra* note 4, at 2.

¹⁸ *Id.* at 1, 2; *see also* CAL. AIR RES. BD., *supra* note 5 at 14.

¹⁹ *Dairy and Livestock Greenhouse Gas Emissions Working Group*, CAL. AIR RES. BD., <https://ww2.arb.ca.gov/our-work/programs/dairy-and-livestock-greenhouse-gas-emissions-working-group/about> (last visited Mar. 26, 2020).

²⁰ CAL. AIR RES. BD., *supra* note 16.

²¹ CAL. AIR RES. BD., *supra* note 19.

²² CAL. AIR RES. BD., FINDINGS AND RECOMMENDATIONS, SUBGROUP 1: FOSTERING MARKETS FOR NON-DIGESTER PROJECTS, https://ww3.arb.ca.gov/cc/dairy/dsg1/dsg1_final_recommendations_11-26-18.pdf (last visited Mar. 26, 2020).

known technologies and practices.²³ The second subgroup analyzed the experiences, barriers, and opportunities for advancing digesters and organized their recommendations into four subcategories: (1) dairy digester expansions, (2) electricity generation and grid interconnectivity, (3) pipeline injected biomethane, and (4) transportation fuel markets.²⁴ The third subgroup worked to identify and prioritize research needs to improve the general understanding of methane emissions from dairies, the strategy to reduce manure emissions, and the feasibility of enteric fermentation methane emission reduction strategies.²⁵ The dairy air subgroup summarized California's research needs with the following diagram:²⁶



The Working Group's recommendations will help inform the state agencies involved in implementing SB 1383 and prioritize incentive funding and research programs moving forward.

B. California Air Resources Board's SLCP Reduction Strategy Plan

In March 2017, CARB adopted its SLCP Reduction Strategy ("SLCP Plan") outlining how it will implement SB 1383.²⁷ CARB predicts that rulemaking for

²³ *Id.*

²⁴ CAL. AIR RES. BD., FINDINGS AND RECOMMENDATIONS, SUBGROUP 2: DAIRY DIGESTERS, https://ww3.arb.ca.gov/cc/dairy/dsg2/dsg2_final_recommendations_11-26-18.pdf (last visited Mar. 26, 2020).

²⁵ *Dairy Research Prospectus To Achieve California's SB 1383 Climate Goals*, CAL. AIR RES. BD., https://ww3.arb.ca.gov/cc/dairy/dsg3/dsg3_final_dairy_air_research_prospectus_11-26-18.pdf (last visited Mar. 23, 2020).

²⁶ *Id.* at 17.

²⁷ CAL. AIR RES. BD., *supra* note 5.

manure will first require regulated entities to report and maintain records so the state can better understand greenhouse gas sources and emission levels at dairy and livestock operations.²⁸ Before regulations are implemented, state agencies are supporting actions to reduce manure emissions through financial incentives and policies encouraging renewable natural gas production.²⁹

The SLCP Plan describes six pathways for reducing methane emissions from dairies: (1) scrape conversion and onsite digestion for pipeline-injected natural gas vehicle fuel; (2) scrape conversion for onsite manure digestion producing; (3) scrape conversion and transport of manure offsite for centralized digestion; (4) retaining existing manure lagoon management with onsite covered lagoon digestion; (5) solar drying of manure onsite; and (6) conversion of dairy operations to pasture-based management.³⁰ A scrape method moves manure from a barn into a holding pit where a “weeping wall” separates the solids and liquids.³¹ A farmer can then spread the solids on fields as a nutrient supplement. This sustainable and closed-loop method results in significantly less emissions than conventional lagoon pits and other storage methods.³²

The natural gas options proposed by CARB demonstrate that methane emissions can be used as a valuable renewable fuel resource. Captured biogas from dairy manure can be used on-site as fuel for farm trucks, equipment, electricity and heat, or injected into natural gas pipelines and off-site as transportation fuel.³³ CARB identifies production of bio-methane for injection into a common-carrier pipeline as one of the most promising options for methane reduction.³⁴ This will require constructing pipeline segments and installing biogas upgrade equipment so pipeline-quality natural gas can be produced and used in natural gas vehicles.³⁵

CARB also proposes switching from anaerobic conditions in open lagoon ponds to anaerobic digesters or solid manure management practices, and transitioning to pasture-based farms.³⁶ Anaerobic digesters are machines that remove oxygen, allow microorganisms to break down organic matter like methane, and produce “digestate.”³⁷ Biogas from the resulting digestate can be

²⁸ *Id.* at 69.

²⁹ *Id.* at 8.

³⁰ *Id.* at 113-14.

³¹ Leilani Clark, *Methane Be Gone*, MADE LOCAL MAGAZINE Sept./Oct. 2017, at 3-4, <https://madelocalmagazine.com/2017/08/methane-be-gone/> (last visited Mar. 26, 2020).

³² *Id.*

³³ CAL. AIR RES. BD., *supra* note 5, at 66-67.

³⁴ *Id.* at 66.

³⁵ Lee, *supra* note 4, at 2; CAL. AIR RES. BD., *supra* note 5, at 66.

³⁶ CAL. AIR RES. BD., *supra* note 5, at 65.

³⁷ *Basic Information about Anaerobic Digestion (AD)*, U.S. ENVTL. PROTECTION AGENCY, <https://www.epa.gov/anaerobic-digestion/basic-information-about-anaerobic-digestion-ad> (last visited Mar. 26, 2020).

used as a renewable fuel. One barrier to utilizing anaerobic digesters is the up-front capital required for installing the necessary infrastructure.

Transitioning to pasture-based systems is also accompanied by challenges. While manure decomposes aerobically in pasture farms, which eliminates almost all methane emissions, nitrogen emissions are often higher.³⁸ Additionally, pasture systems require more irrigated land, supplemental feed, additional infrastructure such as shade structures, and limit a farmer's ability to manage manure as a resource.³⁹ Perhaps most importantly, milk production is lower in pasture systems which means more cows are needed to produce the same volume of milk.⁴⁰ This is a particular concern for California dairy farmers who are already under economic pressures; there has been no growth in the dairy industry since 2007 and prices remain low for milk.⁴¹ SB 1383 accounts for economic concerns by mandating that an evaluation of the economic feasibility of dairy methane regulations occur before any regulations are implemented.⁴²

C. Financing and Future Challenges for Senate Bill 1383

Further capital and research are needed to meet the goals encompassed in SB 1383. The California Legislature made an initial \$50 million appropriation for reducing dairy methane emissions through deployment of anaerobic digesters and alternative manure management practices.⁴³ The CDFA grants this money to farmers through two programs: Dairy Digester Research and Development Program and a new Alternative Manure Management Program.⁴⁴ This money is appropriated from cap-and-trade revenues generated in the state.⁴⁵ Future capital will be needed to enforce regulations and help farmers install anaerobic digesters and initiate improved management practices.

One area that is missing from SB 1383's regulatory scope is enteric fermentation. Enteric fermentation accounts for approximately thirty percent of California's methane emissions, yet is not presently subject to regulation.⁴⁶ The California Legislature intentionally omitted enteric fermentation because of the limited available information regarding long-term effects of proposed mitigation methods.⁴⁷ Rather than regulate enteric fermentation, California is supporting research and exploring voluntary, incentive-based options until economic and

³⁸ CAL. AIR RES. BD., *supra* note 5, at 65.

³⁹ *Id.* at 65-66.

⁴⁰ *Id.*

⁴¹ Lee, *supra* note 4, at 4.

⁴² CAL. HEALTH & SAFETY CODE § 39730.7(b)(4)(B) (2017).

⁴³ A.B. 1613, 2016 Gen. Assemb., Reg. Sess. (Cal. 2016); S.B. 859, 2016 Reg. Sess. (Cal. 2016).

⁴⁴ DAIRY CARES, *supra* note 14, at 1.

⁴⁵ CAL. AIR RES. BD., *supra* note 5, at 64.

⁴⁶ *Id.* at 8.

⁴⁷ *See* CAL. HEALTH & SAFETY CODE § 39730.7(f) (2017).

scientific evidence supports imposing regulations.⁴⁸ Enteric emission reduction measures must not compromise animal health, public health, or consumer acceptance of dairy products.⁴⁹

The market plays a vital role in sustaining the agricultural industry and negative consumer views can significantly affect certain products and farming practices. Consumers' suspicion of the safety and health effects of genetically engineered ("GE") foods and animals, for example, has led to negative market potential for such products. After the FDA approved a GE salmon for human consumption, over sixty stores including Safeway, Trader Joe's, and Whole Foods announced they would not carry GE salmon despite studies concluding GE salmon is as nutritious as other varieties of salmon.⁵⁰ The GE market exemplifies the powerfully negative effect consumer misinformation and fear can have on the agricultural industry. Out of similar concerns for the milk industry, California will wait to regulate enteric fermentation until animal welfare and scientific evidence supports such regulations.⁵¹

Nationally and globally, California is often at the forefront of environmental protection. Through other legislative actions, California has adopted ambitious targets for reducing the state's environmental impacts. In AB 32, the state committed to reducing greenhouse gas emissions to 1990 levels by 2020.⁵² In 2016, this target was increased to forty percent below 1990 levels by 2030.⁵³ In September 2018, Governor Brown signed SB 100, which calls for California to use one hundred percent carbon-free electricity by 2045.⁵⁴ Meeting these ambitious targets necessitates addressing and limiting SLCPs. With SB 1383, California may prove, once again, to be an environmental leader that inspires other states and the federal government to enact similar regulations.

III. THE INTERNATIONAL COMMUNITY

A. *United Nations Climate and Clean Air Coalition*

California is not the only region that recognizes the importance of regulating SLCPs. The United Nations Climate and Clean Air Coalition ("CCAC") is

⁴⁸ CAL. AIR RES. BD., *supra* note 5, at 8.

⁴⁹ CAL. HEALTH & SAFETY CODE § 39730.7(f) (2017).

⁵⁰ SUSAN A. SCHNEIDER, FOOD, FARMING, AND SUSTAINABILITY: READINGS IN AGRICULTURAL LAW 552, 562 (2d ed. 2016); TADLOCK COWAN, CONG. RESEARCH SERV., RL32809, AGRICULTURAL BIOTECHNOLOGY: BACKGROUND, REGULATION, AND POLICY ISSUES 7 (2015).

⁵¹ See CAL. HEALTH & SAFETY CODE § 39730.7(f) (2017).

⁵² A.B. 32, 2006 Gen. Assemb., Reg. Sess. (Cal. 2006).

⁵³ S.B. 32, 2015-2016 Reg. Sess. (Cal. 2016).

⁵⁴ David Roberts, *California Just Adopted its Boldest Energy Target Yet: 100% Clean Electricity*, VOX, <https://www.vox.com/energy-and-environment/2018/8/31/17799094/california-100-percent-clean-energy-target-brown-de-leon> (last visited Mar. 26, 2020).

pursuing similar efforts on an international scale. The CCAC was founded in 2012 as the first organized global effort to address air quality and climate change impacts from SLCPs.⁵⁵ The CCAC is a voluntary coalition of governments, businesses, civil society organizations, and intergovernmental organizations that aims to increase political will and large-scale implementation of SLCP reduction measures.⁵⁶ There are currently 120 state and non-state partners and hundreds of local actors in the CCAC.⁵⁷ The CCAC promotes eleven initiatives, with its Agriculture Initiative targeting black carbon and methane from four primary agricultural sources: enteric fermentation, livestock and manure management, open burning of crops, and paddy rice production.⁵⁸

Evaluating the CCAC's proposed solutions provides valuable insight for future regulation in the United States. The CCAC proposes a variety of tactics for tackling methane in the agricultural sector, including improvements to production practices, animal feed quality, animal health and husbandry, manure management, and energy efficiency.⁵⁹ For enteric fermentation, the CCAC identifies the following solutions: optimizing feed digestibility and availability, balancing feed rations, promoting better animal health, changing animal breeding techniques, improving grazing and grassland management to increase feed quality and productivity, and increasing quality and usage of crop residues as fodder in mixed systems.⁶⁰ For manure management, CCAC recommends improving existing practices, capturing methane as an energy source through anaerobic digesters and other means, and optimizing nutrient utilization for crop production.⁶¹

B. Uruguay

Uruguay is working with the CCAC to identify and implement methane reduction strategies in its agricultural sector while continuing to support development and food security.⁶² Agriculture, particularly beef production, represents an important sector of Uruguay's economy and contributes to the majority of the country's emissions: agricultural sources emit roughly seventy-

⁵⁵ CLEAN AIR AND CLIMATE COAL., *supra* note 8, at 4.

⁵⁶ *Id.* at 12, 19.

⁵⁷ *Who We Are*, CLEAN AIR AND CLIMATE COAL., <http://ccacoalition.org/en/content/who-we-are> (last visited Mar. 26, 2020).

⁵⁸ *Agriculture*, CLEAN AIR AND CLIMATE COAL., <http://ccacoalition.org/en/initiatives/agriculture> (last visited Mar. 26, 2020).

⁵⁹ CLEAN AIR AND CLIMATE COAL., *supra* note 8, at 42.

⁶⁰ *Enteric Fermentation*, CLEAN AIR AND CLIMATE COAL., <http://ccacoalition.org/en/activity/enteric-fermentation> (last visited Mar. 22, 2020).

⁶¹ *Livestock and Manure Management*, CLEAN AIR AND CLIMATE COAL., <http://ccacoalition.org/en/activity/livestock-and-manure-management> (last visited Mar. 22, 2020).

⁶² FAO & N.Z. AGRIC. GREENHOUSE GAS RES. CTR., *LOW EMISSIONS DEVELOPMENT OF THE BEEF CATTLE SECTOR IN URUGUAY-REDUCING ENTERIC METHANE FOR FOOD SECURITY AND LIVELIHOODS* (2017) at v.

five percent of the country's greenhouse gas emissions and beef production, primarily through enteric fermentation, accounts for seventy-eight percent of methane emissions.⁶³

Uruguay and the CCAC collaborated on a study that identified the baseline scenario and key drivers of emissions, explored mitigation interventions by identifying options consistent with Uruguay's development goals, and prioritized these interventions.⁶⁴ The study outlined a set of practices including diet changes, reproductive indicators, genetic changes, legume inter-seeding, and an increase in the commercial efficiency of feed.⁶⁵ Legume inter-seeding involves introducing legumes or more productive grasses into existing pasture sod, which improves nutrition and growth rates in animals.⁶⁶ Inter-seeding is also beneficial for reasons beyond methane reduction, as it increases soil carbon sequestration, improves water quality, and increases the nitrogen in the soil, thereby increasing soil fertility.⁶⁷ Encouraging these practices primarily requires education and outreach rather than expending significant capital. In addition, since many of the practices increase efficiency, these mitigation interventions can result in cost savings for farmers.⁶⁸

With the CCAC's support, Uruguay is introducing these practices to a larger number of farmers. Moving forward, California and the United States should pay particular attention to the Uruguay's enteric fermentation initiatives to better understand how states and national governments can encourage emission reductions in this area.

C. Sweden

Sweden is a valuable case study for the United States because it demonstrates how strong national policies can lead to significant greenhouse gas emission reductions. In 2017, Sweden adopted a law committing to net-zero greenhouse-gas emissions by 2045.⁶⁹ Sweden's Climate Act requires the government to present an annual climate report in its budget bill and create a climate policy action plan every four years outlining how its climate goals will be achieved.⁷⁰ This is

⁶³ *Id.* at 1.

⁶⁴ *Id.* at 3.

⁶⁵ CLIMATE AND CLEAN AIR COAL., *supra* note 8, at 43; FAO & N.Z. AGRIC. GREENHOUSE GAS RES. CTR., *supra* note 62, at 17.

⁶⁶ FAO & N.Z. AGRIC. GREENHOUSE GAS RES. CTR., *supra* note 62, at 19.

⁶⁷ *Id.* at 25.

⁶⁸ CLIMATE AND CLEAN AIR COAL., *supra* note 8, at 43.

⁶⁹ *Sweden Plans to Be Carbon Neutral by 2045*, UNITED NATIONS CLIMATE CHANGE (June 19, 2017), <https://unfccc.int/news/sweden-plans-to-be-carbon-neutral-by-2045> (last visited Mar. 26, 2020).

⁷⁰ Akshat Rathi, *Sweden Legally Commits To Reaching Net-Zero Emissions By 2045*, QUARTZ (June 16, 2017), <https://qz.com/1007833/swedens-climate-act-legally-commits-the-country-to-reach-net-zero-emissions-by-2045/> (last visited Mar. 26, 2020).

an ambitious but attainable goal given that Sweden has been working for decades to lower their emissions in many sectors, including agriculture.

The Swedish government offers a mix of information and economic policies to address agricultural emissions. Education and outreach initiatives target reducing fossil fuel use in farming and increase awareness about manure and fertilizer management. The government provides advice and training for landowners and farm managers to reduce emissions from manure management and improve energy efficiency.⁷¹ The Swedish Board of Agriculture, for example, manages a service called “Focus on Nutrients” that provides farmers with advice on achieving higher nutrient efficiency to reduce nutrient leaching, target greenhouse gas emissions, and increase energy efficiency.⁷² In addition to information initiatives, the Swedish government offers financial support for biogas production through anaerobic digestion of manure.⁷³ The Local Climate Investment Program and Rural Development Program provide further financial support via grants for environmental and climate actions.⁷⁴

The number of dairy cows in Sweden is decreasing as a result of increased productivity, product pricing mechanisms, and adaptation to the European Union agricultural policy regulations.⁷⁵ Decreasing the number of animals is essential to lowering emissions because an increase in an animal’s feed intake increases methane emissions.⁷⁶ In 2015, agriculture emissions accounted for approximately 12.5 percent of Sweden’s greenhouse gas emissions, which is about ten percent lower than 1990 levels.⁷⁷ Sweden expects its agricultural emissions to continue decreasing but will need to limit the use of chemical fertilizers to reach its goal of net zero energy by 2045.⁷⁸

IV. THE UNITED STATES FEDERAL GOVERNMENT

While individual farmers and states are beginning to respond, national standards are needed to attain widespread methane reductions in the United States. For a variety of reasons, the United States federal government is the most logical actor to address methane in the American agricultural sector. First, regulating at the federal level is the most conducive means of addressing air pollution since air pollutants travel across state lines. Second, if states begin regulating methane in a patchwork fashion, it may drive farmers out of states with regulations, or those

⁷¹ GOV. OFF. OF SWEDEN, MINISTRY OF THE ENV’T. AND ENERGY, SWEDEN’S SEVENTH NATIONAL COMMUNICATION ON CLIMATE CHANGE 46 (2017).

⁷² *Id.* at 56.

⁷³ *Id.*

⁷⁴ *Id.* at 13.

⁷⁵ *Id.* at 14.

⁷⁶ FAO & N.Z. AGRIC. GREENHOUSE GAS RES. CTR., *supra* note 62, at 4.

⁷⁷ GOV. OFF. OF SWEDEN, MINISTRY OF THE ENV’T. AND ENERGY, *supra* note 71 at 36-37.

⁷⁸ *See id.*

with more stringent regulations. This would increase the concentration of methane emissions in certain states, which is counterproductive to the goal of reducing emissions throughout the country. Finally, regulating state by state can have potentially adverse effects on economic competition and spur litigation, as exemplified by state animal welfare statutes.

After California voters approved Proposition 2, “The Prevention of Farm Animal Cruelty Act,” many egg farmers were concerned that they would not be able to comply with the law and stay competitive in the national egg market. Consequently, the California Legislature passed a bill prohibiting the sale of eggs from out of state sources unless hens are raised pursuant to Proposition 2’s requirements.⁷⁹ Six states immediately filed suit seeking declarative and injunctive relief.⁸⁰ The states argued that California’s law was preempted by the federal Egg Products Inspection Act and violated the dormant Commerce Clause.⁸¹ The Ninth Circuit affirmed the district court’s denial on narrow standing grounds. The Ninth Circuit ruled that the states failed to demonstrate the first element of *parens patriae* standing, in which a state must articulate an interest apart from private parties.⁸² Further, the potential economic effect was too speculative for Article III standing.⁸³ The Supreme Court denied certiorari.⁸⁴

By dismissing the lawsuit on standing grounds, the courts never reached the merits of the states’ arguments. It remains unclear how a similar lawsuit would be decided if filed by private farmers rather than a state. In any event, California’s law initiated three years of litigation, ultimately reaching the Supreme Court, which is an inefficient means of regulating. The litigation that followed Proposition 2 may foreshadow a similar result for state-enacted methane regulations.

For the abovementioned reasons, the federal government is best suited to regulate agricultural methane emissions. This paper recommends that the Environmental Protection Agency (“EPA”) implement methane regulations by adding methane as a criteria pollutant under the Clean Air Act (“CAA”), thereby requiring states to integrate methane reduction measures into State Implementation Plans (“SIPs”).

A. Existing Forms of Governance

The United States Department of Agriculture (“USDA”) currently offers voluntary programs to address methane and other climate change pollutants from

⁷⁹ CAL. HEALTH & SAFETY CODE § 25996 (2011).

⁸⁰ See *Mo. ex rel. Koster v. Harris*, 842 F.3d 658, 662 (9th Cir. 2017).

⁸¹ *Id.*

⁸² *Id.*

⁸³ *Id.* at 665, 667.

⁸⁴ *Mo. ex rel. Hawley v. Becerra*, 137 U.S. 2188 (2017).

agricultural sources. While these programs are a step in the right direction, a national policy limiting methane emissions is necessary to achieve emission reductions across the country. Before such regulations are implemented, however, farmers should take advantage of USDA's financial assistance programs to reduce their emissions.

The Agricultural Management Assistance ("AMA") helps farmers manage risks, including erosion and water quality, and solve natural resource issues by integrating conservation practices into farming operations.⁸⁵ The Conservation Stewardship Program ("CSP") and the Environmental Quality Incentives Program ("EQIP") similarly provide technical and financial assistance to farmers for maintaining and improving conservation systems and adopting additional practices to address natural resource concerns.⁸⁶ Through EQIP, the USDA provides conservation practice standards for tools that address methane emissions like anaerobic digesters, solid separators, and roofs and covers with methane flaring.⁸⁷

For climate change, the USDA's "Building Blocks for Climate Smart Agriculture and Forestry" offers a voluntary framework for ranchers and farmers to respond to changes on their land.⁸⁸ This program outlines conservation, forestry, and energy programs to reduce greenhouse gas emissions, increase carbon sequestration, and increase renewable energy production in the agricultural sector.⁸⁹ Through the Building Blocks program, the USDA plans to install five hundred anaerobic digesters and cover lagoon and waste storage ponds from ten percent of market swine and dairy cattle operations, in addition to supporting research and education programs exploring methane reducing technologies and practices.⁹⁰ These programs offer farmers valuable tools to learn about conservation and emission reduction practices. The USDA should continue and expand these programs moving forward, as the need for education and financial assistance will only increase if regulations are implemented.

B. The Environmental Protection Agency's Potential to Regulate Methane

A number of federal laws provide the EPA with authority to regulate pollutants from agricultural sources, including the Clean Water Act, CAA, and

⁸⁵ *Financial Assistance*, U.S. DEP'T. AGRIC., <https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/> (last visited Apr. 9, 2020).

⁸⁶ *Id.*

⁸⁷ U.S. DEP'T. AGRIC., LIVESTOCK PARTNERSHIPS, https://www.usda.gov/oce/climate_change/building_blocks/3_LivestockPartnerships.pdf (last visited Mar. 26, 2020).

⁸⁸ U.S. DEP'T. AGRIC., OFFICE OF THE CHIEF ECONOMIST, USDA BUILDING BLOCKS FOR CLIMATE SMART AGRICULTURE AND FORESTRY, 2 (2016) https://www.usda.gov/oce/climate_change/building_blocks/BuildingBlocksImplementationPlanProgressReport.pdf (last visited Mar. 26, 2020).

⁸⁹ *Id.*

⁹⁰ *Id.* at 4.

Comprehensive Environmental Response, Compensation, and Liability Act.⁹¹ Because the CAA is the most applicable authority for regulating methane, it is recommended that the EPA take advantage of this existing framework to implement nationwide methane limits.

Under the CAA, the EPA is authorized to regulate stationary and mobile air pollution sources, which includes livestock and agricultural sources that emit in excess of the threshold limits of regulated pollutants.⁹² The CAA's purpose states that while air pollution prevention is primarily a state and local government responsibility, federal financial assistance and leadership is essential for developing cooperative programs to control pollution.⁹³ Thus, the CAA permits states to design and implement SIPs that outline how it will meet and maintain national ambient air quality standards within each air quality control region.⁹⁴ The EPA is tasked with setting acceptable pollution levels for "criteria pollutants," or those that may reasonably be anticipated to endanger public health or welfare.⁹⁵ The EPA currently identifies six such pollutants—carbon monoxide, sulfur dioxide, nitrogen dioxide, lead, ozone, and particulate matter (PM_{2.5} and PM₁₀)—and sets acceptable limits for each.⁹⁶

In 2009, the EPA made an endangerment finding for six greenhouse gases under section 202 of the CAA: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.⁹⁷ Although this finding occurred in the context of section 202, which addresses emissions from new motor vehicles and engines, the finding could plausibly provide a basis to regulate methane in agriculture operations.⁹⁸ If the EPA included methane in the list of "criteria pollutants," it would set standards for allowable limits and require states to include methane reduction strategies in their SIPs. Allowing states to tailor their methane reduction plans in light of geographic constraints and specific agricultural industry needs would provide requisite flexibility for successful regulation.

⁹¹ See U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-08-944, CONCENTRATED ANIMAL FEEDING OPERATIONS – EPA NEEDS MORE INFORMATION AND A CLEARLY DEFINED STRATEGY TO PROTECT AIR AND WATER QUALITY FROM POLLUTANTS OF CONCERN, 2 (2008).

⁹² *Id.* at 12.

⁹³ See Clean Air Act, 42 U.S.C. § 7401(a)(3-4) (2012).

⁹⁴ *Id.* at § 7407 (2012).

⁹⁵ 40 C.F.R. § 50.2(b) (2020).

⁹⁶ See generally 40 C.F.R. § 50 (2020) (National Primary and Secondary Ambient Air Quality Standards).

⁹⁷ Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 66497 (Dec. 15, 2009); see also John Verheul, *Methane as a Greenhouse Gas: Why the EPA Should Regulate Emissions from Animal Feeding Operations and Concentrated Animal Feeding Operations Under the Clean Air Act*, 51 NAT. RESOURCES J. 163, 178 (2011).

⁹⁸ Verheul, *supra* note 97, at 175.

Regulating through the CAA could provide an effective means of addressing agricultural methane emissions; however, this is an ambitious recommendation based on the EPA's previous actions addressing agricultural air pollution. In 2009, the EPA began a two-year study, "The National Air Emissions Monitoring Study," to collect data on air emissions from animal feeding operations in order to provide a basis for developing federal compliance protocols.⁹⁹ This study did not include methane as an emission to be measured. Furthermore, although the EPA completed the study in 2011, it has not finalized any emission estimating methodologies for agricultural operations.¹⁰⁰ The EPA's website lists the following timelines for creating models out of the data: drafting models for ammonia, hydrogen sulfide, and particulate matter emissions from swine farms by September 2019; poultry farms by February 2020; dairy farms by July 2020; and volatile compound emissions from swine, poultry and dairy farms by November 2020.¹⁰¹ Finalizing emission estimating methodologies is simply marked "TBD."¹⁰²

This significant delay in gathering current emission data, the first step in regulating, is not a promising indication that the EPA will regulate methane in the near future. Looking towards a longer-term solution however, it is significant that the governance framework is already in place for regulating methane and that the EPA concluded that methane is likely to endanger public health and welfare in a prior rule. These two principles lay the groundwork for future federal action.

V. CONCLUSION: RECOMMENDATIONS FOR FUTURE ACTION

Climate change threatens to only get worse as a result of a growing population. As such, future policies will need to carefully balance food security concerns with environmental concerns. Addressing SLCPs is a necessary step in preventing the planet from warming to dangerous levels. Reducing methane and other SLCPs will also have positive effects on environmental health, water quality, and agricultural production. The CCAC reports that reducing SLCP emissions has the potential to prevent over fifty million tons of annual crop losses for staple crops including corn, wheat, soy, and rice by 2030.¹⁰³ This could prevent an estimated 2.4 million premature deaths by 2030.¹⁰⁴

⁹⁹ U.S. GOV'T ACCOUNTABILITY OFFICE, *supra* note 91, at 33.

¹⁰⁰ *See generally* U.S. ENVTL. PROTECTION AGENCY, ELEVEN YEARS AFTER AGREEMENT, EPA HAS NOT DEVELOPED RELIABLE EMISSION ESTIMATION METHODS TO DETERMINE WHETHER ANIMAL FEEDING OPERATIONS COMPLY WITH CLEAN AIR ACT AND OTHER STATUTES, Report No. 17-P-0396 (Sept. 2017).

¹⁰¹ *National Air Emissions Monitoring Study*, U.S. ENVTL. PROTECTION AGENCY, <https://www.epa.gov/afos-air/national-air-emissions-monitoring-study> (last visited Mar. 24, 2020).

¹⁰² *Id.*

¹⁰³ CLIMATE & CLEAN AIR COAL., *supra* note 8, at 11.

¹⁰⁴ *Id.*

After evaluating actions initiated by California with its upcoming dairy methane regulations, international partnerships under the CCAC, and the benefits that flow from national efforts demonstrated by Uruguay and Sweden, it is recommended that the United States federal government implement national methane regulations. CARB's SLCP Plan, CCAC's research, Uruguay's implementation of its CCAC plan, and Sweden's recent legislation demonstrate that numerous methane reduction strategies and technologies exist that can be implemented with the right leadership and support. Federal regulations should occur via the EPA listing methane as a criteria pollutant under the CAA, thus requiring states to integrate methane reduction plans into their SIPs. Since the EPA previously found methane to be harmful to public health and welfare under section 202, the regulatory framework arguably already exists for such action. Depending on the political and practical feasibility of reducing methane emissions to a certain level, the EPA may want to consider adopting two separate methane emission limits: one for industrial sources and another for agricultural sources.

Furthermore, the EPA should partner with the USDA to continue and expand educational and financial opportunities for farmers to reduce emissions on their farms. As noted, the EPA is not likely to regulate methane in the near future based on its delayed actions gathering data on air emissions from farming operations. Before the federal government acts, states should continue encouraging methane reductions from farms. Finally, federal, state, and local governments should provide funding to research enteric fermentation reduction strategies that do not threaten animal welfare, or the quality of animal products intended for human consumption.

Methane is a very harmful greenhouse gas emission that demands attention by local, state, national, and international actors. By taking the steps recommended in this paper, the United States can reduce methane emissions in the agricultural sector and reap significant benefits for the planet, human health, and food security.