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GHG Mitigation in the Absence of a National Carbon Market

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A greenhouse gas (GHG) market is an appealing solution to mitigate GHG emissions because policy makers could "cap" emissions at some predetermined level and market forces would then allocate the required emissions reductions to those entities that could supply them most cost-effectively. If the carbon market resembled those outlined in the Climate Security Act of 2008, the American Clean Energy and Security Act of 2009, and the American Power Act of 2010 which were introduced into Congress in past years, agricultural producers would not be legally required to reduce their emissions but would be allowed to generate "offset credits" by taking voluntary actions that reduce GHG emissions or increase carbon sequestration in soils and biomass. These credits could then be sold to entities in covered sectors, which could use them to satisfy their emissions reduction obligation.

While conceptually appealing, the United States does not have a national carbon market. The last attempt to establish one ended in July of 2010 when the U.S. Senate announced it would not consider companion legislation to the American Clean Energy and Security Act that was passed by the House of Representatives on June 26, 2009. In the period since, there has been no serious attempt to establish a national carbon market. In this absence, a number of public and private sector entities have moved to consider alternative approaches for tapping some of the GHG mitigation potential of the agricultural sector. Three of the most prominent approaches are: placing greater emphasis on GHG mitigation in the United States Department of Agriculture's (USDA) conservation and renewable energy programs, facilitating private sector-led supply chain initiatives to reduce the carbon footprint of specific products, and supporting joint public-private efforts centered on voluntary GHG mitigation.

USDA Programs

USDA's conservation, renewable energy, and energy efficiency programs incentivize farms to adopt many practices that result in GHG mitigation. The Conservation Reserve Program (CRP) provides farmers with annual payments and other incentives to shift environmentally sensitive cropland to grasses, trees, and other conservation covers for periods of 10 to15 years. These shifts typically increase the carbon stored in soils and vegetation, and decrease carbon dioxide (CO2) and *nitrous oxide* (N2O) associated with field operations. The Environmental Quality Incentives Program (EQIP) provides technical and financial assistance to farmers to adopt a variety of conservation practices on lands that remain in production. USDA's Natural Resources Conservation Service (NRCS) has identified 35 EQIP supported practices that increase carbon sequestration and reduce emissions of CO2, methane (CH4), and N2O (USDA, NRCS, 2014). USDA Rural Development's (RD) Rural Energy for America Program (REAP) provides financial assistance to farms to install renewable energy systems (such as solar panels, wind mills, and anaerobic digesters) and to invest in improved energy efficiency (for example, more energy-efficient irrigation pumps). Expanding the supply of renewable energy and improving farm energy efficiency can mitigate CO2 emissions by reducing the demand for energy generated from fossil fuels. Between 2009 and 2011, REAP funded projects produced over 6.5

million *megawatt hour* (Mwh) of renewable energy and improved energy efficiency (USDA, RD, 2012).

USDA has increasingly emphasized improving the scientific understanding of climate change and the technical and economic challenges it poses to U.S. agriculture and forestry. In 2014, for example, USDA published comprehensive entity-scale methods for quantifying GHG fluxes from agriculture and forestry operations (Eve et al., 2014). It also established a network of regional Climate Hubs to provide region specific information and guidance on climate related technologies and risk management practices. In the conservation and energy programs, this emphasis has focused on quantifying and tracking mitigation benefits. For 2011, USDA estimated the GHG mitigation benefits of CRP, REAP, and the NRCS conservation programs at, respectively, 51.6, 11.9, and 1.9 teragrams (Tg) equivalent carbon dioxide (CO2e) (U.S. Department of State, 2014).

While significant in magnitude, the GHG mitigation benefits of USDA's conservation and energy programs have largely been achieved while targeting other conservation, energy, and rural economy objectives. This raises the policy option of using these programs to explicitly incentivize GHG mitigation. The approach would be to pay producers to adopt practices, technologies, and land uses that reduce the emissions associated with their operations or increase the carbon stored in soils and vegetation.

The potential costs and GHG benefits of a USDA program to incentivize farmers to mitigate GHG emissions would depend on how the program was structured. For example, an approach based on existing programs, authorities, and funding levels would likely be more limited in scope, resources, and mitigation potential than an approach based on new authorities and additional funding. Recent work, however, provides some insights regarding the overall mitigation potential of incentivizing a specific set of farm-level GHG mitigation options.

ICF International (ICF) (2013) identifies 20 farm-level practices and technologies that various representative farms could adopt to reduce their GHG footprint—including changes in tillage intensity, nutrient management, manure management, and land uses. ICF differentiates farms by region, size, and commodity produced. For each farm and mitigation option combination, ICF calculates the incentive, in dollars per metric ton (MT) of CO2 mitigation that just covers the farm's adoption cost; this is labeled the "CO2 break-even price". Lewandrowski et al., (2014) incorporate these 20 mitigation options into a marginal abatement cost curve (MACC) framework and develop a farm-sector supply curve for GHG mitigation. At $20 per MT CO2, the MACC indicates that U.S. farms supply mitigation equal to 55 Tg CO2e. One interpretation is that USDA could facilitate about 55 Tg CO2e of new mitigation by offering farmers $20 per MT CO2 to adopt one of the 20 technologies and practices reflected in the MACC. The total cost would be about $1.1 billion, and would generate soil health, water quality, air quality, and habitat benefits in addition to GHG mitigation.

Supporting Private Sector GHG Mitigation Actions

Many private companies and other non-federal entities have made voluntarily commitments to reduce their GHG footprint. Examples include the National Hockey League (NHL, 2014), Chevrolet (2014), and more than 1,300 partners that have joined the U.S. Environmental Protection Agency's (EPA) Green Power Partnership (EPA, 2014). These commitments typically include a stated GHG mitigation goal, a timeframe to achieve it, a detailed action plan, periodic reporting on progress, and independent third party verification that the mitigation being reported is real.

While USDA cannot mandate how private voluntary GHG mitigation commitments are structured, operationalized, or enforced, it can use a variety of non-payment-to-farmer incentives and policies to help make these commitments occur more frequently. Three private-sector led GHG mitigation initiatives are described below along with the USDA policies that have been used to support them.

Reducing GHG Emissions in the Supply-Chain for Fluid Milk

In 2009, the dairy industry, working through the Dairy Innovation Center (DIC), committed to reduce the GHG emissions associated with the supply chain for fluid milk by 25% by 2020 (DIC, 2013a). The commitment included four on-farm projects aimed at improving farm profitability and mitigating GHG emissions. The programs, described below, focus on expanding farm production of clean energy, improving farm energy efficiency, and decreasing farm energy consumption. The dairy industry has set a mitigation goal for the four programs of 2.68 Tg CO2e annually by 2020 (DIC, 2014). Progress is reported annually in DIC's Greenhouse Gas Reduction Projects Progress Report (DIC, 2014).

Farm Smart is an online decision support tool that allows farms to assess the environmental impacts of their operations, including their energy use and GHG footprint, using a standard set of methodologies and metrics. Farm Smart was pilot tested in 2012 using a set of dairy farms encompassing 60,000 cows with annual milk production of 150 million gallons. In 2013, testing was expanded to farms and dairy retailers nationwide. GHG mitigation goals for 2020 include reducing dairy sector use of nitrogen fertilizer by 10% and reducing annual GHG emissions associated with fluid milk production by 230,000 MT CO2e.

The Farm Energy Efficiency Program promotes energy conservation, energy efficiency, and GHG reductions on dairy farms by connecting producers with opportunities for energy audits and equipment upgrades, largely through EQIP. Between 2011 and 2013, DIC's partnership with NRCS resulted in 667 on-farm energy audits. These audits identified potential energy savings of over 55,500 million British thermal units (MmBTU), potential GHG reductions of 11,500 MT CO2e, and potential cost savings of over $2 million. Program goals for 2020 include conducting 7,200 energy audits, improving farm energy efficiency 10 to 35%, and reducing GHG emissions for fluid milk by 50,000 MT CO2e.

The Dairy Power/Biogas Capture and Transport project promotes the capture and utilization of biogas through the adoption of anaerobic digester systems on dairy farms. In 2013, DIC supported an assessment of the potential market for digester related products on confined dairy operations over 500 cows (Informa Economics, 2013; DIC, 2013a). Assuming all such dairies installed digesters, potential products included 11.7 Mwh of electricity, 440 thousand tons of nitrogen and phosphorous fertilizers, and 30 million cubic yards of fiber. The market value of these products was estimated at over $1.9 billion. The potential GHG mitigation benefits were estimated at 34.3 Tg CO2e. Program goals for 2020 include the adoption of 1,300 additional digesters on U.S. dairy farms.

Finally, the Cow of the Future program advances scientifically sound and economically viable methods of reducing enteric fermentation CH4 emissions from dairy cows through improved nutrition, genetics, and health. Under this program, DIC released a report entitled *Considerations and Resources on Feed and Animal Management* (DIC, 2013b). The report discusses economic and environmental considerations of known feed and animal best management practices. Program goals for 2020 include reducing GHG emissions for fluid milk by 600,000 MT.

Prairie Pothole Region Grasslands Project (PPRGP):

The Prairie Pothole Region (PPR) contains thousands of shallow wetlands known as "potholes." These potholes provide critical nesting habitat for many duck species and sequester large amounts of carbon in the soil. In the United States, the PPR includes parts of North Dakota, Montana, South Dakota, Minnesota, and Iowa. Currently, the U.S. PPR loses about 50,000 acres of native grasslands per year due to conversions to cropland (Climate Trust, 2014). These conversions significantly reduce the carbon stored in the affected soils (Euliss et al., 2006). Emission rates are estimated to the range between 0.5-2 MT of CO2 per acre per year.

In November 2014, Chevrolet Motor Company, Ducks Unlimited (DU), The Climate Trust, and USDA announced a partnership to generate carbon offsets through voluntary actions that avoid conversions of private grasslands to row crops. Enrolled lands can be used for hay production and grazing but not crop-based agriculture. In exchange for a perpetual grassland easement, participating farmers and ranchers receive revenue derived from the transaction of carbon credits. Carbon credits are generated and saleable for 20 years.

The PPRGP began in 2011, when NRCS awarded DU a Conservation Innovation Grant (CIG) to fund the development of a methodology to quantify the carbon emissions that would be avoided if prairie grasslands, under threat of conversion to row crops, were preserved as grasslands. In 2013, the methodology was approved by The American Carbon Registry (ACR), a major U.S. carbon offset registry (ACR, 2014). ACR's approval was critical because it provided credibility that the project's offsets were real and verifiable.

Through an existing agreement with U.S. Fish and Wildlife Service (USFWS), DU has the ability to transfer easements it secures on private property to USFWS (DU, 2009). Through this agreement, the easements secured by DU in the PPRGP are held, monitored, and enforced by the USFWS.

In addition to the CIG grant, USDA supported the PPRGP by allowing private landowners to simultaneously enroll their grasslands in a special grazing lands EQIP project (USDA NRCS, 2012). The EQIP project targets grasslands covered by expiring CRP contracts and provides landowners with financial and technical assistance to establish or enhance grazing systems (such as installing fencing, planting forage, prescribed grazing, forage harvest management, and water infrastructure development). To complete the partnership, the Climate Trust and the Bonneville Environmental Foundation negotiated a purchase agreement with Chevrolet for nearly 40,000 MT of carbon credits generated by PPRGP. The project is part of Chevrolet's publicly announced goal of reducing eight million metric tons of GHG emissions between 2010 and 2015 (Climate Trust, 2014; Chevrolet, 2014).

Lower Mississippi Valley Grouped Afforestation Project (LMVGAP)

The Mississippi River alluvial plain once supported around 51.9 million acres of riparian forests, of which less than 12.4 million acres remain (TNC, 1992). Much of the Lower Mississippi Valley's forested wetland systems have been significantly altered by human use, which makes the area a priority for forest restoration efforts. In 2009, as part of a broader strategy to restore bottomland hardwood forests in the Lower

Mississippi River Basin, Disney and The Nature Conservancy (TNC) formed a collaboration called the Lower Mississippi Valley Grouped Afforestation Project (LMVGAP). LMVGAP initially targets 2,000 acres for restoration.

LMVGAP prioritizes lands that would likely stay in agricultural production in the absence of carbon financing. Private property owners who enroll land in LMVGAP receive a payment from TNC in exchange for granting TNC a permanent conservation easement and the right to transact carbon credits derived from the restored forest. TNC has committed to deliver a portion of these carbon credits to Disney in exchange for the financing that made the easement acquisitions possible. USDA supports the collaboration by allowing landowners to participate in both LMVGAP and the CRP or *Wetlands Reserve Program* (WRP). TNC works with USDA to condition easements on lands being enrolled in either a 15 year CRP contract or a 30-year WRP contract—for completeness, the Agricultural Act of 2014 terminated the WRP and rolled its existing contracts into the Agricultural Conservation Easement Program. Additionally, land currently covered by a CRP grassland practice contract may be converted to a forest practice contract. LMVGAP covers the cost of site preparation and tree planting, while USDA and landowners share the cost of hydrologic restoration (TNC, 2011).

LMVGAP establishes credibility that its carbon-offsets are real and verifiable in several ways. First, LMVGAP follows the requirements of the Verified Carbon Standard (VCS), which provides independent validation for the project design and the methods and processes by which offsets will be quantified and verified (VCS, 2011). VCS has validated the LMVGAP project design for privately owned lands in Louisiana, Arkansas, and Mississippi. Verification will occur periodically in the future as the forests mature and sequester additional carbon in soils and biomass (VCS, 2011). VCS requires that 10% of the project's certified carbon credits remain unsold to insure against the risk that less carbon gets sequestered than the methodology predicted. VCS also requires an additional credit withholding to account for potential "leakage"--carbon emissions from offsite forest conversions motivated by producers replacing some of the land removed from crop production by the project (VCS, 2011). Finally, TNC requires that participating landowners sign an affidavit certifying that without the easement payments they would not have placed their property in permanent conservation (TNC, 2014).

The financing made possible through the TNC/Disney collaboration, combined with the payments provided through CRP or WRP, provide an incentive that is sufficient for participating landowners to overcome the opportunity costs of converting land from agricultural use to forests. As a result, more forested wetlands are restored, more carbon is sequestered, and there is more certainty that the wetlands will remain wetlands after their enrollment in CRP or WRP expires than if TNC or USDA had acted alone.

Looking to the Future

Achieving any significant portion of agriculture's GHG mitigation potential will require large numbers of farms to adopt technologies and practices that reduce the GHG emissions associated with their crop and livestock production systems or increase the quantity of carbon stored in soils and vegetation. Farms that adopt such technologies and practices, however, will typically incur costs and may face additional risks. While the costs can range from relatively modest decreases in expected net revenues for some cropping practices to several million dollars for advanced anaerobic digester systems (ICF, 2013), it is unlikely that large-scale adoption of any GHG mitigating practice or technology will occur unless farms can recover the adoption costs and address the associated risks.

From a policy standpoint, establishing a national carbon market with agricultural offsets would be a straight forward framework to enable farms to recover costs and address risks associated with adopting GHG mitigating practices and technologies. Such a market would make GHG mitigation a commodity complete with production technologies, production costs, and expectations about total output and net revenue. Absent a national carbon market, other policy approaches can be used to promote additional GHG mitigation in the farm sector.

Through its conservation and energy programs, USDA has extensive experience incentivizing farms to adopt specific conservation practices. To date these programs have generally not had a primary focus on GHG mitigation. Even so, farm participation in three programs—CRP, EQIP, and REAP—currently produces GHG mitigation on the order of 65 Tg CO2e annually. One policy option to foster additional GHG mitigation in the farm sector is to incentivize the adoption of select practices and technologies based on their GHG mitigation potential. For example, offering farmers a fixed payment per MT CO2e mitigation achieved, would encourage farms to identify the most cost-effective GHG mitigation technologies and practices for their circumstances and provide the funds necessary to cover some or all of the costs of adoption. The overall mitigation potential of such payments would largely be determined by the share of the adoption costs covered and program budget.

USDA can also facilitate and encourage private-sector led GHG

mitigation initiatives through a variety of non-payment-to-farmer incentives. In the context of the DIC's commitment to reduce GHG emissions, the PPRGP, and LMVGAP, these incentives have included funding the development of methods and tools to measure and track the GHG benefits associated with specific actions, providing funding for on-farm energy audits, and allowing farmers to simultaneously enroll land in a USDA conservation program and a private-sector led initiative.

These incentives reduce the costs associated with developing credible metrics and processes for measuring, monitoring, and tracking GHG mitigation. They also help farms identify specific areas in their operations where mitigation is most cost-effective. Finally, by allowing public and nongovernmental organizations to pool their resources, producers can be offered higher mitigation payments. This allows more mitigation to be achieved than if entities act individually.

For More Information

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