Background

At their summer meeting in 2014, members of the National Sustainable Agriculture Coalition (NSAC) voiced an interest to learn more about agricultural protocols used to generate offset credits within carbon markets. In the spring of 2015, the Institute for Agriculture and Trade Policy (IATP) and the California Climate & Agriculture Network (CalCAN) presented a webinar on "Carbon Markets and Agriculture: A US and International Perspective" to provide an introduction to carbon market strategies across the globe. This case study analysis delves into four different agricultural carbon market protocols for utilization by farmers and ranchers. It discusses the general requirements of each "project activity" to qualify for offset credits as well as any potential barriers to adoption for sustainable producers. Additionally, each protocol is discussed in terms of CalCAN's principles for carbon markets, including taking a whole farm approach, consideration of economic, environmental, and human health co-benefits, creating a transparent and accountable marketplace, keeping farmers and ranchers as beneficiaries of offset credits, and leveling the playing field among small- and mid-scale producers. This document is meant to inform NSAC members on agricultural carbon markets protocols, as well as aid the NSAC's policy position on credited agricultural offsets as a useful tool to mitigate greenhouse gas emissions on the farm.

Introduction

In order to ensure that the generation of tradable offsets actually result in greenhouse gas mitigation, carbon markets require strict guidelines referred to as protocols. The mitigation must be: 1) quantifiable, whether measured directly or modeled; 2) verified by a third-party certifier; 3) additional to business-as-usual scenarios (e.g., it can't be a common practice or already mandated by a law); and 4) permanent either through avoidance of emissions entirely or very long contract periods that keep the carbon stable.

These four requirements have the potential to deter enrollment into these markets. For instance, 40-year contract periods required to stabilize carbon pools are exceptionally long and the "additionality" requirements preclude early adopters of eligible sustainable practices. As a result, despite the clear conservation benefits many of the following protocols result in outside of climate change, working towards offset certification may prove too cumbersome and expensive for small- and mid-scale producers.

In 2006, California passed the Global Warming Solutions Act (AB 32) giving the California Air Resource Board (ARB) the responsibility to reduce the state's greenhouse gas emissions. One strategy to accomplish their goal was to institute a Cap-and-Trade system as well as approve several protocols to allow individuals to generate offsets. These offsets can come from many industries, including agriculture, forestry, and natural resource extraction. Ultimately, this program has two financial incentives to mitigate climate change: a carbon market mandatory for certain industries as well as public revenue sources that incentivize voluntary practices with less stringent requirements.

The two types of markets that exist are referred to as mandatory and voluntary markets. The main distinction between the two is that the offsets generated within mandatory markets can currently be traded while voluntary markets generate Early Action credits that can be traded once approved. The purpose of Early Action credits is to supplement the initial supply as protocols are approved over time. For instance, currently protocols exist for Rice Cultivation in California generating Early Action credits;

however, over the next year this protocol will be approved for the mandatory market and all producers receiving Early Action credits can trade them for Compliance Offset Credits that can be sold to regulated industries.

Members of NSAC support and represent early adopters of conservation practices, so called "best actors", who are often not large-scale producers. NSAC's support for Cap-and-Trade markets like California's would be dependent on the protocol's ability to benefit these types of sustainable producers as well as truly mitigating greenhouse gas emissions in ways that provide additional value to ecosystems and human populations. The following analysis examines four protocols with an eye towards feasibility for these producers to engage in California's carbon market.

Mandatory Markets

Mandatory carbon markets are currently eligible for trade in California's Cap-and-Trade Program for major emitters such as refineries, power plants, and industrial facilities. Five current protocols exist: U.S. Forests, Urban Forests, Livestock, Ozone Depleting Substances, and Mine Methane Capture. However, to date only three of those have transitioned from Early Action Offset Credits (i.e., voluntary markets) into Compliance Offset Credits. The following section reviews two agricultural protocols, one already in the mandatory market, Livestock, and one nearing approval, Rice Cultivation.

Livestock

Adopted in 2011, 'Capturing and Destroying Methane from Manure Management Systems' was the first agricultural protocol approved by the California Air Resources Board. The project consists of adding a biogas control system (BCS) (i.e., an anaerobic digester) to combust methane associated with dairy cattle or swine manure that would otherwise emit into the environment. If left untreated, the manure would decompose anaerobically (i.e., without oxygen) converting the organic matter (i.e., carbon) into methane (CH_4) and result in emissions of the greenhouse gas from the storage site.

The offset project occurs within a facility for storing or treating waste or within a livestock operation. Lagoons, ponds, tanks, or pits store waste from concentrated animal operations until removal and/or land application can occur. To minimize negative impacts from odors, food safety, and water pollution, anaerobic digesters compost the manure and extract the methane.

While the comprehensive emissions of installing and operating a BCS are not assessed in the protocol, there are defined boundaries of the system that dictate the "offset credits" that can be traded in California's Cap-and-Trade program. Status quo emissions include methane from waste storage, and carbon dioxide emissions from farm support equipment, collection (on-site) and transportation (off-site) of waste. The addition of the BCS reduces methane emissions from storage, but also adds carbon dioxide emissions through upgrading equipment such as gas pipelines and powering farm equipment such as the anaerobic digester, pumps, and flares. Additionally, emissions from venting and incomplete combustion of the gas as well as the remaining effluent from the waste are considered additional methane emissions that occur using the BCS. Using a series of meters, only methane confirmed to have been captured and subsequently destroyed contributes to tradable offsets. Calculated with elaborate

formulas and location-specific values[1], ultimately the sum of the additional carbon dioxide emissions combined with the net methane reduction determines the final credit value. Any electricity, gas, or thermal energy product from the project used on or off-site is not included in the offset.

The initial operation of the BCS begins the crediting period, which lasts for ten years. Following this period, ranchers have the option to reapply for another ten years. During this time, operators are expected to keep flow meters calibrated and operational, and report records for verification at a maximum every twelve months. To demonstrate that the reduction in GHG emissions is "additional," it must be demonstrated that the present lagoons create anaerobic conditions and that they are common practice in the project area.

The livestock protocol demonstrates why it is important to take a "whole farm" approach to carbon markets. Specifically, purchasing an anaerobic digester supports a liquid manure system commonly used in concentrated feeding animal operations (CAFO). Utilizing CAFO production techniques instead of pasture or rangeland results in a greater demand for feed introducing a suite of emissions through tilling (e.g., loss of soil carbon), fertilizer application (i.e., nitrogen emissions), and farm equipment operation (i.e., electricity and vehicular emissions). Alternatively, since only cattle and swine manure count towards methane capture, this protocol does not incentivize using the BCS for food waste from local retailers and producers.

The protocol also ignores the potential for environmental co-benefits, such as consideration of the water demands CAFOs require through feed versus sustainable ranching practices. Lastly, waste storage lagoons increase the risk for food borne illnesses when in conjunction with heavy rains, and pose occupational health hazards to farm workers who inhale toxic gases resulting in fatalities within the confined space[2]. Conversely, the protocol does have economic co-benefits in that captured energy can be used on-site or be sold off-site as gas, electricity, or thermal energy.

In regard to small- and mid-scale producers, implementation of a BCS system is cost-prohibitive for many small producers. In addition to the equipment upgrades, full-time monitoring of the meters require constant documentation that may be less feasible for operations with fewer employees. The protocol does allow for centralized digester where an operator could aggregate waste from smaller CAFO livestock operations; however, the aggregator would own the credits keeping the small and mid-scale producers out of the carbon market.

Despite being the first approved agriculture protocol, the incorporating anaerobic digesters fails to meet CalCAN's principles for carbon markets. It does not consider potential emissions related to changes in herd management following BCS installation, has limited co-benefits (e.g., odor reduction), poses an occupational hazard, and is cost-prohibitive for smaller producers. Lastly, if anaerobic digesters are included in agricultural carbon market protocols they should incorporate credits for any methane captured, not just from liquid manure.

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[1] The California Air Resource Board uses state-specific values for volatile solids by animal type as well as EPA eGRIP2007 values to determine 'emission factors' for grid-connected electricity usage.

[2] In addition to other toxic effects, sudden exposure to high concentrations of hydrogen sulfide can cause unconsciousness. If the employee falls into the pit, fatality occurs through suffocation within the lagoon.

Rice Cultivation

Both the American Carbon Registry (ACR) as well as Climate Action Reserve (CAR) have released protocols for rice cultivation. The California Air Resources Board (ARB) has approved the "Voluntary Emission Reductions in Rice Management Systems v1.0" protocol from ACR for generation of "Early Action Offset Credits" to help create an initial supply of credits for trading in the carbon market. Rice producers can participate in the protocol, and later transfer these "Early Action" credits from ACR, an ARB-approved registry, into ARB Offset Credits, the currency of the California's carbon market.

This protocol allows for Californian rice growers in the Sacramento and San Joaquin Valleys[3] to mitigate methane emissions caused by anaerobic digestion in flooded rice fields. Together, the duration of flooding and the availability of organic matter (e.g., root exudates and plant residues) for decomposition impact the amount of methane produced by methanogens, a special class of microbes that emit the greenhouse gas.

The final protocol will include two ways to prevent the methane emissions for Californian rice farmers: replace wet seeding with dry seeding and early drainage at the end of the growing season[4]. For Early Action Offset Credits, Californian rice farmers can also participate through removing rice straw from the field after harvest and before flooding.[5]

Emissions considered for offsets in the final protocol include carbon dioxide (CO_2), methane, and nitrogen dioxide (N_2O)[6]. These originate from soil dynamics, water pumps, cultivation equipment, and crop residue removal and management. By reducing anaerobic decomposition of organic matter, the primary effect of the protocol is reducing the methane emissions occurring within the biogeochemical interactions of the soil. Increased secondary emissions from equipment hauling the residue from the fields and/or burning it (i.e., crop residue management) are factored against the primary methane reductions to generate permanent offset credits[7].

The standard crediting period for the ACR is five years, but can be renewed indefinitely as long as adoptability remains under 50 but over 5 percent. The rationale being that it is only "additional" if it is not common practice, and if after ten years fewer than 5 percent of producers in the region are adopting the practice there is assumed to be a barrier to adoption. The draft ARB protocol, conversely, requires

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[3] The Mississippi River Delta as well as Gulf Coast areas in Texas and Louisiana will also be eligible in ARB's protocol, but require additional empiric data for regional calibrations.

[4] Mid-South Regions (Arkansas, Missouri, Mississippi, and Louisiana) are given two options as well: intermittent flooding and early drainage at the end of the growing season.

[5] The ARB is willing to consider this activity in the future, but it was not addressed in the original Environmental Assessment and thus no conclusive data indicates the impact straw removal will have on bird populations in regions utilizing the flooded rice fields.

[6] Emissions from carbon dioxide are included in the ACR Early Action Offset Credits, however the final protocol will not include reductions due to soil organic carbon or from removal of rice straw after harvest, which make up the majority of the carbon dioxide (CO_2) emissions in the protocol.

[7] Unlike soil sequestration, which has the potential to release stored carbon, prevented emissions from anaerobic decomposition are inherently permanent because the methanogens are unable to convert the organic matter into methane.

ten reporting periods lasting approximately a year in a crediting period. In all protocols, fallow years or crop rotations still count towards reporting periods and additionality requirements include the rice fields underwent flooded conditions for two years preceding enrollment.

Early Action Offset Credits requires enrollment of a minimum of five individual rice fields or 405 ha (1,000 acres), but the fields can be distributed among different farmers/farms; however, the draft ARB lists a minimum for 5,000 enrolled acres for participation.[8] Emissions are modeled using the DeNitrification-DeComposition (DNDC) biogeochemical process model that has been calibrated to a particular rice-growing region. These models are based on empirical data that allows the protocol to be regionally calibrated rather than on a project-by-project basis, and the ARB protocol will not be tied to any direct on-site measurements.

In regard to the whole farm approach, emissions from additional activities required by the protocol are accounted for within the methodology. Therefore, additional emissions are unlikely to occur from draining the fields or dry seeding.

While the rice cultivation protocol may not have additional co-benefits, it does have trade-offs between biodiversity and emission reductions. The ARB is concerned that baling of hay and the draining of fields will impact waterbird use of winter flooded rice fields. Their staff has recommended baling not count towards credits to therefore mitigate any related consequences towards these populations, but will consider it in the future if further research determines a minimal environmental impact.

Because the ARB protocol does not require any on-site measurements, rice farmers do not require any technical expertise, and with the aid of a certified verifying body can be expected to meet the reporting requirements without difficulty. However, the requirement to enroll 5,000 acres is a barrier for small- and mid-scale producers. The current ARB draft has no language about aggregation efforts, although the ACR Early Action Offset Credits allow for it with reporting periods starting as new parcels are incorporated.

Among CalCAN principles, the land requirement is the greatest constraint for rice farmers to utilize this protocol for carbon markets. Because it does not utilize direct measurements, the enrollment must be this large to account for uncertainties in the model, creating a trade-off for ease in measurement, reporting, and verification. Unlike protocols with issues of permanence of soil carbon addressed later in this report, draining rice fields and dry seeding has potential to mitigate greenhouse gases without causing greater indirect emissions, has potentially little environmental consequence, and requires minimal work by the farmer to comply.

[8] So many acres are required in order to minimize uncertainty from field-specific measurements of greenhouse gas emissions at baseline and throughout the crediting period.