COMPLIANCE OFFSETS PROTOCOL TASK FORCE

FINAL RECOMMENDATIONS

March 2, 2021

Summary of Changes

The following is a summary of changes made to the Compliance Offsets Protocol Task Force's Initial Draft Recommendations. The intent is to provide an overview of changes rather than a detailed list of edits.

- Added Executive Summary
- Consolidated Background and Introduction with Executive Summary
- Updated Chapters 1 through 5
- Added abbreviations and acronyms to appendix
- Moved and added Task Force member information (name, stakeholder group, subgroup membership, affiliation, financial interests) to an appendix
- Moved Chapter 3 appendix to end of document
- Removed flags
- Added table of contents to each chapter
- Minor changes throughout document

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Executive Summary

Assembly Bill (AB) 398 (Garcia, Chapter 135, Statutes of 2017)[1] required the California Air Resources Board (CARB or Board) to establish the Compliance Offsets Protocol Task Force (Task Force) to provide guidance to CARB in establishing new offset protocols for the Cap-and-Trade Program with direct environmental benefits in the state while prioritizing disadvantaged communities, Native American or tribal lands, and rural and agricultural regions. In addition, AB 293 (Garcia, Chapter 85, Statutes of 2019)[2] requires the Task Force to consider the development of additional offset protocols, including, but not limited to, protocols for the enhanced management or conservation of agricultural and natural lands, and for the enhancement and restoration of wetlands. Furthermore, the legislation directed the Task Force to develop recommendations to CARB on methodologies to allow groups of landowners to jointly develop natural and working lands offset projects under approved Compliance Offset Protocols.

This Final Recommendations Report is the result of countless hours of work by Task Force members, three public Task Force meetings, dozens of Task Force Subgroup meetings, and written and verbal input from the public, experts, and other interested parties.

In this Final Recommendations Report, the Task Force considered public comments received on the Compliance Offsets Protocol Task Force's Initial Draft Recommendations at the November 13, 2020 Task Force meeting, and written comments submitted by November 6, 2020.

I. TASK FORCE MEMBERS

AB 398 directed CARB to appoint members to the Task Force that include, but are not limited to, a representative from each of the following stakeholder groups: scientists, air pollution control and air quality management districts, carbon market experts, tribal representatives, environmental justice advocates, labor and workforce representatives, forestry experts, agriculture experts, environmental advocates, conservation advocates, and dairy experts. Following an open, public, and multi-month solicitation process for applicants, the Board appointed thirteen members to the Task Force at the January 23, 2020 Board Hearing. The membership represents a wide range of stakeholder groups and expertise. Furthermore, two public member positions were appointed to benefit the work of the Task Force. In Resolution 20-5 appointing the Task Force members, the Board also adopted a charter to help the Task Force conduct its business pursuant to AB 398 and other applicable laws.

See appendix for a list of Task Force members.

[1] https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180AB398
[2] https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201920200AB293

II. PROCESS

The Task Force held three public meetings, the first on March 2, 2020, the second on November 13, 2020, and the third on March 2, 2021. The first meeting was a kickoff meeting and included discussion of key topic areas for the Task Force to consider. Task Force members also self-selected into five subgroups based on topic areas at the first meeting.

- Subgroup A: Blue Carbon and Wetlands
- Subgroup B: Forestry
- Subgroup C/D: Livestock, Agriculture, and Rangelands
- Subgroup E: Urban Forestry, High GWP (ODS), and Mine Methane Capture
- Subgroup F: Overarching/Programmatic Considerations

After the first meeting, each subgroup worked independently to develop recommendations. Each subgroup provided its discussions and recommendations to CARB for compilation into a draft report entitled Compliance Offsets Protocol Task Force Initial Draft Recommendations. CARB publicly noticed the availability of the initial draft report for review and comment. The release of the report was the first time Task Force members had an opportunity to review subgroup recommendations outside of their subgroup.

The second meeting occurred on November 13, 2020 and included discussion of the initial draft report, written comments received by the public, and verbal comments made by the public at during the second meeting. This second meeting was the first time Task Force members had an opportunity to discuss amongst the entire group the content and recommendations in the report.

The third and final meeting occurred on March 2, 2021. The Task Force finalized its report to CARB at that third meeting.

III. RECOMMENDATIONS

Recommendations are organized by subgroups since the bulk of the work occurred within them. Recommendations do not necessarily represent endorsement by any individual Task Force member or by CARB.

If CARB decides to proceed with any new protocols based on Task Force final recommendations, this would be done pursuant to the same public rulemaking process CARB undertakes for all regulations and amendments. That process includes many opportunities for all interested parties to submit input, concerns, and recommendations.

The following table summarizes the recommendations made by each subgroup. Detailed recommendations are included in Chapters 1 through 5.

A. Subgroup Recommendations: Overarching/Programmatic Considerations

The purpose of the Overarching/Programmatic Considerations subgroup is to examine and make recommendations to CARB regarding overarching issues that affect the California Compliance Offsets Program as a whole, and do not fall into a particular issue area or protocol type. These recommendations are provided in more detail in Chapter 1.

Item	Recommendations	Summary
A	**Options for expanding utilization of offsets**	
1	Improve invalidation requirements	Reduce the default invalidation period for all offset projects to three years. Limit offset invalidation to infractions that occur on the project site and have an environmental impact. Apply a remedy that is proportional to the violation's direct effect on greenhouse gas (GHG) reductions or removals.
2	Allow offset usage limits to be traded among compliance entities	Entities that do not use their full offset usage limit should be able to trade any unused portion to other entities as long as the total usage limit does not exceed the limits established under AB 398.
3	Consider recommendations regarding allowance supply adjustments	CARB should carefully consider recommendations from the Independent Emissions Market Advisory Committee (IEMAC) and the Scoping Plan process regarding future allowance supply adjustments.
4	Recognize that compliance grade offsets can be a tool for helping achieve other state and federal climate policy initiatives	CARB should seek to expand the options for utilizing CARB-approved compliance offsets via other policy mechanisms including carbon neutrality, California Environmental Quality Act (CEQA) mitigation, curbing aviation emissions, and linkages with other programs and jurisdictions.
B	**Specific recommendations to support disadvantaged communities, Native American or tribal lands, and rural and agricultural regions**	
5	Project development loans and subsidies	Consider mechanisms to provide low and zero-interest loans to Native American tribes and other disadvantaged communities to cover offset project development and initial project management costs.

Item	Recommendations	Summary
6	Project consolidation across fragmented tribal land ownership	Develop mechanisms and protocols to allow consolidation of offset projects and reduce legal and economic constraints associated with multiple-owner projects (similar to recommendation on aggregation).
7	Pricing agreements	Encourage reductions and/or waivers of certain project development costs and associated fees for tribal, indigenous, and disadvantaged rural/agricultural communities.
8	Project inventory and verification streamlining	Simplify and streamline carbon inventory and verification to reduce costs, while preserving quantitative confidence (similar to recommendation on verification guidance).
9	Investments and partnerships incentives	Promote private investment in offset project development within tribal and indigenous communities and revenues to support project development and technical support services.
10	Land and project conversions	Incorporate mechanisms for future project type conversion(s) and/or equitable conversion of portions of existing projects to other uses or project types while preserving project integrity and confidence.
11	Agency technical support	Develop technical training and support services to interested Native American tribes and other disadvantaged communities to promote project development, technical and analytical capacity, and project administration capabilities.
C	**Criteria for prioritization of new protocols**	
12	Air quality and environmental justice considerations	Reductions associated with offset projects should be preferably located where emissions are occurring, and investments related to the development of offset projects should preferentially occur in those communities.
13	Prioritize benefits for California: direct environmental benefits in the state	New protocols should favor projects that provide substantial opportunity for emission reductions within California, or that are geographically California-specific.

Item	Recommendations	Summary
14	Include CARB staff capacity when considering whether to advance a new offset protocol	Consider CARB staff capacity to undertake development and approval of a new Protocol. Also consider the potential scale and quality of credits, market demand and cost-effectiveness.
D	**Improving efficiency of the offset program**	
15	Support aggregation of project participants	Review existing aggregation methods from registries and convene a workgroup to advise CARB on key elements of an aggregation method that is credible, simple, and cost-effective while improving access for small landowners.
16	Improve efficiency and transparency of the CARB review process	Establish an online Status Tracker, a formal Issues Log to track review findings and requests, hold Opening and Closing meetings and implement risk-based reviews of offset projects.
17	Make CARB guidance regularly and publicly available	Regularly publish guidance, directives or decisions by CARB that are currently communicated on an ad hoc basis to ensure broad and timely access to information and a level playing field.

B. Subgroup Recommendations: Blue Carbon and Wetlands

The purpose of the Blue Carbon and Wetlands subgroup is to assess, evaluate, and recommend potential blue carbon/wetlands greenhouse gas emission reduction or removal methodologies for consideration and further development as compliance offset protocols by CARB. These recommendations are provided in more detail in Chapter 2.

Item	Recommendations
1	Review American Carbon Registry's Restoration of California Deltaic and Coastal Wetlands Methodology for consideration as a compliance offset protocol
2	Support continued research, and explore climate finance options to support project development within blue carbon/wetlands ecotypes

C. Subgroup Recommendations: Forestry

The purpose of the Forestry subgroup is to consider and recommend potential changes to the existing *Compliance Offset Protocol U.S. Forest Projects*, adopted June 25, 2015, as well as any new offset protocols, for the Task Force to consider that will improve efficiency, reduce costs, decrease barriers to participation, and increase offset projects with direct environmental benefits to the state of California, while prioritizing

disadvantaged communities, Native American or tribal lands, and rural regions. These recommendations are provided in more detail in Chapter 3.

Item	Topic	Consensus Recommendations
A. Recommendations for 2021 Rulemaking (Regulation and Protocol)		
1	Geographic eligibility: Hawaii and Alaska	Now that there is USDA Forest Service Forest Inventory and Analysis (FIA) data available, include Hawaii and additional parts of Alaska in program.
2	Eligibility: Previously listed projects	Allow for land in projects that were previously listed as an offset project to be eligible for inclusion in another project if no offsets were previously issued.
3	Definition: Forest Owner	Scope definition to owners of affirmative interests with title and/or control of property resources relevant to offset project responsibility and liability.
4	Reversals: Standard of Negligence	Clarify standard of negligence related to intentional reversals to be consistent with typical California legal standard of willful misconduct or gross negligence.
5	Reversals: Alternative Accounting for Certain Types	Provide additional flexibility for managing certain types of reversals, while maintaining offset permanence and core requirement that all reversals be verified and compensated.
6	Common Practice Baseline	Update FIA-derived common practice statistics for assessment areas on a regular schedule. Remove site index classifications and use average values consistently. Change period for determining High Stocking Reference if project area has changed ownership in the last 10 years.
7	Qualified Conservation Easements (QCE): Timing	Allow for QCE to be granted no later than date Forest Owner requests issuance from CARB of offset credits for first reporting period, provided there is a binding commitment to do so. Allow for QCE to be granted in phases over five years.
8	Verification: Projects with few or no new offset accruals	Reduce verification frequency and intensity for projects with small offset issuances and projects no longer seeking new offset issuances.
9	Project Boundary Changes	Allow project area boundaries to be changed under certain circumstances to add or remove area after project registration.
10	Buffer pool: Insurance	Allow project operators to purchase CARB approved insurance products to cover reversal liability as an alternative to contributing offsets to buffer pool.
11	Revise Inventory Sampling Design Standards	Remove the requirement that modifications to inventory methodologies must achieve an equal or greater accuracy relative to the original sampling design.

Item	Topic	Consensus Recommendations
B. Recommendations for 2021 CARB Administrative Action		
12	Qualified Conservation Easements (QCE)	Require interagency cooperation between CARB and state funding agency to apportion responsibility for enforcement of conservation easement.
13	New methods for inventory and modeling	Provide guidance and an efficient process for CARB approval of new technologies and methodologies proposed by project developers.
14	Assets at Risk	CARB should consult with CALFIRE to add carbon projects to the list of mapped assets at risk.
C. Recommendations for CARB Expert-Stakeholder Work Groups		
15	Verification: Sequential Sampling	Evaluate the technical appropriateness and practical application of sequential sampling in verification and consider alternative statistical methods.
16	Reforestation baseline	Provide an alternative, more predictable baseline for reforestation projects using FIA data.
17	Non-federal public lands baseline	Simplify the method for estimating baseline carbon stocks for improved forest management projects on lands owned or controlled by non-federal public agencies.

D. Subgroup Recommendations: Livestock, Agriculture, and Rangeland

The purpose of the Livestock, Agriculture, and Rangeland subgroup is to evaluate and recommend strategies for incentivizing climate friendly agricultural practices with California regulatory offset protocols. These recommendations are provided in more detail in Chapter 4.

Item	Topic	Recommendation
	Protocols which can be developed with existing scientific research	
1	Avoided grassland conversion	The avoided conversion of grasslands to croplands has significant potential for avoided release of sequestered carbon. Two protocols have been developed for the avoided conversion of grasslands to croplands and have seen significant uptake.
2	Cattle feed additives to reduce enteric fermentation	There is a growing body of evidence that multiple feed additives work to reduce enteric fermentation. Absent other reliable, tangible economic benefits, an offsets protocol could provide additional incentive for cattle operators to try feed additives for the purpose of reducing methane.

Item	Topic	Recommendation
3	Diversion/conversion of cattle manure storage from anaerobic to aerobic systems	The availability of funding for alternative manure management projects remains an important bottleneck in achieving emission reductions from dairies. The California Department of Food and Agriculture's (CDFA) Alternative Manure Management Program (AMMP) remains oversubscribed. A regulatory offsets program could provide significant funding, and the pathway to having one is straightforward – the current CARB Livestock Protocol is well suited for adaptation to provide offsets for AMMP-style projects.
	Practices where protocols could be developed, but there are scientific or economic barriers	
4	Compost applications to grazed grasslands (offsets alone unlikely to overcome economic barriers)	The application of compost to grazed grasslands has the potential to sequester a significant amount of carbon. A protocol developed by American Carbon Registry (ACR) provides a method for generating revenue. Unfortunately, this practice is not currently economic.
5	Subsurface drip fertigation with manure or synthetic fertilizer (more research needed to quantify under specific cropping scenarios)	The Subgroup believes that broader implementation of conventional and manure subsurface drip irrigation would benefit California agriculture while reducing N_2O emissions. However, there are significant challenges in the short term with developing a carbon offset protocol to achieve this goal.
	Practices where significant additional research is necessary	
6	Limited or no-till agriculture (quantification/permanence of carbon sequestration)	More research is needed to determine the potential of reduced tillage and use of cover crops to increase carbon storage in California soils, climate and cropping systems. Depending on the findings of such research and ability to quantify increased storage using specific cover crops, tillage patterns, etc., in California cropping systems, CARB may wish to revisit considering a regulatory offset protocol in the future.
7	Cover crops (quantification/permanence of carbon sequestration)	

E. Subgroup Recommendations: Urban Forestry, High GWP (ODS), and Mine Methane Capture

The purpose of Urban Forestry, High Global Warming Potential (Ozone Depleting Substances), and Mine Methane Capture subgroup is to examine and make recommendations to CARB regarding possible modifications to existing offset protocols in the areas of urban forestry, destruction of high global warming potential gases, and mine methane capture, as well as to consider new protocols in these areas. These recommendations are provided in more detail in Chapter 5.

Item	Recommendations
	Urban Forestry
1	Consider adopting the Climate Action Reserve (CAR) Urban Forest Management Protocol v.1.1 after making modifications to address ongoing issues such as cost and scale
	Modification(s) to Ozone Depleting Substances (ODS) protocol
2	Add R-22, R-134a, R-125, R-32, and R-143a as eligible
3	Reduce scope of regulatory conformance to activities directly affecting ODS processing and destruction
4	Modify ODS foam baseline to better align with current recovery and reuse
5	Update Global Warming Potential (GWP) factors for refrigerants, refrigerant substitutes, and 10-year emission rates
6	Allow ODS sourced from the federal government as eligible
7	Review the current American Carbon Registry (ACR) ODS protocol
	Modification(s) to Mine Methane Capture (MMC) protocol
8	Update MMC protocol to facilitate more projects that will reduce venting methane. Possible updates include: a) simplify quantification methodology by revising the equations to focus on eligible methane destruction activity; b) remove the decline curve concept from quantification of abandoned mine methane projects; c) remove or modify the prohibition on natural gas pipeline projects at active mines; and d) consider ways to remove economic barriers to participation due to upfront costs and threat that payback period may be cut off if legal requirements are later adopted and projects are no longer considered additional

Chapter 1: Analysis and Recommendations on Overarching/Programmatic Considerations

I. SUMMARY OF RECOMMENDATIONS

Item	Recommendations	Summary
A	**Options for expanding utilization of offsets**	
1	Improve invalidation requirements	Reduce the default invalidation period for all offset projects to three years. Limit offset invalidation from local, regional, state, and national environmental and health and safety laws and regulations (§ 95985 (c)(2)) to infractions that occur on the project site and have an environmental impact. Apply a remedy that is proportional to the violation's direct effect on GHG reductions or removals.
2	Allow offset usage limits to be traded among compliance entities	Entities that do not use their full offset usage limit should be able to trade any unused portion to other entities as long as the total usage limit does not exceed the limits established under AB 398.
3	Consider recommendations regarding allowance supply adjustments	CARB should carefully consider recommendations from the IEMAC and the Scoping Plan process regarding future allowance supply adjustments.
4	Recognize that compliance grade offsets can be a tool for helping achieve other state and federal climate policy initiatives	CARB should seek to expand the options for utilizing CARB-approved compliance offsets via other policy mechanisms including California's carbon neutrality goal, CEQA mitigation, participation in the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), and linkages with other programs and jurisdictions.
B	**Specific recommendations to support disadvantaged communities, Native American or tribal lands, and rural and agricultural regions**	
5	Project development loans and subsidies	Consider mechanisms to provide low and zero-interest loans to Native American tribes and other disadvantaged communities to cover offset project development and initial project management costs.

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12	Air quality and environmental justice considerations	Reductions associated with offset projects should be preferably located where emissions are occurring, and investments related to the development of offset projects should preferentially occur in those communities.

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14	Include CARB staff capacity when considering whether to advance a new offset protocol	Consider CARB staff capacity to undertake development and approval of a new Protocol. Also consider the potential scale and quality of credits, market demand and cost-effectiveness.
D	**Improving efficiency of the offset program**	
15	Support aggregation of project participants	Review existing aggregation methods from registries and convene a workgroup to advise CARB on key elements of an aggregation method that is credible, simple, and cost-effective while improving access for small landowners.
16	Improve efficiency and transparency of the CARB review process	Establish an online Status Tracker, a formal Issues Log to track review findings and requests, hold Opening and Closing meetings and implement risk-based reviews of offset projects.
17	Make CARB guidance regularly and publicly available	Regularly publish guidance, directives or decisions by CARB that are currently communicated on an ad hoc basis to ensure broad and timely access to information and a level playing field.

II. INTRODUCTION AND BACKGROUND ON TASK FORCE SUBGROUP

The purpose of the Subgroup on Overarching/Programmatic Considerations is to examine and make recommendations to CARB regarding overarching issues that affect the California compliance offsets program as a whole, and do not fall into a particular issue area or protocol type. The subgroup's work focused on framing the issues and questions that we believe should be front and center as CARB considers the charge of approving or developing new offset protocols for the purpose of increasing offset projects with direct environmental benefits in the state while prioritizing disadvantaged communities, Native American or tribal lands, and rural and agricultural regions.

The subgroup held standing weekly meetings starting in July 2020. The subgroup reached out to a number of external stakeholders but received no formal public comments prior to the 30-day public comment period (October 7, 2020 to November 6, 2020). It is important to note that the subgroup did not undertake a formal review of the

offset program. In developing the information and recommendations in this chapter, the subgroup referred to independent third-party market analysis and data, previous comments published by the Environmental Justice Advisory Committee (EJAC) in 2017, as well as the expertise of subgroup members. The subgroup considered written public comments received during the 30-day public comment period, as well as additional oral public comment and discussion by Task Force members during the Task Force's second meeting on November 13, 2020. These public comments and discussions have informed revisions to this chapter. As stated in the Task Force Charter, the information provided in this chapter is advisory only, and reflects the opinions and perspectives of the subgroup members as informed by input from the larger Task Force and public.

III. Overarching Considerations for Offsets Program

A. Overview of Offsets Role and Benefits

A short discussion of the role and benefits of offsets within California's cap-and-trade program is helpful when considering the addition of new offset protocols, including amendments to existing protocols. Although familiar to many, this brief recap is intended to refresh understanding of basic principles that underlie a credible offset, and highlight the multiple benefits that offsets offer. This guidance seeks to ensure that new or amended protocols will maintain the high standards of integrity that the California offset program has sought to date and continues to insist upon.

i. Offset Basics

An offset is defined as a reduction in emissions made to compensate for emissions made elsewhere.

(1) *Pricing Carbon*: Putting a price on carbon is a primary tool for driving emission reductions. When it is expensive to pollute, we do less of it.

Offsets play a limited but important role in California's comprehensive climate program. In addition to a suite of regulations and incentives, California sets a price on greenhouse gasses through a cap-and-trade system that incorporates market rules and an auction for allowances.

Large emitters, known as covered entities, must submit one compliance instrument, comprised of either an allowance or an offset, for every ton of greenhouse gas they emit. Offset use is limited to a small percentage of an entity's total compliance obligation (8%, 4% or 6% based on year), with the balance being met by allowances. Beginning in 2021, at least one half of offsets submitted must also provide direct environmental benefits to California (DEBS).

(2) *A Ton is a Ton*: Offsets are based on the principle that a ton of greenhouse gas has the same climate forcing effect no matter where in the globe it is produced. For

example, an emission reduction in one location has the same beneficial effect on the atmosphere as removing and storing an additional ton (above business as usual) from the atmosphere somewhere else.

(3) *Tests that a Compliance Offset must meet*: These are well defined in CARB regulations. Offsets must be real, permanent and additional. They must meet strict measurement, reporting and verification requirements. Phony tons, or tons not strictly enforced, only serve to undermine and discredit the entire program and further accelerate climate change.

Carbon dioxide emitted to the atmosphere has a long residence time. Compliance protocols must assure that the offset for an emitted ton will be permanent in order to ensure that the ton emitted by a polluting entity will be matched by an equal avoided or removed ton somewhere else. For example, destruction of ozone depleting substances and methane is considered permanent since a reversal is physically impossible once the chemical is destroyed. In contrast, offsets based on biological systems such as forests and wetlands face a risk of reversal (re-emission to the atmosphere). For these systems CARB defines permanence as 100 years, and detailed rules to address reversals have been put in place.

ii. Offset Benefits

(1) *Offsets expand the opportunities for emission reductions:* Offsets serve to incentivize emission reductions from sectors of the economy that would otherwise be difficult to obtain.

Greenhouse gas emissions from utilities, refineries and manufacturing sites come from stationary sources that are relatively straightforward to measure. They can be reported, verified and enforced, and generally are under the control of a limited number of owners. As a group, large emitters are designated as capped, or covered, entities and are subject to cap-and-trade regulation.

In contrast, most natural emission sources and sinks are dispersed, difficult to measure and vary in time. They are often under the control of many individual landowners who apply different management practices with varying emission profiles. Examples include livestock operations, forestry and agriculture, where the emissions (or sequestration) from individual operations are relatively more difficult to measure and regulate. As a group these are designated as uncapped sectors.

Uncapped sectors offer significant emission reduction potential assuming that stringent measurement, permanence and validation criteria are met. It is the market value of the offset credit that provides the economic incentive for landowners to engage in emission reduction (or enhanced sequestration) activities that they would not otherwise pursue. “But for” the economic driver of the market, carbon gains from these landowners would be difficult to attain.

(2) *Offset Co-Benefits:* In addition to providing direct carbon benefits, offset projects commonly bring a suite of other social and environmental benefits along with them. In California for example, almost 75% of offset projects are located in economically disadvantaged areas, providing jobs and lowering pollution loads for neighboring residents (Climate Action Reserve (CAR), pers. comm.).

Offsets from nature-based projects also benefit the broader ecosystem. Forest projects often restore diverse habitat types, increase biodiversity, incentivize larger and older trees, and improve watersheds and water quality. Agricultural offsets can reduce soil erosion, enhance soil carbon, reduce leaching of agricultural chemicals, and increase biodiversity through habitat management of hedgerows, field edges and crop residues.

Beyond the carbon benefit, it is often the social and environmental co-benefits of "charismatic carbon" projects that attract entities to include offsets in their compliance mix. Offset co-benefits can be important contributors to existing CSR (corporate social responsibility) and ESG (environmental, social and governance) pledges made by entities for other purposes.

(3) *Cost Containment*: The cap-and-trade program is designed to provide covered entities the flexibility to implement the lowest cost options to reduce emissions. The last increment of emission reductions is often the most expensive to attain and offsets offer an alternative means to reach a compliance target. Offsets generally sell at a lower, "discounted" price than allowances and thereby offer an element of cost-containment However, as noted in other portions of the Offset Protocol Task Force (OPTF) work, offsets are also accompanied by additional uncertainties, liabilities and transaction costs that are not incurred by allowances, which can make them a somewhat more challenging compliance instrument to utilize.

B. Offset Market Considerations

Under AB 32, CARB has developed one of the leading compliance offset programs in the country, if not the world. Since its beginning in 2013, the offset market has supported the development of innovative projects and technologies in uncapped sectors such as agriculture and forestry on a scale not achievable to date through command and control regulations alone. There has been broad interest and participation from across the country with 1,220 projects registered and over 200 million CARB offset credits issued from 37 states as of September 23, 2020. Of these, 17 projects and over 81 million credits have been issued to projects undertaken by Native American Tribes and Alaska Native Corporations (CARB, 2020). In addition, numerous businesses and jobs have been created to support the development and verification of projects, trade credits, and generally support the market.

Under Assembly Bill 398 (Chapter 135, Statutes of 2017) the offset program is mandated to shrink. AB 398 codified the use of offsets in the Program through 2030, yet at the same time reduced the offset utilization limit. Starting in 2021, the quantitative offset usage limit will be cut in half, decreasing from 8% to 4% for the period from 2021-2025 and then increasing to 6% from 2026-2030. In addition, no more than 50% of the offsets used for compliance can come from projects that do not provide Direct Environment Benefits to the state of California (DEBS).

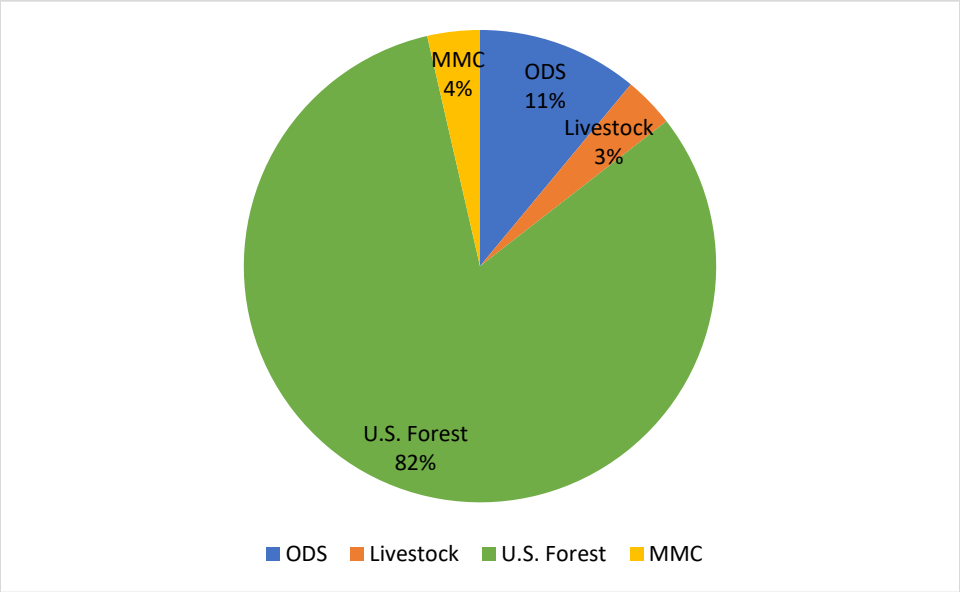
AB 398 also contained the dual goals of establishing this Compliance Offsets Protocol Task Force and encouraging greater participation in the offset program via new offset protocol development. The goal was to expand participation and encourage more projects to enroll in the program. As such, there needs to be corresponding increase in demand to support an influx of additional supply into the market. It would be a disservice to disadvantaged communities, Native American and tribal lands, and rural and agricultural regions to encourage greater participation in the offset market from these communities without a robust market in which to sell their credits. In order to achieve the goal of increased participation in the offset program, it will be important to maximize the ability of entities to use offsets under the new AB 398 parameters.

i. Offset Production and Utilization to Date

(1) Offset production to date

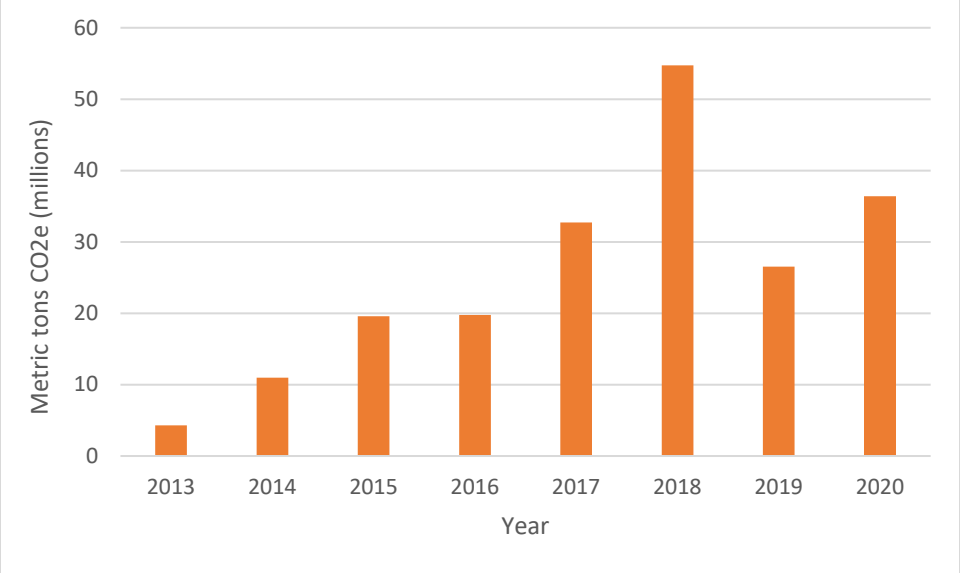
As of September 23, 2020, CARB had issued over 200 million offset credits, of which 82% are from U.S. Forest projects, 11% are from ODS projects, 4% are from Mine Methane Capture (MMC) projects, and 3% are from Livestock projects (Table 1). No credits have been issued from either Urban Forest or Rice Cultivation projects to date. Annual offset credit issuance has been increasing over the last 7 years, with a peak in calendar year 2018 (Table 2).

Table 1. ARB Offsets Issued by Project Type



Source: CARB, September 23, 2020

Table 2. ARB Offsets Issued by Year



Source: ICIS, September 23, 2020

Unlike allowances, offsets can be invalidated for issues of double-counting, material over-statement of GHG reductions, and non-compliance with environmental, health and safety regulations that have a bearing on the integrity of the generated offsets. The

default period of time during which an offset credit can be invalidated is 8 years following the end of the applicable reporting period; however, this period can be reduced to 3 years upon successful re-verification within 3 years of credit issuance. Of the total credits issued, just over half or 103,264,833 credits have been converted to California Carbon Offsets with a 3-year invalidation period (CCO3s), and for the vast majority of those, the invalidation time frame has already expired, meaning the credits no longer carry any invalidation risk (CCO0s). An additional 21,678,185 compliance credits have been issued by the registries and were awaiting CARB issuance as of early September (ICIS, 2020).

Recently, CARB has started designating whether certain projects and their credits meet the DEBS criteria. As of September 23, 2020, 18% of issued credits had been designed as DEBS, with 82% remaining as non-DEBS. To date, the only projects located outside of California to be designed as DEBS have been ODS projects that have sourced ODS gasses from within California and thus provide DEBS, and a few forestry projects in Oregon and Washington that have demonstrated direct environmental benefits to California (CARB, 2020).

(2) Offset utilization to date

Market data indicate that of the issued credits available for compliance (after accounting for the forest buffer pool account, as well as retired, returned and invalidated credits), almost 50% have been surrendered for compliance under Compliance Periods 1, 2 and the first year of Compliance Period 3. That leaves a supply of approximately 90 million offset credits available for future compliance as of September 2020 (ICIS, 2020).

Past usage patterns suggest that a majority of compliance entities have not used the entirety of their 8% offset limit. Under Compliance Period 1, offsets made up just 4.4% of compliance instruments surrendered, and under Compliance Period 2, offsets made up approximately 6.4% of compliance instruments surrendered. If compliance entities had used their maximum 8% limit under Compliance Periods 1 and 2, an additional 26 million offset credits could have been purchased and used for compliance (CaliforniaCarbon.info, 2020). This equates to a foregone value of over $300 million at today's offset prices that could have otherwise gone to offset project participants, including California-based landowners, Native American Tribes, rural and disadvantaged communities, and others.

In Compliance Period 2, only 48 covered entities used their full 8% offset limit, although these tended to be the largest entities which make up over half the emissions in the system. The second largest group of 72 compliance entities used some amount of offsets but less than the full 8%. The largest group of entities, making up 186 firms and representing 45% of emissions in the system, used no offsets in the second compliance period. This demonstrates that larger firms make up a disproportionate amount of total offset usage and that there is untapped demand potential from smaller and medium

sized entities if they were compelled to use a higher share of offsets. General sentiment in the carbon market, according to recent survey results from CaliforniaCarbon.info, is that this lack of demand is primarily due to the relatively low cost savings of offsets when considered in light of the invalidation risk associated with offsets, as well as the transactional costs and administrative complexity of undertaking bilateral purchase and sales agreements and managing use of offset credits. CaliforniaCarbon.info estimates that a handful of small and medium sized entities that used minimal or no offsets in Compliance Period 2 stand to gain total cost savings on the order $3-6 million if they were to increase their offsets use to the maximum 4% in Compliance Period 4 (CaliforniaCarbon.info, 2020). While this is not a huge cost savings as a proportion of overall compliance cost, it represents a meaningful source of potential revenue for landowners, rural communities and businesses within California and elsewhere.

ii. Forecast Supply and Demand Dynamics

In the program's fourth compliance period (2021-2023), which will be the first compliance period under the lower 4% offset usage limit, offset demand is projected to be between 33 and 40 million CCOs (California Carbon Offset), depending on whether compliance entities use offsets in line with historical usage patterns, or opt to use their full 4% limit. This is a substantial reduction in demand compared to the total usage in the program's second compliance period (2015-2017) of 63 million CCOs, the last compliance period for which there is complete data (CaliforniaCarbon.info, 2020). Moreover, available supply sufficient to meet this demand appears to already exist in the market today, even without new credit issuances, although complete data on offset usage for the program's third compliance period (2018-2020) is not yet available.

Overall, projections are that the supply of both DEBS and non-DEBS offset credits will be able to meet and could exceed demand through 2030, even assuming full offset utilization (ICIS, 2020). These projections do not account for the adoption of new protocol methodologies, as is being contemplated in this report. In a recent survey, CaliforniaCarbon.info found that the majority of stakeholders surveyed, including project developers, verifiers, and operators, believe that the upcoming restrictions in offset usage brought about by AB 398 would have a negative impact on offset demand and price (CaliforniaCarbon.info, 2020). This could dampen future growth of the offset sector, which in turn would limit the offset program's ability to further the goals of reducing GHG emissions in uncapped sectors, increasing carbon storage in natural and working lands, and spreading climate diplomacy.

iii. Key Questions and Considerations for the Offset Program

The data show that substantially more GHG reductions have been generated by the offset program than have been used for compliance to date. This is a positive outcome from a climate perspective, as it has incentivized private investment towards GHG

reductions in sectors that are not directly regulated and do not fall under the cap. It has also had positive ripple effects from spreading climate diplomacy around the country, particularly in the 37 states which have had projects enrolled in California's offset program. However, for landowners and businesses that are involved in offset projects, the lack of full offset utilization and the forthcoming constraints established by AB 398 present potential deterrents to future investment and growth of the program.

AB 398 demonstrated that there is support for expanding the positive impacts of the offset program, particularly within the state, and in disadvantaged communities, Native American and tribal lands, and rural and agricultural regions. However, that important goal is at odds with the shrinking size of the program, which will reduce the market signal for offset project development. If the legislature and CARB truly want to expand participation in the program through the adoption of new protocols, including the modification of existing protocols, then they should also consider how to expand this important market mechanism by driving additional demand for offsets via a range of policy mechanisms, both within and outside of the cap and trade program.

IV. Recommendations

A. Options for Expanding Utilization of Offsets

Given the benefits that offsets provide, CARB should consider the following options for promoting greater utilization and market demand for offsets.

i. Improve Invalidation Requirements for Offsets

California offsets have met the statutory requirements of being real, additional, quantifiable, permanent, verifiable and enforceable GHG emission reductions. The current framework of buyer liability for invalidation limits offset usage and dampens demand from all but the largest compliance entities. Given the renewed push for new offset protocols, improving these provisions is an important mechanism for increasing demand in order to accommodate further expansion of the offset program.

The invalidation rate to date has been 0.06%; of the over 200 million offset credits issued, only 112,718 have been invalidated as of September 9, 2020. There have been no invalidations to date from the largest offset project type, U.S. Forest Projects (CARB, 2020). The empirical invalidation risk is therefore extremely low, which suggests that current requirements around invalidation may be overly conservative. The result leads to a market restriction without additional environmental benefit. To draw an analogy, car insurance premiums often go down as a result of demonstrated good driving record. Similarly, the offset program should be updated to reflect the fact that invalidations have occurred with much less frequency and severity than originally anticipated. Given the track record to date, the invalidation provisions should be re-evaluated as follows:

1. Set the default invalidation period for all offset projects to 3 years, not 8 years and remove the requirement to double-verify in order to qualify for a reduced invalidation period.

    a. CCO3 “double verification” is a substantial cost burden for projects and the price premiums for CCO3s vs CCO8s are often not high enough to justify the cost; however, there is greater market demand for CCO3s because buyers assume invalidation risk for a much shorter length of time. Therefore, projects are often required to shoulder the additional burden and cost of CCO3 verification without added benefit to the projects or program.

    b. Under the Cap-and-Trade Regulation, as well as through the attestations provided in the listing, Offset Project Data Report (OPDR) and Request for Issuance forms, CARB retains the ability to separately address instances of fraud or perjury.

    c. For U.S. forest projects, which have made up over 80% of credit issuances to date, the most likely risks to offset integrity are from reversals, and these have also been very low to date: 0.02% for intentional reversals and 0.5% for unintentional reversals, even with increased wildfire activity in recent years (CARB, 2020). Moreover, these reversal risks are already addressed via existing provisions and mechanisms.

2. Clarify regulatory guidance on determining violations of laws and regulations that would require invalidation of offset credits. Limit offset invalidation to infractions that occur on the project site and have an environmental impact. Apply a remedy that is proportional to the violation’s direct effect on GHG reductions or removals.

    a. CARB should explicitly limit offset invalidation to infractions that occur on the project site and have an environmental impact; and, in such cases, apply a remedy that is proportional to the violation’s direct effect on GHG reductions or removals, and is sufficient to ensure the project’s compliance with environmental regulations. Invalidation of offsets would only occur if the project proponent is cited by a government agency for a significant, rather than a minor violation.

    b. Current invalidation language creates unnecessary risk for offset projects due to the potential wide range of interpretations that could be applied to the regulatory language. This risk and uncertainty is a barrier to participation by proponents who might otherwise develop a carbon project. Further, narrowing the risk of invalidation will level the playing field for

California-based projects that often operate under more stringent legal and regulatory requirements than other jurisdictions across the U.S.

ii. Allow Offset Usage Limits to Be Traded Among Compliance Entities

As discussed above, during the last compliance period, only 16% of compliance entities used their full allowance of offsets. If entities are not able or do not wish to use their full offset usage limit, they should be able to trade any unused portion of their offset usage limit to other compliance entities as long as the total usage limit does not exceed the maximum limits established under AB 398 (4% usage in 2021-2025 and 6% usage in 2026-2030). This market-based approach would allow the maximum benefits of offsets as both a cost-containment mechanism and a market signal for further investment in offset project development to be realized within the limits set by AB 398.

iii. Consider Recommendations Regarding Allowance Supply Adjustments

Ongoing discussions are occurring and will continue in venues such as the Independent Emissions Market Advisory Committee (IEMAC) and around development of the Scoping Plan. This Task Force is not the appropriate place for those discussions; however, we encourage CARB to consider the recommendations that arise from those discussions carefully, as a tightening of allowance supply could encourage greater demand for offsets as compliance instruments, which in turn would provide financial incentive for new offset project development.

iv. Recognize That Compliance Grade Offsets Can Be a Tool for Helping Achieve a Number of Other State and Federal Climate Policy Initiatives

The high standards CARB has pioneered through the compliance offset program should be transferrable to a number of other programs and policy initiatives. Rather than trying to "reinvent the wheel" CARB should build on the robust foundation established through the existing offset program. Doing so would give participants in California's compliance offset program more opportunities to trade and sell offset credits, which in turn would promote greater offset project development (and therefore additional GHG reductions). Compliance offsets are already being voluntarily retired in certain instances for use outside of the Cap and Trade system. CARB should expand this option via the following policy mechanisms:

1. Carbon Neutrality

On September 10, 2018, Governor Edmund G. Brown Jr. issued the original Executive Order on carbon neutrality (EO B-55-18 15) stating that "the achievement of Carbon Neutrality will require both significant reductions in carbon pollution and removal of carbon dioxide from the atmosphere, including sequestration in forests, soils and other landscapes." Offset protocols provide an accounting mechanism to quantify, verify and report these GHG reductions and removals. If utilized to their full potential, compliance

grade offsets could reduce the cost of this important policy initiative and should be a key component of helping the state reach climate neutrality by 2045.

2. California Environmental Quality Act (CEQA) mitigation

CARB offset credits should be allowed for use as mitigation under CEQA when direct, onsite mitigation is not possible. According to a survey of submitted Environmental Impact Reports, there could be demand for as many as 20 million offset credits as mitigation under CEQA in the next few years, and the demand profile is growing. This demand is driven in large part from housing development projects that are necessary to meet California's significant housing shortage (CAR, 2020).

3. Airline emissions

The International Civil Aviation Organisation is in the process of finalizing the design of a system to reduce GHG emissions from aviation, called the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). Estimated demand for offsets under CORSIA was at one point approximately 2.7 billion offset credits over the full period from 2021 to 2035 (Schneider & La Hoz Theuer, 2017). This program is still evolving, and more recent changes to how baseline emissions are established will affect future demand. CARB should explore allowing both Registry Offset Credits (ROCs) and Air Resource Board Offset Credits (ARBOCs) to be voluntarily retired for use under the CORSIA program.

4. Additional linkage opportunities

An important part of California's climate program is "climate diplomacy" or the ability of California to serve as a model of climate action for other jurisdictions. The original AB 32 Climate Change Scoping Plan highlighted the fact that reducing in-state emissions alone would not solve the climate change crisis. It recognized the need for global action for the benefit of California. CARB should therefore continue its efforts to promote climate diplomacy by seeking additional linkages with jurisdictions such as New York State, which recently passed its own climate change legislation similar to that of California's, as well as neighboring states like Oregon and Washington that continue to work towards passing their own climate change legislation.

B. Recommendations Specific to Disadvantaged Communities, Native American or Tribal Lands, and Rural and Agricultural Regions

CARB has recognized the need to consider and address social justice and environmental concerns resulting from implementation of programs and protocols as currently defined under AB 32, and subsequently reauthorized under AB 398. Substantial and justified misgivings exist over accessibility and equitable participation by disadvantaged communities, Native Americans, other indigenous peoples, and rural and agricultural communities in the California Cap and Trade program ("Program"). In

addition, concern exists over the direct impact of regulated entities' operations on adjacent communities, including the effects of GHG emissions and other toxic industrial pollutants. Furthermore, impacts from ongoing regulated entity emissions to economically disadvantaged communities in rural and agricultural areas may be exacerbated by the lack of sufficient financial resources, education, and adequate social support systems to respond to these unintended impacts resulting from implementation of AB 32.

Solutions to these issues are complex and challenging, and will require additional dialogue with impacted stakeholder groups; however recommendations and considerations are offered here on the AB 32 Cap and Trade program in general, and for CARB to consider as existing and/or additional offset methodologies are endorsed as a means to increase accessibility and successful participation by disadvantaged communities, Native American tribes, other indigenous communities, and agricultural/rural communities.

i. Land Base, Legal, and Jurisdictional Constraints

The California Carbon Market allows participation across multiple states and regions, and includes a multitude of disadvantaged rural communities, and Native American tribes, that could, and often wish to participate in the program. These regions are vast and diverse, and include hundreds of thousands of acres of lands within the historic ancestral territory of many federally recognized Native American tribes. Impacts from decades of natural resource extraction, development and industrial uses have often proved detrimental to the resources that these communities and tribes have depended upon for subsistence, commercial, and cultural purposes since time immemorial.

Native American tribes and other low-income and disadvantaged communities often do not have legal ownership, jurisdictional rights, or the economic resources to develop economically viable carbon offset projects. Land ownership fragmentation within reservation lands and historical ancestral territories also limits the ability to develop financially feasible land-based projects. Despite these obstacles, tribal peoples and rural communities often possess unique Traditional Ecological Knowledge (TEK), skills, and experience living, managing, and working within these natural ecosystems, which may provide alternative approaches to 'western' land management strategies. Integration of TEK with western land management strategies may provide increased project-level DEBS, and support multiple-use benefits, including increased local economic opportunities and job development, through restoration and conservation-based job creation. In addition, application of TEK on the local level will increase ecological diversity, promote native flora and fauna, and conserve and restore culturally important places, foods, and medicines. Last, but not least, increased engagement and participation in the Program will promote the self-determination and cultural conservation goals of Native American tribes. CARB protocols should recognize the unique constraints and obstacle facing these communities, develop strategies to reduce

the logistic, technical, legal, and economic obstacles of project development, and recognize the potential community, ecological, and environmental benefits that will result from diverse program participation.

ii. Economic and Technical Resource Challenges

Project development costs for carbon offset projects are high and technically complex, requiring substantial economical investment. The following list of topics and strategies should be considered by CARB when modifying existing compliance offset methodologies, or as new offset methodologies are developed and endorsed by CARB.

(1) Project development loans and subsidies

Recommend CARB consider mechanisms within the Program, and associated California Climate Investments (CCI) funded grant programs to provide low and zero-interest loans to Native American tribes and other disadvantaged communities to finance carbon sequestration and emission-reduction offset project development and initial project management costs. This program could be modeled on the State Water Resources Control Board's State Revolving Fund (SRF) Loan Program for water infrastructure and water quality improvement projects. CARB should work with legislators and Program stakeholders to scope and secure initial funding for this no/low-interest loan program.

(2) Project consolidation across fragmented tribal land ownership

Recommend CARB consider and develop mechanisms and protocols to allow consolidation of offset projects on fragmented tribal trust and fee lands, and tribal member allotments. Recommend CARB support evaluation and resolution of legal and economic constraints of multiple-owner projects, and/or the establishment of "cooperatives" of forest carbon project developers as a means to reduce and share costs, share technical resources, and increase capacity. For example, multiple tribal member-owned allotments could be developed into a project "cooperative" within a tribal reservation. See associated recommendation on aggregation, below.

(3) Pricing Agreements

Recommend CARB implement incentives for associated carbon registries to offer reduced project registration and listing costs, and associated fees for tribal, indigenous, and disadvantaged rural/agricultural communities. Also, recommend CARB waive all annual project costs and fees for economically qualified rural and disadvantaged communities, and federally recognized Native American tribes.

(4) Project Inventory and Verification Streamlining

Recommend CARB evaluate mechanisms to simplify and streamline carbon inventory and verification to reduce costs, while preserving quantitative confidence, benefiting

especially tribal-owned and disadvantaged community-owned carbon sequestration and emission-reduction projects once project half-life is achieved. See associated recommendations on program efficiency and verification guidance, below.

(5) Investments and Partnerships Incentives

Recommend CARB evaluate and implement procedures and mechanisms to promote private investment in offset project development within tribal and indigenous communities. Possible development and implementation of a "community project development buffer," where a portion of issued carbon offsets across the Program are preserved to generate revenues to support project development and technical support services for disadvantaged rural communities, Native American tribes, etc.

(6) Land and Project Conversions

Recommend CARB recognize traditional land management strategies and incorporate mechanisms for future project type conversion(s) to promote ecosystem diversity, wildlife habitats, wildfire prevention, and climate change resiliency into existing projects. CARB-adopted methodologies should take into consideration mechanisms for equitable conversion of portions of existing registered projects to other uses or project types while preserving project integrity and confidence.

(7) Agency Technical Support

Sufficient technical resources and expertise may not be available to these communities to meet the high standards for compliance offset project development, implementation, and management. In addition, costly consultation and contracting services reduce much needed economic resources needed to support internal capacity-building, and develop critical technical skills of tribal members and staff. As self-governed, federally recognized tribes, the ability to effectively and efficiently manage Tribal resources is of critical importance, both for cultural preservation and to promote and advance their self-determination goals. Recommend CARB develop technical training and support services to interested Native American tribes and other disadvantaged communities to promote project development, technical and analytical capacity, and project administration capabilities.

C. Criteria for Prioritization of New Protocols

The following are recommendations for how CARB could consider prioritizing the approval or development of new protocols. Several of the Offset Task Force subgroups categorized and prioritized the recommendations within their subgroup chapters to assist CARB with this process. In addition, this subgroup recommends that CARB keep the following overarching issues in mind while developing a process for how to evaluate and prioritize recommendations across subgroups.

i. Air Quality and Environmental Justice Considerations

The AB 32 Environmental Justice Advisory Committee (EJAC) in 2017 submitted its recommendations on the use of offsets. The EJAC recommended that offsets, if they must be used, should come from projects located in the same area as the emissions that are being offset. Reductions associated with offset projects should be located in those communities where the emissions are occurring, and investments related to the development of offset projects should occur in those communities. Offsets should not be allowed in an environmental justice community if the use of offsets would result in the deferral or delay of emissions reductions with related air quality impacts in that community.

ii. Prioritize Benefits for California: DEBS

Given the legislative direction of the Task Force under AB 398 to focus on "… increasing offset projects *with direct environmental benefits in the state* while prioritizing disadvantaged communities, Native American or tribal lands, and rural and agricultural regions," a top criteria for recommending any new protocol or amendment to CARB should give high priority to offset types that provide direct environmental benefits to California (DEBS).

As defined in Section (E)(ii), "…"direct environmental benefits in the state" are the reduction or avoidance of emissions of any air pollutant in the state or the reduction or avoidance of any pollutant that could have an adverse impact on waters of the state."

CARB further defines DEBS in regulations implementing the cap and trade system. Offset projects that are located within, or that avoid GHG emissions within, California are automatically considered to provide direct environmental benefits in the State (§ 95989). A process is also provided for out-of-state projects to provide documentation, including peer-reviewed literature, that they also provide DEBS (Section 95989(b)).

Especially in light of other concerns regarding market demand, we recommend that any new protocol type favor projects that provide substantial opportunity for emission reductions within California, or that are geographically California-specific.

iii. Include CARB Staff Capacity When Considering Whether to Advance a New Offset Protocol

Mindful that quality and integrity of offsets are of primary importance in ensuring credibility and public confidence in the market, CARB should continue its tradition of setting high standards for credits and their enforcement. When adopting new Protocols, including making modifications to existing Protocols, CARB should consider its own staff capacity to undertake the regulatory and stakeholder processes required for developing a new Protocol. CARB should also consider the potential scale and quality of credits generated, taking into account market demand and whether the Protocol will actually be

used given high cost of project development. Cost frequently emerges as a barrier to compliance offset development. CARB should therefore consider cost-effectiveness and potential uptake of the Protocol by project participants as a central determinant in whether or not to go forward with the effort of developing a new protocol.

D. Improving Efficiency of the Offset Program

i. Support Aggregation of Project Participants

CARB should incorporate aggregation approaches and associated programmatic efficiencies into newly adopted protocols as appropriate. Aggregation of project participants, such as small forest and agricultural landowners, can create efficiencies, reduce costs, and potentially create more interest in innovative financing structures to address the high upfront project costs that create a participation barrier to most small landowners.

There is a significant amount of agriculture and forest land in California owned by families and individuals whose average ownership is small. The ownership of most forest land is less than 1,000 acres and the average size of most farms in California is 500 acres. These properties are often not able to participate in California's Cap and Trade program due to the project economics – cost exceeding revenue. Two significant cost centers for natural and working lands are project development and monitoring, reporting, and verification (MRV) requirements. It is not possible for many small landowners to absorb the full amount of these cost centers. Also, small landowners often do not have the technical knowledge and skills necessary to develop and manage a carbon offset project without additional support from project developers and technical consultants. Nevertheless, research by organizations including the American Forest Foundation – sponsor of the American Tree Farm Program – and stakeholder feedback to carbon registries (American Carbon Registry, Climate Action Reserve, and Verra) suggest there is considerable interest and potential in developing offset projects on small acreages falling below typical thresholds that limit financial feasibility and subsequent enrollment in the CARB program. Additionally, if new protocols addressing agricultural or wetland conservation projects were to be developed, the issue of multiple ownerships within a project area will need to be addressed due to the fact that ecological functions operate on the project area as a whole, and not according to parcel boundaries.

Aggregation offers a path to, at minimum, cost share the MRV expenses over the project life, which can improve efficiencies and reduce landowners' upfront investment in the project and its ongoing MRV costs. In addition, aggregators can fill the gaps in the landowners' knowledge and skills to ensure project success. When considering ways to promote aggregation, CARB should seek to incorporate common criteria and requirements for any project type that proposes aggregation as an option. CARB

should give due consideration to issues around project integrity and legal liability for individual project participants.

In particular, CARB should:

1) Review the existing aggregation methods currently available and in use under the American Carbon Registry, Climate Action Reserve, and Verra; and
2) Convene a workgroup comprised of interested stakeholders to advise CARB staff on key elements of an aggregation method that is credible, simple, and cost-effective while improving access for small landowners interested in participating in offset projects.

Incorporating aggregation approaches and associated programmatic efficiencies across all relevant offset project types and protocols would reduce a key barrier to entry for more participants to enroll their lands and benefit from carbon finance, especially in rural and agricultural regions of California and across the U.S.

ii. Improve Efficiency and Transparency of the CARB Review Process

a. Establish an online Status Tracker for the ROC to ARBOC conversion process

Nearly nine years of experience with the CARB ARBOC review process have revealed areas where increased efficiency would simplify the workload of CARB staff and remove sources of frustration for project participants.

A common problem for project operators is the indefinite “black box” period once a Request for Issuance of ARB Offset Credits is filed with CARB to convert Registry Offset Credits (ROCs) to ARB Offset Credits (ARBOCs). After filing, project operators are often forced to repeatedly contact CARB staff to determine where their project stands in the queue, and what stage of review the project is in. These inquiries are inefficient for staff to respond to and frustrating for project operators to pursue.

Other state agencies have addressed the task of tracking administrative permits by posting a permit-tracking table online. For example, the California Natural Resources Agency maintains *CalTREE - the California Timber Regulation and Environmental Evaluation System*[3], which allows timber harvest plans to be tracked through each stage of the CalFire administrative approval process and determine “whose court the ball is in”.

A more simplified CARB online tracker that indicates the status of projects in the ROC conversion process would help ease communication. At a minimum, the tracker would include a check-off list of generic tasks associated with a project review and which ones have been completed.

[3] See: https://www.fire.ca.gov/programs/resource-management/forest-practice/caltrees/#information-portal

b. Formal Issues Log to track review findings and requests

CARB does not use a consistent and transparent method to document information requests and findings that project operators and/or verification bodies are required to address during CARB's project review process.

Verification bodies and registries use formal written logs to track project review findings, including non-compliance items and requests for information. The typical process is that once the initial review of the project is completed by the verification body or registry, a log is prepared and sent to the project operator and verification body that includes information requests and all findings that must be addressed and resolved to achieve project approval. Several rounds of review may be required to close out all the issues identified through the review process, including new findings based on information and/or responses received from the project operator and/or verification body. Minor information requests are often addressed through phone or email; however, any significant requests are documented in the log for clarity and transparency.

We recommend that CARB institute a formal Issues Log process to document its review findings and requests that is shared and used by project operators and verification bodies to document their responses and for CARB to close out each finding or information request. This will provide transparency and certainty to project operators and verification bodies on the status of the review.

c. Opening and Closing meetings for parties involved in ROC-ARBOC conversions

When a CARB staff member receives a new application for a ROC conversion they must start from scratch, by themselves, to understand the project and the host of supporting documents. Eventually they may reach out individually to the project operator, the verifier or other technical party for specific information and further explanations.

Other registries have adopted a useful "Opening Call" process to aid staff in initial orientation to the project. This involves an initial, standardized meeting that brings together the assigned review staff, the project operator, and perhaps the verifier, with the purpose of introducing staff to the project, talking through the documents, and highlighting any unique or different characteristics to be aware of.

A similar opening call process for CARB, held shortly after receiving the *Request for Issuance of ARB Offset Credits* form, would provide an introductory overview and save staff time spent figuring out easily explained aspects, and identifying areas needing particular attention. Nothing in the meeting would reduce the rigor of subsequent project screening or decision making.

The need for a Closing Call is less definite, but could be considered, either before ARBOCs are issued or to formalize announcement of the award.

d. Risk-based reviews of offset projects

In order to support expanded participation in the offset program, CARB should consider increased implementation of risk-based review and audit mechanisms that can achieve the same level of quality assurance and rigor without requiring the same level of CARB staff time on each project as was expended in the early years of the system. CARB should consider shifting to a risk-based triage for project reviews that allocates limited staff resources based on the objectively assessed risk level of the underlying verification. More detailed checklists and review procedures should be applied to high-risk reviews than to low-risk reviews. Standard review times should be established for each type of review, with a shorter review time expected for lower-risk reviews, and CARB should make every effort to comply with the regulatory timeframe of 45 days. When thinking about risk, factors that could reasonably lead to a material number of offsets issued for emission reductions that were in fact not real, additional, measurable and verifiable should be prioritized. Materiality should be considered from the perspective of total program-wide credit issuance in addition to project-level materiality thresholds.

In addition, CARB should issue and publish guidance for verification to ensure verifiers focus on assessing material compliance with the Protocol with reasonable assurance. Independent verification is a foundation of the offset program and essential to the integrity of offsets. Unfortunately, verification has become one of the primary barriers to program participation, especially by small participants. For some protocol types, verification has become the single most expensive, time-consuming and unpredictable aspect of the offset program, leading its cost to skyrocket 8-fold in only 9 years and for verifications to sometimes take a year to complete. Lack of clear guidance has led to "mission creep" in verification under an apparent standard of *absolute* assurance that is almost impossible to attain. CARB should prepare, publish and, as necessary, update written guidelines for verification to guide project developers and verifiers so that all parties know exactly how each aspect of project compliance will be evaluated. Such guidance should be sufficient to establish a standard of "reasonable assurance" for verification of emissions reductions and program compliance.

As procedures are strengthened and implemented, CARB staff should be able to rely more on the program's cadre of experienced and accredited verification bodies as the primary line of review and for flagging issues that may require further attention from CARB staff. It may be useful to increase the number of formal project audits conducted by CARB staff while restructuring the internal CARB checklist and reducing staff time spent on standard project reviews. Time well spent by verification bodies is time saved for CARB review staff, and CARB should focus its efforts on ensuring uniform, high-quality review by all verifiers rather than spending time double-checking or even re-doing the work of the verifiers. With clear and transparent guidance and greater reliance

on CARB's approved verifiers, CARB reviews can become a more predictable, manageable, and cost-effective process.

iii. Make CARB Guidance Regularly and Publicly Available

CARB should regularly publish guidance, directives or decisions by CARB that are communicated to project developers, verifiers or registries. This is critical to assuring a level playing field and reducing the cost of project development and verification, thereby enhancing participation, especially by small landowners, tribes and other developers facing financial and institutional barriers.

CARB should provide regular, transparent and publicly available communication disclosing its guidance, directives and/or decisions ("Guidance") to OPRs and OPOs, posting FAQs, notes or other kinds of documents on its website no less frequently than once a quarter. If no new guidance or the like has been conveyed to an OPR or OPO, CARB can simply post a notification to that effect. Guidance provided pertaining to one or another project can be communicated without naming the project or disclosing non-public particulars; rather the Guidance can be written so as to identify the issue and the resolution CARB has determined is acceptable. CARB's FAQs are a good and welcome vehicle for this but such FAQs need to be regularly issued on a standard schedule such as quarterly. Further, CARB should publish on its website notes from its meetings with the Offset Project Registries.

None of the offset protocols have been adopted or amended since 2015 yet changes to interpretations and guidance have continued in the background and are ill-understood by the public and stakeholders. CARB frequently interacts with Offset Project Operators and the Offset Project Registries to address questions that arise in the course of individual project verification and offset issuance. CARB decisions and guidance to OPOs and OPRs are seldom broadly disclosed; and even when communicated it is done in an irregular fashion to the detriment of those not directly involved in the specific discussion. Therefore, often news of CARB's interpretations and guidance is spread by rumor, making it difficult to ascertain its accuracy; or, worse, a project developer learns only in the process of verification that some completely new work is required that was unknown except to the verifier, who learned the hard way in a previous verification. This creates a scheme of shadow regulation that is at the very least unfair and creates inequities in project development, favoring large projects and developers who have the financial means and experience with numerous projects while disfavoring small projects. To maintain public confidence and stakeholder engagement, as well as expand participation, it is important for CARB to be more transparent and to regularly communicate its guidance, directives and/or decisions.

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Chapter 2: Analysis and Recommendations on Blue Carbon and Wetlands

I. EXECUTIVE SUMMARY

The Blue Carbon and Wetlands Subgroup of the Compliance Offsets Protocol Task Force (Task Force) met eleven (11) times between July 1 and Sept 25, 2020, to assess, evaluate and recommend potential blue carbon/wetlands carbon sequestration and greenhouse gas (GHG) methodologies for consideration and further development as compliance offset protocols by California Air Resources Board (CARB). The Subgroup members deliberated and developed the process to research and effectively evaluate existing blue carbon/wetlands methodologies and protocols applicable to California, but could also be applied in other states and regions. This evaluation process included outreach to major carbon offset registries in the United States and Europe, and included presentations and interviews with registry staff, as well as collaborating scientists, research consultants, and agency representatives. The Subgroup greatly appreciates the time and input from all experts who shared their knowledge, involvement, and expertise developing blue carbon/wetland carbon sequestration methodologies and restoration projects.

The Subgroup deliberated the rationale for protocol evaluation to determine the effectiveness, level of development and applicability for potential compliance-grade development and adoption by CARB. While we focused on practices and protocols that would be useful in California, we recognize that creation of a regulatory protocol could also encourage use of these practices outside California. Additional research of existing methods and protocols determined that several projects have been developed for wetlands ecotypes (e.g. mangroves, tidal wetlands, etc.) in other regions, however California-specific projects are limited. In recognition of the current limitation of adopted methods, the subgroup determined that methods with the most applicability to California, and potential for direct environmental benefits in the state (DEBS) and other environmental co-benefits would be prioritized for further evaluation.

The Subgroup outreached to three major carbon registries, including:

- American Carbon Registry
- Climate Action Reserve
- VERRA

The Subgroup determined that the American Carbon Registry's Restoration of California Deltaic and Coastal Wetlands Methodology was most applicable for potential consideration, development, and implementation as a compliance carbon offset protocol by CARB. The Subgroup recognizes the important potential for substantial GHG reduction and carbon sequestration in other blue carbon/wetlands ecotypes, and strongly advises CARB to support additional research, climate finance considerations, and project development where applicable within the market area.

II. INTRODUCTION AND BACKGROUND ON TASK FORCE SUBGROUP

The purpose of the Blue Carbon and Wetlands Subgroup was to identify potential carbon sequestration and GHG reduction protocols and methodologies that have potential for further development and application as compliance offsets protocol(s) within the California (CA) Cap-and-Trade Program (Program). The subgroup reviewed scientific research, stakeholder and industry reports, and conducted interviews with a diverse group of experts and stakeholders. Through these meetings and research, the subgroup reviewed existing adopted protocols that have the potential to generate reductions in carbon dioxide (CO_2), nitrous oxide (N_2O), and methane (CH_4) as well as practices that increase the sequestration of carbon in soils and organics. A comprehensive list of the literature reviewed by subgroup members can be found in the Bibliography.

The Subgroup convened eleven (11) meetings between July 1 and September 25, 2020. The agenda for these meetings included internal process discussions, deliberations, and presentations from the following organizations:

- American Carbon Registry (ACR)
- Climate Action Reserve (Reserve)
- Verra

The carbon offset registries provided overviews and presentations on adopted protocols, approval processes, descriptions of developed projects, and recommendations on the specific applications by wetlands ecotype(s). A list of those protocols is presented in Table 3. The registries also provided recommendations on project application constraints, limitations, costs, environmental co-benefits, and identified additional research that should be pursued to further refine compliance offset protocols.

Table 3 - Existing Voluntary Protocols Presented by Stakeholder Interviews

Methodology Title	Protocol Category	Organization
Restoration of CA Deltaic and Coastal Wetlands	GHG reduction	American Carbon Registry
Restoration of Degraded Deltaic Wetlands of the Mississippi Delta	Carbon sequestration and GHG reduction	American Carbon Registry
Methodology for Coastal Wetland Creation, VM0024	Carbon sequestration and GHG reduction	Verra
Methodology for Tidal Wetland and Seagrass Restoration, VM0033	Carbon sequestration and GHG reduction	Verra
REDD+ Methodology Framework (REDD+MF), VM0007	Carbon sequestration and GHG reduction	Verra

In addition, Subgroup gained valuable perspective from representatives from the Climate Action Reserve (CAR) on the challenges, constraints, costs, and state of the science required to develop and adopt rigorous quantitative blue carbon/wetlands carbon protocols, and the CAR process for evaluation and adoption of newly developed methodologies.

The Subgroup reviewed and evaluated information and presentations from the external stakeholders, conducted independent research, deliberated on the recommendations and prepared the present report for consideration by the full Task Force, CARB, and the public.

III. OVERVIEW OF PRACTICE/PROJECT EVALUATION

The Subgroup focused its efforts on identifying registry approved GHG reduction and carbon sequestration methodologies that have been utilized to develop projects in the United States, and other regions. Research and evaluation determined that due the diverse nature of blue carbon/wetlands ecotypes, and the associated complexity of each quantitative technique for GHG emission reduction and carbon sequestration in these ecotypes, a general, standardized methodology has not yet been developed. Substantial effort and resources have been made by researchers and scientists to advance the state of the science to develop a standardized method, but additional work remains to refine the science. Considering the potential available acreage of wetlands ecotypes, amount of GHG reduction potential, direct environmental benefits in the state (DEBS), and potential environmental co-benefits, the subgroup prioritized existing approved voluntary methodologies with active projects in California.

One ACR-adopted voluntary methodology was determined to be currently most applicable to the California blue carbon/wetlands carbon setting described here:

- Voluntary Offset Protocol: American Carbon Registry’s Restoration of California Deltaic and Coastal Wetlands Methodology

The methodology was developed collaboratively by Hydrofocus Inc., and the Sacramento-San Joaquin Delta Conservancy, with support from the CA Department of Water Resources, the CA Coastal Commission, the Metropolitan Water District, and Sacramento Municipal Utilities District. The methodology was reviewed and adopted by ACR in 2017.

IV. EVALUATION OF EXISTING PROTOCOLS, METHODOLOGIES, AND PROJECTS

A. American Carbon Registry's Restoration of California Deltaic and Coastal Wetlands Methodology

i. Role of Project Type in Climate Change Mitigation

The primary objective of this methodology is to reduce greenhouse gas (GHG) emissions through conversion of reclaimed agricultural lands to wetlands. Stay soil oxidation of islands in the Sacramento-San Joaquin delta by re-wetting the land to serve as a wetland or rice farm. Current crops (corn, alfalfa) require drainage of ground water in the root zone (using tiles), thereby exposing soil to oxidation and continued subsidence. Method developed specifically for the Sacramento-San Joaquin Delta, San Francisco Bay Estuary, and other similar riverine delta areas of California.

ii. Development of Project Type

1) Voluntary Protocol adopted by American Carbon Registry:
"Carbon Accounting standards and methodology: Restoration of California Deltaic and Coastal Wetlands" https://americancarbonregistry.org/carbon-accounting/standards-methodologies/restoration-of-california-deltaic-and-coastal-wetlands

See also: Restoration of degraded deltaic wetlands of the Mississippi Delta https://americancarbonregistry.org/carbon-accounting/standards-methodologies/restoration-of-degraded-deltaic-wetlands-of-the-mississippi-delta

The method primarily reduces emission of GHG that occurs through desiccation and drying of previously wetted soils, resulting from levee construction and agricultural development. Desiccation of heavy organic alluvial soils results in oxidation and emission of GHG substances, including: carbon dioxide (CO_2), nitrous oxide (N_2O), and methane (CH_4). Baseline or business-as-usual scenarios include agriculture, seasonal wetlands, and open water areas. Baseline carbon stock changes and GHG emissions result primarily from the oxidation of organic matter. Project scenarios include tidal wetland restoration; managed, permanently flooded, non-tidal wetlands; and rice cultivation. These activities stop or greatly reduce Baseline emissions and, in the case of managed wetlands, can be net GHG sinks.

2) Stakeholder input:
- Peter Weisberg: 3 Degrees pweisberg@3degrees.com

- Steven Deverel: Hydrofocus, Inc. See references on Delta subsidence http://www.hydrofocus.com/Personnel/Steven-Deverel/steven-deverel.html

- Campbell Ingram: Executive Officer, CA Delta Conservancy cingram@deltaconservancy.ca.gov

3) Projects underway or completed under ACR voluntary standard:

- Work by DWR: California Department of Water Resources
  Managed wetland on 1,600 acres, to start 50,000 ERTs+ successfully verified; awaiting ACR and California Department of Water Resources approval.

- 3Degrees Rice conversion with four landowners on 1,200 acres, to start. Conversion currently underway; enrolling landowners formally and preparing project design documentation.

- The Nature Conservancy
  Managed wetland and rice conversion. Conversion complete; preparing project design documentation.

iii. Description of Project Type

Current agricultural practices on delta islands have resulted in up to 25' of subsidence of the soil surface below sea level on land inside delta levees. Water pressure from outside the levees increases risk of levee failure and flooding of the islands. Flooded islands would allow the mix of salt and fresh water to reach intake pipes for the State Water Project.

Subsidence ranges from 0.25 to 1.5 inches per year emitting "a chimney of emissions".

Example accounting (mtCO2e/acre):

- Delta total: Land subsidence in the Sacramento Delta now emits 2 MTCO2e/yr.
- Draining of peat soils by existing agriculture (tile drains) causes microbial oxidation of peat soils
- Organic carbon volatizes releasing CO2 and methane

Per acre: Subsidence releases an average of 10 metric tons of CO2 per year
= ~2,000,000 metric tons of CO2 per year, Delta
= ~500,000 vehicle equivalent
= Just over 1/4 of CA's total plant based agriculture carbon emissions

Project activity would:
Avoided soil carbon oxidation +15 mtCO2e/acre

Provide Soil carbon sequestration	+5 mtCO2e/acre
Reduce Methane	-5 mtCO2e/acre
= Net benefit 15 mtCO2e/acre	

The Vision for the Delta: A mosaic of wetlands, rice fields, seasonal wildlife hunting and wildlife habitat that is financially sustainable.

iv. AB 32 Criteria

i. **Real:**
- A real GHG reduction is one that:
  - Results from a clearly identified action or decision by the promoter
  - Is quantified using methods that are reliable, reproducible, based on the best available science, appropriate to the project's GHG source and take into consideration specific local conditions
  - Is quantified in a "conservative" manner that appropriately accounts for uncertainty thresholds and applies the necessary reduction factors that minimize the risk of overestimating emissions reductions
  - Does not lead to leakage, i.e. contributes to increases in GHG emissions elsewhere that would, in whole or in part, cancel the benefits associated with a project's GHG emissions reductions.
- Baseline Activities are corn and alfalfa agriculture; soil is drained through subsurface tile system resulting in soil oxidation; potential levee failure as subsidence progresses
- Quantification modules for agriculture; seasonal wetlands; open water (ACR p. 51-70)
- Procedures and parameter tables

ii. **Additional**:
- Legal Requirement Test: No federal, state or local laws have been identified that require Managed Wetlands, Tidal Wetlands, or Rice Cultivation projects. If any such laws were to be identified, credits would be limited to GHG reductions in excess of anything legally required.
- Performance Standard Test: uses "practice-based" performance approach which evaluates penetration level of particular practice within sector. None are common practice – less than 5%.

iii. **Quantifiable**:
- Estimation of *baseline* C Stock changes and GHG Emission (p. 43)

- Measurement methods to estimate C stock changes and GHG Emissions
- Methodology Models include biogeochemical models; fossil fuel emissions; baseline and project uncertainty
- Best available science; detailed measurement methods modules; Peer reviewed
- QA/QC procedures: Estimation of *Project* C Stock changes and GHG Emissions (p.44)
- Estimation of Total Net GHG Emissions reductions (Baseline – Project- Leakage)
- Models for GWP leakage evaluation for replacement to traditional agriculture by wetlands and rice
- Calculations of Uncertainty; Risk Assessment

iv. **Permanent**:

- Sequestration = Emission Reduction
- American Carbon Registry: 40-years duration; CARB standard: 100-years
- Current solutions = Long-term commitments; Insurance pool
- Risk tool for estimating Permanence and Risk

Subgroup recommends permanence requirements for this method need further consideration: Avoided emissions may not need permanence requirement

v. **Verifiable**:

- The verification requirements for ACR protocols are listed in the ACR Validation and Verification Standard, and are well documented and transparent. All projects must undergo an objective review by an accredited verification body. The ACR protocol states that a desk-based verification audit is required prior to the issuance of credits. A full verification including a field visit is required at the first verification and again at least every 5 years.
- Amend to ARB standards, i.e., reduction must be completely and sufficiently documented such that a qualified auditor who is a member of an accredited verification body can, by an objective review of the offset project site, confirm its completion and accuracy. ACR methodology requires that the verification team includes at least one hydrologist, biogeochemist or professionals with biogeochemical modeling experience in the Delta or similar peatland systems.

i. **Enforceable*:*** The Subgroup believes CARB could adopt measures and provisions to adapt the protocol to make it enforceable, and hold project owners liable for protocol violations. Recommend amending to CARB standards and ensuring clear monitoring and measurement

requirements that can be audited by a verifier and enforced by CARB. ACR (p. 42-43) sets forth monitoring plan requirements.

v. Direct Environmental Benefits (DEBS)

The method has the potential to provide substantial direct environmental benefits in project areas, and contribute to cumulative population-level increases of fish and wildlife. These DEBS include:

- Improved levee stability through subsidence reversal. Aggressive approach could reduce probability of levee failure 50% by 2070
- Increase in biodiversity with transition from monoculture industrial agriculture to aquatic/fluvial systems
- Increased habitat for avian, amphibian and invertebrate species (some special status)
- Increased food resources, growth, and survival for ESA/CESA listed fish species, including Delta smelt *(Hypomesus transpacificus)* and Winter-Run Chinook salmon *(Oncorhynchus tshawytscha)*
- Healthy wetlands protect communities and habitat from sea level rise and flooding

vi. Disadvantaged Communities, Native American or Tribal Lands, and Rural and Agricultural Regions

In order to avoid redundancy between subgroup report chapters, the Subgroup has included recommendations for this section in the Overarching/Programmatic Considerations chapter of this report. These Subgroup recommendations to improve Program participation by disadvantaged communities, Native Americans, and rural and agricultural communities are not protocol specific, and should be considered and applied where appropriate by CARB as new protocols are considered and adopted, and/or existing protocols are updated.

vii. Cost Barriers

Without revenue from the sale of carbon offset credits, proponents indicate that the goal of voluntary land conversions to achieve GHG emissions, crop conversion and levee protection goals cannot be attained. The market value of crop substitution from corn and alfalfa to rice offers little incentive for agricultural land conversion to restored deltaic wetlands. Table 4 displays estimated revenues per acre for restored deltaic wetlands project lands.

It is the avoided emissions from avoiding land subsidence that results in the tremendous emission savings. It is the income stream from sale of offsets that makes the land-use conversion economically viable for land owners and cooperatives.

Table 4. Estimated costs, gross, and net revenue per acre for restored deltaic wetlands projects.

Estimated Annual Income per Acre	Voluntary	Compliance (Base case)	Compliance (High Case)
Offsets Generated	15	15	15
Held in Buffer Account	(4)	(4)	(4)
Offsets for Sale	11	11	11
Sale Price ($/Offset)	$7.00	$19.00	$30.00
Gross Revenue per Acre	$77.00	$209.00	($26.00)
Verification and Registration Costs	($18.00)	($26.00	($26.00)
Net Revenue per Acre	$59.00	$183.00	$304.00

viii. Market/Demand Implications

The 3 Degree project proponents have conducted market analyses to demonstrate that the economics of replacing corn and alfalfa crops by rice, developing revenue from wetland and recreational uses, and revenue from substantial carbon offsets will result in a financial incentive sufficient to support sustained operation of the new land uses and subsidence avoidance.

~200,000 acres of good conversion candidates
~10 mtCO2e/acre/year
= 2 million mtCO2e/year of credits with DEBS

(Assuming capped emissions of ~350 million mtCO2e/year)
2% = 7 million mtCO2e demanded from projects with Direct Environmental Benefits to CA
= 30% of the DEBS bucket

ix. Joint Development Of Projects

- Methodology allows for aggregation as per ACR Programmatic Development Approach
- Allows for reduced verification/validation costs per acre
- Flexibility to add project areas at different times
- Cohort approach for validation and verification

x. Leakage

Based on the Subgroup's review, there is a very limited risk of activity-shifting or market-shifting leakage from this method. In cases where there is a leakage risk, it can be controlled by monitoring and reporting. Methodology evaluation of potential leakage of practices include:

- Leakage analysis conducted in 2016
- Predicted GWP changes insignificant relative to baseline emissions

- Projects implemented on less than 35,000 acres of cropland or 10,000 acres of pasture do not require leakage deduction.

xi. Perverse Incentives

Possible perverse incentives are expected to be minimal, however initial increased water utilization could result for rewetting of agricultural lands. Additional water allocations are not expected, and impacts to current annual water management practices are not expected. Estimates of water evapotranspiration rates for major agricultural crops in the Delta are comparable to recently restored deltaic wetlands (Eichelman et. al 2018). Table 5 compares water consumption rates of corn, alfalfa, and rice to recently re-wetted wetlands projects. Overtime, mature wetland (20 years) evapotranspiration was similar to alfalfa (Eichelman et al 2018). Water temperature decreases have been observed in riverine habitats as a result of wetlands restoration. Hemes et al (2018) observed substantial water temperature decreases resulting from re-wetted agricultural lands/floodplains.

Table 5. Estimated evaporation rates/acre for major Delta crop types and wetlands re-wetting (Eichelman et. al 2018)

Activity/Agricultural Crop Type	Estimated Evapotranspiration Rates/ Acre
Corn	3.0 acre-ft./acre
Alfalfa	3.0 acre-ft./acre
Rice	3.2 acre-ft./acre
Recently Re-wetted Wetlands/floodplains	3.6 acre-ft./acre
Mature wetlands/floodplains	3.0 acre-ft./acre

xii. Jobs

The Subgroup was unable to quantitatively estimate impacts or benefits to local and regional jobs as result of large-scale implementation of this methodology. However, it can be speculated that minor impacts to agricultural laborers may result. However, these impacts may be mitigated through creation of restoration, and technical positions. In addition, secondary job creation may result from increased wetlands habitats, and subsequent fish and wildlife production, including: eco-tourism, hunting/fishing guiding, and other resource management related business opportunities.

xiii. Environmental Impacts

The Subgroup does not expect significant environmental negative impacts from implementation of this method and/or project development. Therefore, mitigation

measures are unlikely to be necessary. The practices identified and the protocols that support them are not expected to increase the acres of agricultural land and therefore will not impact aesthetics, cultural resources, land use and planning, population and housing, public services, or recreation. These impacts are expected to be the same as they are currently. Method result in minor impacts on agricultural communities from decreases in cultivated acreage.

The implementation of most of the practices will have a positive impact on air and water quality; biological resources; energy demand; geology, soils and minerals; GHG emissions; hydrology and water quality; and utilities and service systems. For example, avoiding the continued agricultural production, and/or conversion to rice production, will reduce the emissions associated with plowing fields and may preserve habitat for threatened or endangered species.

V. SUBGROUP COMMENTS ON OTHER POTENTIAL PROTOCOLS

The Blue Carbon subgroup has made a substantial outreach effort to examine existing offset methodologies and protocols related to the conservation, restoration and creation of wetlands ecotypes. The purpose of our evaluation was to determine the development status, current applications and project development, scientific-rigor, and potential for elevation to possible compliance status by CARB.

Specifically, we had excellent presentations from developers of blue carbon/wetlands offset methodologies designed for the voluntary market including:

- Climate Action Reserve (Craig Ebert, President, Sami Osman, Policy Director) August 5, 2020
- 3Degrees/Hydro Focus Inc., Delta Conservancy, and Coastal Conservancy (Peter Weisberg, Campbell Ingram, Steve Deverel, Sabrina Dore): American Carbon Registry's Restoration of California Deltaic and Coastal Wetlands Methodology, July 15, 2020
- Tierra Foundation: Blue Carbon: Wetlands in Carbon Markets (Sara K. Mack, PhD, CFM, President and CEO), September 2, 2020
- VERRA: VCS Program Wetland Restoration and Conservation (Amy Schmid, Manager, Natural Climate Solutions Development), September 16, 2020

These protocols have been adopted by recognized registries for the voluntary market, usually in response to a particular opportunity in a specific habitat/ecotype, region, or location. As noted above, we recommend one of these protocols offers good potential for further examination by CARB for development as a new protocol, namely a protocol addressing subsidence in the Sacramento-San Joaquin delta.

However, we find that as a group, the remaining voluntary protocols present a variety of barriers that discourage their being advanced to compliance status at this time. We acknowledge the excellent investment that has been made in developing the science,

modeling, and accounting tools for these voluntary protocols. We commend the work, and encourage their use where appropriate. Nevertheless, we find that the following issues constrain their further consideration by CARB at this time:

1. ***Cost-Effectiveness****:* The cost of implementing and monitoring the blue carbon project exceeds projected carbon revenue, even at current prices for compliance offsets.
2. ***Project Areas:*** The limited acreage of target wetlands habitats/ecotypes available for blue carbon projects in California and the west coast, which limits the number of offset credits that can be generated.
3. ***Research and Development:*** The need for substantial further research on the carbon balance in tidal areas, which is difficult to monitor in a dynamic, fluctuating environment subject to erosion and deposition that is outside the control of the project developer.
4. ***Consistent Project Certainty:*** Permanence is difficult to ensure, especially in exposed coastal areas subject to storm surge and sea level rise.
5. ***Relevance to California:*** The voluntary protocols developed for peatland, mangrove and tropical forest habitats are not relevant for California and the west coast, and have only limited application in other areas of the U.S.
6. ***Limited Participation:*** The voluntary protocols do not prioritize disadvantaged communities.
7. ***Lack of Data:*** There is a lack of data availability and high technical complexity which would make it difficult to show that the projects meet the criteria for being real, as well as for verifying reductions.

For these reasons the Subgroup recommends further CARB staff analysis using the Task Force review process and template. However, we believe that these projects could have the potential to contribute to CARBs offset program in the future, as more projects are implemented in the voluntary market and the supporting science is advanced, and methodologies refined and developed. The Subgroup recommends CARB continue to monitor and evaluate these methods and protocols at a future time.

VI. DISCUSSION

With the time and resources available to the voluntary Blue Carbon/Wetlands Carbon Offsets Subgroup, we have determined that the American Carbon Registry's Restoration of California Deltaic and Coastal Wetlands Methodology has the most potential for immediate reduction in GHG emissions and carbon sequestration within the limited wetlands ecotypes in the Program market area, and specifically in California. The methodology has been reviewed, and approved though ACR's rigorous voluntary offset evaluation process, and has been utilized to develop and establish active wetlands restoration projects in the Delta. Considering the massive contribution of GHG emissions from this region, the Subgroup believes this methodology holds considerable promise for further development, and recommends CARB to conduct additional review

of this methodology for potential and implementation as a compliance carbon offset protocol by CARB. The Subgroup also recognizes the important potential for substantial GHG reduction and carbon sequestration and environmental co-benefits in other blue carbon/wetlands ecotypes in addition to the Delta, and advises CARB to support continued research, and explore climate finance options to support project development where applicable within the market area.

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Chapter 3: Analysis and Recommendations on Forestry

I. INTRODUCTION AND BACKGROUND ON TASK FORCE SUBGROUP

The purpose of the Forestry Subgroup was to consider and recommend potential changes to the existing *Compliance Offset Protocol U.S. Forest Projects* (Forest Protocol), adopted June 25, 2015, as well as any new offset protocols, for the Compliance Offsets Protocol Task Force (Task Force) to consider that will improve efficiency, reduce costs, decrease barriers to participation, and increase offset projects with direct environmental benefits to the state of California, while prioritizing disadvantaged communities, Native American or tribal lands, and rural regions.

The Subgroup met via video conference beginning in May. The Subgroup then met weekly to bi-weekly from June through mid-September 2020. The agendas for these meetings included one presentation from the Climate Action Reserve, review of written public comment from external stakeholders and discussion and review of recommendations by the Subgroup members. Individual Subgroup members conducted outreach to experts in various subject matters to gather information used to inform elements of its recommendations.

External written recommendations were received by:

- American Carbon Registry
- California Council of Land Trusts
- California Forest Carbon Coalition
- Climate Action Reserve
- Parhelion Underwriting Inc.

The initial draft of this chapter was used in the first public comment period and to facilitate discussion with Task Force members at its November 13, 2020 meeting.

This chapter version incorporates oral and written public comment received by the Task Force and discussion among Task Force members during its November 13, 2020 meeting. The Task Force received 36 written comments during the initial public comment period, of which 17 comments addressed forestry related recommendations.

II. RATIONALE FOR RECOMMENDATIONS FOCUSED ON EXISTING FOREST OFFSET PROTOCOL

The *Compliance Offset Protocol U.S. Forest Projects* seeks to achieve conservatively quantified, additional, permanent, verifiable, and enforceable credits, with multiple environmental and social co-benefits, derived from qualifying forest conservation, improved forest management and reforestation activities. Projects under this Protocol have generated over 82 percent of all CARB offset credits issued to date - 176 million out of the 214 million offset credits issued as of December 28, 2020. In just eight years, CARB data shows that approximately 120 forest projects across 5.1 million acres in 25 states have issued offsets. Thirty-seven projects are in California, significantly more

than any other state. No other U.S. forest offset standard has this level of participation and as such the Forest Protocol has become the national standard for forest offsets.

Thus, it is the consensus of the Forestry Subgroup that the Forest Protocol is generally effective in its current version. However, there is also consensus of the Forestry Subgroup, consistent with expressions from external stakeholders, that now we can benefit from the experience of projects to date in order to provide clarification and guidance in certain areas and revisions to several elements of the Forest Protocol to improve efficiency, correct errors, and address the barrier of high costs of project development, verification, and monitoring, while maintaining current standards of rigor and conservativeness of quantification. This will benefit the program by removing barriers to participation, especially for smaller, rural, and Native American or tribal landowners.

The Forestry Subgroup did not reach consensus on recommending any new protocols to the Task Force.[4]

III. SUMMARY OF SUBGROUP RECOMMENDATIONS TO THE TASK FORCE

Table 6 on the next page contains a list and summary statement for each recommendation. These are grouped in three categories: The first represent technical changes that we recommend CARB review, further refine as necessary and propose for rulemaking in 2021; the second represent changes that CARB can make administratively in 2021; and the third are changes we consider important for further consideration and refinement through a stakeholder process convened by CARB.

All the recommendations are detailed in Section IV.

Proposals that the Subgroup is not recommending due to a lack of consensus are in Section V.

[4] The subgroup did review and discuss the concept of a new protocol to address “avoidance of wildfire emissions” through fuels reduction (mechanical thinning and prescribed fire) projects. It also discussed concepts that would allow participation by federal-owned public lands and removal of the requirement that land owned by the project developer outside of the project area be considered in the baseline. However, these concepts did not find sufficient support within the subgroup to include them as recommendations.

Table 6. Summary of Recommendations

Item	Topic	Consensus Recommendations
A. Recommendations for 2021 Rulemaking (Regulation and Protocol)		
1	Geographic eligibility: Hawaii and Alaska	Now that there is FIA data available, include Hawaii and additional parts of Alaska in program.
2	Eligibility: Previously listed projects	Allow for land in projects that were previously listed as an offset project to be eligible for inclusion in another project if no offsets were previously issued.
3	Definition: Forest Owner	Scope definition to owners of affirmative interests with title and/or control of property resources relevant to offset project responsibility and liability.
4	Reversals: Standard of Negligence	Clarify standard of negligence related to intentional reversals to be consistent with typical California legal standard of willful misconduct or gross negligence.
5	Reversals: Alternative Accounting for Certain Types	Provide additional flexibility for managing certain types of reversals, while maintaining offset permanence and core requirement that all reversals be verified and compensated.
6	Common Practice Baseline	Update FIA-derived common practice statistics for assessment areas on a regular schedule. Remove site index classifications and use average values consistently. Change period for determining High Stocking Reference if project area has changed ownership in the last 10 years.
7	Qualified Conservation Easements (QCE): Timing	Allow for QCE to be granted no later than date Forest Owner requests issuance from CARB of offset credits for first reporting period, provided there is a binding commitment to do so. Allow for QCE to be granted in phases over five years.
8	Verification: Projects with few or no new offset accruals	Reduce verification frequency and intensity for projects with small offset issuances and projects no longer seeking new offset issuances.
9	Project Boundary Changes	Allow project area boundaries to be changed under certain circumstances to add or remove area after project registration.
10	Buffer pool: Insurance	Allow project operators to purchase CARB approved insurance products to cover reversal liability as an alternative to contributing offsets to buffer pool.
11	Revise Inventory Sampling Design Standards	Remove the requirement that modifications to inventory methodologies must achieve an equal or greater accuracy relative to the original sampling design.

Item	Topic	Consensus Recommendations
B. Recommendations for 2021 CARB Administrative Action		
12	Qualified Conservation Easements (QCE)	Require interagency cooperation between CARB and state funding agency to apportion responsibility for enforcement of conservation easement.
13	New methods for inventory and modeling	Provide guidance and an efficient process for CARB approval of new technologies and methodologies proposed by project developers.
14	Assets at Risk	CARB should consult with CALFIRE to add carbon projects to the list of mapped assets at risk.
C. Recommendations for CARB Expert-Stakeholder Work Groups		
15	Verification: Sequential Sampling	Evaluate the technical appropriateness and practical application of sequential sampling in verification and consider alternative statistical methods.
16	Reforestation baseline	Provide an alternative, more predictable baseline for reforestation projects using FIA data.
17	Non-federal public lands baseline	Simplify the method for estimating baseline carbon stocks for improved forest management projects on lands owned or controlled by non-federal public agencies.

IV. SUBGROUP CONSENSUS RECOMMENDATIONS

This section contains the 17 recommendations that cover technical changes that should be addressed in a 2021 rulemaking; CARB administrative actions that should be addressed in 2021; and those we consider important for further consideration and refinement through a stakeholder process convened by CARB.

The recommendations are each addressed separately in the order listed in the Summary table and contain a detailed description of the recommendation, a statement of the issue/problem the recommendation is addressing, information on how the recommendation address the goals and objectives contained in Assembly Bills 32, 293, and 398, and provides a list of resources used in the development of the recommendation.

We believe these recommendations will help the existing Forest Protocol be more effective in generating offsets that meet the statutory requirements, improve the accuracy of conservative quantification of offsets, and significantly enhance participation on a more equitable basis, especially for smaller, rural and Native American or tribal landowners who lack the significant resources needed to develop projects. These changes are also likely to provide more Direct Environmental Benefits to Californians, as well as to residents of states where forest management is less regulated. Further, implementation of these recommendations could increase job opportunities in rural forested areas of the state, providing benefits to economically depressed rural and tribal communities.

A. Recommendations for 2021 Rulemaking (Regulation and Protocol)

Recommendation 1. Geographic Eligibility: Hawaii, Alaska and U.S. Territories

A. Summary of Recommendation:

Expand the eligible project locations to include the State of Hawaii, additional portions of Alaska, and US territories.

B. Detailed Description of Recommendation:

The *Compliance Offset Protocol U.S. Forest Projects* (FOP) should be modified to include the State of Hawaii, expand areas within Alaska, and evaluate inclusion of U.S. territories as eligible project locations in Section 3.2.

When the FOP was originally adopted, both Alaska and Hawaii were not eligible to participate in forest project due to lack of U.S. Forest Service Forest Inventory and Analysis (FIA) data. In updates to FOP adopted June 25, 2015, portions of Alaska became an eligible location due to FIA data availability. However, the U.S. Forest Service was still collecting initial FIA data across the Hawaii counties and additional areas within Alaska, so action to include Hawaii and additional portions of Alaska were deferred until such time as FIA data becomes available to establish common practice values across the state. In addition, U.S. territories where FIA data exists should be considered for inclusion as eligible project locations.

Hawaii

Currently, Hawaii is the only state that is not eligible to participate in forest projects under the FOP due to lack of regional-specific data. CARB should include Hawaii as an eligible project location now because U.S. Forest Service FIA data is available across the Hawaii counties and FIA has published equations and factors needed to estimate growth and yield for a range of species found throughout the Hawaiian Islands.

Further, we recommend:
Supersections should be:

- Based on US Forest Service ecosections
- Spatially explicit ecological regions based on similar physical and biological conditions
- If necessary, adjacent ecosections sharing similar environmental, economic, and regulatory conditions be combined

Assessment Areas should be:

- Distinct forest community within supersections

- Consist of common regulatory and political boundaries that affect forest management

Since Hawaii's forests have similar species composition, assessment areas can be defined by biophysical settings. We recommend spatially defining biophysical settings using the set of moisture zones from Price et al. (2012).

Alaska

Within Alaska there are geographic regions that are not eligible to participate in forest projects due to lack of regional-specific data. CARB should include additional portions of Alaska as an eligible project location because U.S. Forest Service FIA data is available for such additional areas; and because FIA has published equations and factors needed to estimate growth and yield for a range of species found in Alaska.

U.S. Territories

The U.S. Forest Service collects data in various U.S. territories. CARB should evaluate inclusion of U.S. territories where there is sufficient FIA data and FIA has published equations and factors needed to estimate growth and yield for a range of species found in these territories.

C. Justification Statement (Why):

The *Compliance Offset Protocol U.S. Forest Projects* adopted June 25, 2015, Section 3.2 (c). states "Forest projects in Hawaii are not eligible at this time due to lack of regional-specific data". In addition, only certain areas within Alaska are currently eligible to participate in forest projects.

Until recently, the U.S. Forest Service had not collected FIA data in Hawaii, certain portions of Alaska, and U.S territories that are the basis for CARB common practice values. The U.S. Forest Service has completed its initial FIA data collection and this information is available to establish Protocol common practice values. In addition, the U.S. Forest Service FIA team now has published equations and factors needed to estimate growth and yield for a range of species found throughout the Hawaiian Islands, Alaska, and various U.S territories. These equations and factors are needed to estimate carbon stocks and to project future growth and volumes.

D. Resources Used in the Development of the Recommendation:

Compliance Offset Protocol U.S. Forest Projects adopted June 25,2015

https://www.climateactionreserve.org/how/protocols/forest/

Conversations with U.S. Forest Service FIA staff

CAR Presentation to the Forestry Subgroup, May 29, 2020

Public Comment – November 6, 2020 letter to the Compliance Offsets Protocol Task Force from Climate Action Reserve.

Public Comment – November 6, 2020 letter to the Compliance Offsets Protocol Task Force from Chugach Alaska Corporation, Antha, Inc, and Sealaska Corporation.

E. How the Recommendation Addresses/Meets AB 32 Requirements and/or Would Further Support AB 398 or AB 293

This modification to an approved Protocol meets AB 32 requirements. This change supports attainment of AB 398 and AB 293 goals to expand participation by landowners in states with large indigenous populations, providing jobs and new revenue. Allowing for forest projects located in Hawaii and portions of Alaska would benefit the rural forest regions of these states. In Hawaii, the rural, native, tropical forests across the state are imperiled by a history of conversion and environmental degradation over the past 150 years and are further threatened by invasive species. Access to the California Cap-and-Trade Program would stimulate protection and restoration activities that would help reestablish native forests that will benefit native Hawaiians and native wildlife, such as birds which are endemic to Hawaii – 48 species that are listed as endangered or threatened by the U.S. Fish and Wildlife Service. In portions of Alaska, rural and native populations would economically benefit from participating in forest projects that would protect fragile boreal forest types and their cultural and traditions.

Recommendation 2. Eligibility: Previously Listed Projects

A. Summary of Recommendation:

Land that was previously listed as part of a compliance offset forest project should be eligible to re-list as part of a new forest project as long as it was not included in a project that was successfully registered and issued offset credits.

B. Detailed Description of Recommendation:

Section 3.1(b)(4) of the *Compliance Offset Protocol U.S. Forest Projects, adopted June 25, 2015*, states under General Eligibility Requirements:

"To be eligible under this protocol, a forest offset project must not . . . Take place on land that was part of a previously listed compliance offset forest project, unless the previous forest project was terminated due to an unintentional reversal or is an early action offset project transitioning to this protocol according to the provisions of the Regulation and this protocol." (Page 24)

We recommend Section 3.1(b)(4) be modified to read:

"To be eligible under this protocol, a forest offset project must not . . . Take place on land that was part of a previously ~~listed~~ registered compliance offset forest project, unless the previous forest project was terminated due to an unintentional reversal or is an early action offset project transitioning to this protocol according to the provisions of the Regulation and this protocol." (Page 24)

C. Justification Statement (Why):

The current language of the Protocol prevents land that was submitted for listing as part of a compliance offset project from ever being enrolled in a future project. This makes sense as a means to prevent double counting of credits from the same area, but it assumes that the project originally submitted for listing proceeded through all of the required steps following listing and was ultimately issued offset credits. There may be many reasons why a project may have been listed initially, but then did not progress through all of the subsequent steps in the timeframes required by the regulation. Examples include: 1) a deadline may have been missed; 2) the project proponent may have desired to reconfigure the project; 3) the land in the original project listing may have changed ownership; 4) the project area boundary might have also changed since listing and the previously listed area may have been excluded from the boundary of the final registered project area; and 5) a natural disturbance occurred that prevented the project from successfully undergoing verification. If credits were never issued for land that was part of a previously listed project, then those acres should be eligible for enrollment in a future carbon project. This would both avoid double-counting and allow all eligible acres of land to participate in California's offset program.

D. Resources Used in the Development of the Recommendation:

Compliance Offset Protocol U.S. Forest Projects, adopted June 25, 2015

Public Comment – November 6, 2020 letter to the Compliance Offsets Protocol Task Force from Climate Action Reserve.

E. How the Recommendation Addresses/Meets AB 32 Requirements and/or Would Further Support AB 398 or AB 293

AB 398 established the Offset Protocol Task Force "*for the purpose of increasing offset projects with direct environmental benefits in the state while prioritizing disadvantaged communities, Native American or tribal lands, and rural and agricultural regions*." By allowing previously listed project area to participate in a future carbon project as long as it does not result in double-crediting, CARB would be making more acreage in rural, forested regions eligible to participate in the offset program.

Recommendation 3. Definition: Forest Owner

A. Summary of Recommendation:

Better scope the definition of Forest Owner so that responsibility and liability for offset projects is clearly assigned to parties that have direct title to or control of property, its forest and land management, germane to offset project permanence and integrity; exclude third parties whose limited rights and exercise thereof have no impact on the offset project. Specifically change Forest Owner definition to include only fee title owner(s) and owner(s) of timber and/or carbon rights; and exclude conservation easements and other similar interests.

B. Detailed Description of Recommendation:

Change current definition in the *Compliance Offset Protocol U.S. Forest Projects, adopted June 25, 2015* to read (changes underlined or ~~crossed out~~):

> "Forest Owner" means the owner of any interest in the real (as opposed to personal) property involved in a forest offset project, ~~excluding government agency third-party beneficiaries of conservation easements.~~" specifically meaning fee title or real property interest in the trees, timber or carbon.
>
> The definition goes on to state that, "[g]enerally, a Forest Owner is the owner in fee of the real property involved in a forest offset project. In some cases, one entity may be the owner in fee while another entity may have an ownership or management ~~an~~ interest in the trees or the timber on the property, in which case all entities or individuals with such ownership or management interests in the real property are collectively considered the Forest Owners…"
>
> The holders of easements that do not have management or ownership control over the timber or the land will not be deemed to be Forest Owners.

C. Justification Statement (Why):

The current definition is overly broad in reference to offset project and property ownership, as well as quantification and permanence of offsets. It creates a chilling effect on project development by making innocent third parties liable for project deficiencies, including reversals, over which they have no control, nor, typically any knowledge as they are not party to the property's fee ownership or management nor that of the offset project. There is no reasonable justification to include all third-party interests in the definition of Forest Owner.

Current Regulation:

CARB's Regulations for the Cap-and-Trade Program implemented at California Health & Safety Code Section 38500 *et. seq.* (the "Cap-and-Trade Statute") state in section 95983(c) that the "Forest Owner" will be liable for any intentional reversals under a carbon project and will be required to purchase and retire offset credits based on the metric tons lost due to the reversal. (This requirement is further addressed in Section 3.5.3 of the 2015 Protocol adopted by CARB for Forestry Offsets.) Section 95802 of the Regulations defines "Forest Owner" broadly to include most conservation easement holders and all access easement holders. Neither the Regulations nor the Protocols address the allocation of liability for intentional reversals among this broad class of potential Forest Owners. Regulation Section 95802 provides a general negligence standard by defining intentional reversal as that caused by the "forest owner's negligence, gross negligence, or willful intent." The Regulations and 2015 Protocol state that the "Forest Owner(s)" of a project will be responsible for purchasing replacement credits for intentional reversals, which implies joint and several liability between all Forest Owners. As noted above, currently, "…all entities or individuals with an interest in the real property are collectively considered the Forest Owners…"

The Problem:

Including the fee title owner and any timber or carbon rights holders as a Forest Owner makes sense given the parties' ability to control the land through *active* management activities. However, the current regulatory definition *also* includes any other entity that holds a real property interest (except, currently, for government agency third-party beneficiaries of conservation easements). This broad definition creates joint and several liability for project compliance and intentional reversals for all the following entities, in addition to the fee title owner and timber rights holders:

- Non-government agency third-party beneficiaries of a conservation easement
- Government agencies, tribes or non-profits that directly hold a conservation easement
- Holders of access easements along roads or trails that cross the property
- Tenants and licensees of the property
- Water rights holders

In general, these parties are not actively managing the land and exercise of their real property interests is carefully scoped through easements, leases, or licenses. The potential impact of these rights on an offset project is so remote as to be negligible. To the degree a pre-existing right might affect an offset project, e.g., by reducing the project footprint to account for a road or trail easement, such right must be addressed in the project design and quantification of the Baseline and Project. In particular, a conservation easement holder likely will

only access the land once per year to monitor the property, unless more frequent access is necessary. The conservation easement holder will not have the right to remove trees, construct improvements, or undertake any of the typical actions associated with land management. In summary, it is entirely illogical and unnecessary to include the entities listed above as Forest Owners.

Public access easements present their own issues, as many conservation projects provide for this public benefit, which should be encouraged as it benefits low-income or otherwise disadvantaged people who may not otherwise have access to natural open space. Generally, California law provides certain liability protections to public and private landowners that permit the public to access their lands for recreational purposes. (See California Civil Code Section 846 and Government Code Section 831 et seq.) Excluding trail and recreational easement holders entirely from the definition of Forest Owner is consistent with established public policy encouraging recreational access to private lands and will protect the landowner from automatic joint and several liability under a carbon project for that public recreational access. If CARB wishes to hold a trail user or easement holder responsible for damage and therefore a reversal to a forest offset project, liability should be scoped to each party's actual responsibility for the particular activity giving rise to that reversal, and it should be made clear that the mere act of permitting public access will not automatically make the Forest Owner liable for a reversal caused by the public.

D. Resources Used in the Development of the Recommendation:

California Code of Regulations, Title 17, Division 3, Chapter 1, Subchapter 10, Article 5

Compliance Offset Protocol U.S. Forest Projects, adopted June 25, 2015

Letter from California Council of Land Trusts (Nov. 22, 2019)

Public Comment – November 6, 2020 letter to the Compliance Offsets Protocol Task Force from FiniteCarbon.

E. How the Recommendation Addresses/Meets AB 32 Requirements and/or Would Further Support AB 398 or AB 293

This change is a correction to an approved Protocol that meets AB 32 requirements. This change supports attainment of AB 398 and AB 293 goals to expand participation by eliminating confusion as to what parties are Forest Owners and more clearly and reasonably allocating responsibility for a property's offset project, including reversals. This will reduce costs, including for expensive legal advice, and increase participation, especially for smaller rural and Native American or tribal forest owners who are resource constrained.

Further, more Forest Offset projects on properties subject to conservation and trail easements in California are likely to be undertaken if this change is made, providing a multitude of Direct Environmental Benefits associated with the properties, including protection of water quality and quantity, habitat for imperiled species, and outdoor recreational opportunities for stakeholders including residents of Disadvantaged Communities, among others. Removing this barrier to participation will not weaken the overall Program's rigor nor threaten permanence; but will expand participation and extend DEBS in rural and economically depressed regions. More projects will occur on working forestlands managed for both timber and carbon, supporting jobs and the rural resource-based economy.

Recommendation 4. Reversals - Standard of Negligence

A. Summary of Recommendation:

Clarify standard of negligence related to intentional reversals to be consistent with typical California legal standard of willful misconduct or gross negligence.

B. Detailed Description of Recommendation:

Change the current definition of "intentional reversal" in the *Compliance Offset Protocol U.S. Forest Projects, adopted June 25, 2015* as to its standard of intent and/or negligence to fairly allocate liability among parties with both direct and indirect interests in a property: Intentional should mean just that, not merely negligent, but willful, a conscious voluntary act or omission.

Change definition to read (changes underlined or ~~crossed out~~):

> "Intentional Reversal" means any reversal, except as provided below, which is caused by a F~~f~~orest O~~o~~wner's ~~negligence~~, gross negligence~~,~~ or ~~willful~~ intentional misconduct, including harvesting, development, and harm to the area within the offset project boundary, or caused by approved growth models overestimating carbon stocks. … The mere act of permitting third party access to the Project Area will not be deemed to be gross negligence or misconduct on the part of the Forest Owner.

C. Justification Statement (Why):

More accurately allocating liability based on actual wrongdoing by a specific party rather than casting a huge net will encourage greater responsibility and accountability for actions taken on the property by any specific individual, protect innocent parties, and reduce barriers for greater implementation of forest offset projects. Toward that end, specifying a more precise standard of intent into the definition of *Intentional* Reversal is also very important. If a reversal is truly

"intentional" then willful misconduct and gross negligence are the most appropriate standard. Those two standards are used broadly in California and are supported by a body of case law to aid in interpretation. Further, it clarifies the situation of third-party access so that landowners are not incented to close off a project site from approved third party users, including public recreational access.

D. Resources Used in the Development of the Recommendation:

Letter from California Council of Land Trusts (Nov. 22, 2019)

California Code of Regulations, Title 17, Division 3, Chapter 1, Subchapter 10, Article 5

Compliance Offset Protocol U.S. Forest Projects, adopted June 25, 2015

E. How the Recommendation Addresses/Meets AB 32 Requirements and/or Would Further Support AB 398 or AB 293

This change is to an approved Protocol that meets AB 32 requirements. This change supports attainment of AB 398 and AB 293 goals to expand participation by conforming the standard of liability for reversals to those commonly used in California. This will reduce costs, including for expensive legal advice, and increase participation, especially for smaller rural and Native American or tribal forest owners who are resource constrained.

Recommendation 5. Reversals - Alternative Accounting for Certain Types

A. Summary of Recommendation:

Provide additional flexibility for managing certain types of reversals, while maintaining offset permanence and core requirements that all reversals be verified and compensated.

B. Detailed Description of Recommendation:

The California Cap and Trade Regulation (Regulation) and the Compliance Offset Protocol U.S. Forest Projects, adopted June 25, 2015 (Protocol) contain robust requirements for dealing with reversals to ensure that any obligated carbon that may be lost—whether intentionally or unintentionally—is replaced. However, some of the existing requirements around reversals and the maintenance of carbon stocks are overly restrictive without providing increased protection for the offset program. Landowners require additional flexibility if they are to effectively manage their forestland over a project life of 100 years or more.

The Protocol currently views reversals as one of two types: 1) unintentional reversals, meaning "any reversal, including wildfires or disease that is not the

result of the forest owner's negligence, gross negligence, or willful intent," or 2) intentional reversals, meaning "any reversal, except as provided below, which is caused by a forest owner's negligence, gross negligence, or willful intent, including harvesting, development, and harm to the area within the offset project boundary." The Regulation also considers reversals "caused by approved growth models overestimating carbon stocks" to be intentional reversals, which require replacement of the reversed credits by the forest owner(s) (Section 95802).

However, there are a number of reasons why a project may experience an "intentional" reversal that is not necessarily caused by a forest owner's negligence, gross negligence, or willful intent to cause harm. Some additional types "intentional" of reversals that we recommend be explicitly addressed in the Protocol include:

Computational reversal: As described in the Version 5.0 of the Climate Action Reserve's Forest Project Protocol (CAR), computational reversals are those that can occur as a result of following the required protocol calculations (CAR, Section 7.3.3). Deductions that are intended to make the Protocol conservative, such as confidence deductions for sampling error and deductions to account for secondary effects, may both cause computational reversals if annual growth is insufficient to overcome these deductions. Total onsite carbon stocks within the forest and project area may still be increasing in these situations, but the net effect of deductions against growth may nonetheless result in the calculation of a reversal.

Technical reversal: A technical reversal is similar to a computational reversal but may be the result of a project using an approved growth and yield model or updating its inventory methodology. Modeling forest carbon is an imprecise science, and even if great pains have been taken to calibrate a model using project-specific input data and parameters, the model outputs may not exactly match the estimates achieved through other methods, such as field sampling. It is possible for a model to under-predict or over-predict carbon stocks, even if there is no negligence, gross negligence, or willful intent to do so. Moreover, as inventory methods improve over time and methodologies change for a variety of reasons—such as to increase precision and accuracy, improve efficiency, or reduce cost—these changes in methodology will likely result in changes to the estimate of carbon stocks. Like computational reversals, these technical reversals may not necessarily reflect an underlying change in the forest, but merely the methods used to provide forest carbon estimates.

Planned reversal: A planned reversal is one that is anticipated by a forest owner and is the result of planned forest management objectives. Some examples include balancing age classes, switching from one harvesting regime to another, or thinning to improve forest health. These activities may result in a short-term

decrease in onsite carbon stocks but are not intended to cause harm to the forest or to the integrity of the offset project.

Currently all intentional reversals, regardless of type or cause, must be followed by a full site visit verification and must be completed within one year of the reversal. All unintentional reversals must be followed by a full site visit verification within 23 months of discovery of the reversal. Importantly, the below recommendations do not propose changing the fundamental principles that 1) all reversals must be verified, and 2) all reversals must be compensated to maintain the integrity of the offset program. The below recommendations do, however, propose adding flexibility and removing unnecessarily restrictive requirements that simply add complexity and expense without added benefit.

The Compliance Offset Protocol should be modified to:

- Adopt the CAR Version 5.0 approach of allowing intentional reversals to provide a verified estimate of the reversal by means of a desk verification rather than a full site visit verification as long as the reversal: 1) does not coincide with a regularly scheduled site visit verification, and 2) does not represent a loss of 35% or more of the previous year's onsite carbon stocks (CAR Section 7.3.2). The reversal must still be compensated by the offset project operator following confirmation of the reversal amount via a desk verification.
- Adopt the CAR Version 5.0 approach of addressing computational reversals by allowing projects that experience either a computational reversal or a technical reversal to defer verification until the next regularly scheduled verification period. Allow projects with either computational or technical reversals to carry the reversal as a negative balance and apply it against future credits that the project may be eligible for (e.g. if onsite carbo stocks are in fact increasing as the forest continues to grow). Any negative balance that persists after the next regularly scheduled verification (maximum of 6 years later) would have to be compensated by the offset project operator (CAR Section 7.3.3).
- Remove the requirement that projects are only eligible to participate in the program if they 1) do not experience a decrease that results in the standing live tree carbon stocks falling 20 percent or more below the standing live carbon stocks at the project's initiation (Protocol, Section 3.1(b)(2)); and 2) do not experience a decrease in standing live tree carbon stocks over any 10 consecutive year period or 10-year "rolling average" (Protocol, Section 3.1(b)(1)). The program already rightly requires all intentional reversals to be compensated, and landowners who desire increased management flexibility should be able to manage their forestland for short-term decreases in onsite carbon stocking as long as they compensate for any reversals that result from those management

activities. This would allow landowners to more easily manage their forests over 100+ years, while also maintaining the integrity of the offset program. The existing provisions in the Protocol that trigger project termination, such as if live tree carbon stocks fall below the baseline, and that require additional penalty payments for voluntary early termination should be maintained.

- Allow projects to request only partial credit issuance and bank carbon storage in excess of issued credits in order to cover future reductions in carbon stocks. This would allow projects with planned reversals to compensate for a future reduction in stored carbon without triggering a formal reversal proceeding, including verification. If a project planned to accumulate carbon beyond what was credited, then this excess carbon storage would be used to compensate for a future reduction through the standard calculation process. If the future reduction did not occur or was less than anticipated, then credit issuance could be requested following the next verification. Although CARB currently allows for partial offset credit issuance, this change would require expressly allowing Offset Project Registries to provide partial ROC issuance as well.
- Allow projects that experience an unintentional reversal to provide a verified estimate of the reversal by means of a full verification within 36 months rather than 23 months of discovery. This would allow more time for tree mortality associated with the reversal event (e.g. a wildfire or beetle outbreak) to become more fully apparent and would ensure that the calculation of the reversal more fully and accurately reflects conditions on the ground.

C. Justification Statement (Why):

Forests are dynamic natural systems that are managed for a variety of goals and objectives. Over the 100 years or more of an offset project life, a project could change ownership and/or management strategy multiple times. CARB's offset program should primarily be concerned with upholding the standards of offset integrity, including the permanence of issued offset credits, and ensuring that committed carbon remains stored in the forest for at least 100 years or else is fully compensated for with equivalent compliance instruments. Many forests—especially in California—are currently in an overstocked condition and therefore susceptible to natural disturbance, wildfire, and forest health issues. Future management strategies may require that average carbon stocking level off or decline in some forests rather than increase in perpetuity. Future declines in carbon stocks are not inherently bad, particularly if they are part of a long-term management strategy that supports the long-term health of the forest and durability of carbon stores. Landowners should be given increased flexibility to manage their forest for a wide range of goals and objectives as long as the core principle of permanence for issued offset credits is maintained.

D. Resources Used in the Development of the Recommendation:

Compliance Offset Protocol U.S. Forest Projects, adopted June 25, 2015

Climate Action Reserve Forest Project Protocol Version 5.0, adopted October 16, 2019

Cap and Trade Regulation: Cal. Code Regs. tit. 17, § 95800-96022, effective April 1, 2019

CAR Presentation to the Forestry Subgroup, May 29, 2020

E. How the Recommendation Addresses/Meets AB 32 Requirements and/or Would Further Support AB 398 or AB 293

AB 398 established the Compliance Offsets Protocol Task Force "*for the purpose of increasing offset projects with direct environmental benefits in the state while prioritizing disadvantaged communities, Native American or tribal lands, and rural and agricultural regions*." This recommendation would provide important management flexibility for all landowners, but especially those in California that may face a difficult decision between maximizing carbon offset revenue and improving forest health. By recognizing a wider range of intentional reversals and providing more options for when and how reversals are managed, CARB can allow greater flexibility while still ensuring full compensation for reversals.

Recommendation 6. Common Practice Baseline

A. Summary of Recommendation:

Update FIA-derived common practice statistics for each defined assessment on a regular schedule. Remove site index classifications and use average values consistently across all Assessment Areas. Change period of time for determining High Stocking Reference if project area has changed ownership in the last 10 years.

B. Detailed Description of Recommendation:

CARB should review and adopt changes to the existing baseline determination process, including common practice determination. Specifically:

- Update the common practice values since it has been over 5 years since the last update, and institute a process to regularly update the common practice values on a pre-determined cycle (i.e. every 5 years) to ensure they reflect recent changes in common practice and nature-based carbon stock changes.

- Delink the process of updating the common practice values from the protocol update process to ensure efficiency and predictability.
- Use a single weighted average common practice value for each assessment area rather than low and high site values for some of the assessment areas and a single combined value for others.
- Require projects that are below common practice to determine a High Stocking Reference (HSR) over the preceding 10-year period or since acquisition of the project area, if acquisition by a non-affiliated forest owner occurred within the last 10 years.

C. Justification Statement (Why):

CARB is using outdated common practice values that do not reflect recent changes in common practice and nature-based carbon stock changes. Instituting a process that results in regular common practice updates every five years will ensure the integrity of the common practice values over time. In addition, the methods used to calculate common practice values should be clearly described and made public to increase transparency and ensure that updates are consistently and appropriately applied.

Currently, the process to update common practice values is tied to Protocol updates, which requires a full regulatory process and could result in delays in updating common practice values. Thus, delinking the two processes will ensure more timely common practice value updates, which is a technical issue that should not be required to go through lengthy administrative and public review processes.

Currently, the Compliance Offset Protocol U.S. Forest Projects, in some but not all cases, uses a low and high site class to determine common practice for assessment areas contained within a project geographic boundary. Using a single weighted average common practice value for each assessment area is more practical because site class (index) is difficult to determine across project areas due to variations in soil type, aspect, elevation, and proximity to water. Also, site class is difficult to verify by verification bodies. It would also bring all assessment areas into alignment for consistency. Further, FIA data does not stratify site class into low and high categories by Assessment Area; thus, using a low/high site class designation is not appropriate and should not be used.

For projects that are below common practice, determining a High Stocking Reference (HSR) within the last 10 years to use in modeling the baseline can be difficult, particularly if the land has changed ownership within the last 10 years. A new landowner that seeks to undertake a carbon project should not be negatively impacted by events that predated their ownership if the new landowner is not affiliated in any way with the previous landowner. Therefore, the 10-year look-back should apply only if the land has not changed ownership within the last 10

years. If it has, and the change in ownership was not between affiliated entities, then the HSR should be calculated only during the time that the current forest owners owned and controlled the land rather than the maximum 10-year period.

D. Resources Used in the Development of the Recommendation:

Informal discussions with stakeholders and subject experts.

Climate Action Reserve Presentation to the Forestry Subgroup, May 29, 2020

Public Comment – November 6, 2020 letter to the Compliance Offsets Protocol Task Force from Climate Action Reserve.

E. How the Recommendation Addresses/Meets AB 32 Requirements and/or Would Further Support AB 398 or AB 293

These are changes to an approved Protocol that meets AB 32 requirements and are intended to improve efficiencies, provide for more consistent quantification methods, and promote transparency and equity. As such, this recommendation supports attainment of AB 398 and AB 293 goals to decrease barriers to participation and increase offset projects with direct environmental benefits to the state of California, while prioritizing disadvantaged communities, Native American or tribal lands, and rural regions.

Recommendation 7. Qualified Conservation Easements

A. Summary of Recommendation:

Allow for Qualified Conservation Easement (QCE) to be granted no later than date Forest Owner requests issuance from CARB of offset credits for first reporting period, provided there is a binding commitment to do so. Allow for QCEs to be granted in phases over 5 years, subject to a binding commitment to do so.

B. Detailed Description of Recommendation:

A conservation easement is a truly permanent, binding restriction on a property's use and cannot be readily amended or extinguished. To realize its benefit to a forest carbon project there are risks in terms of timing of the grant of a Qualified Conservation Easement that need to be resolved to encourage the broader use:

- Rather than requiring the deadline for the grant of the QE be no later than the end of the initial reporting period, we recommend that the relevant sections of the Forest Protocol be amended to allow for the grant of the Easement to occur no later than at the time the Forest

Owner requests CARB to issue CARB offset credits for the initial reporting period. Provided, however, that the Forest Owner demonstrate the intent to make such a grant by entering into a binding commitment in the form of an Option between the Forest Owner and the easement holder during the initial reporting period that requires the Forest Owner to grant the easement at the time of the project's successful initial verification. The reduction in the buffer pool credits for the project would then be made when the easement is accepted and qualification is verified by the verifier for the registry, prior to submittal for issuance from CARB.

Further, due to the size and scale of some working forest properties, many conservation easements on forestlands are granted in phases to enable public funds to be raised in tranches over several annual funding cycles. Under the current Protocol requirements, the Qualified Conservation Easement must be granted over the entire property within the initial reporting period. We recommend a solution to this challenge:

- Amend the Protocol to permit a series of QCEs to be undertaken on a property if there is a binding agreement made during the initial project reporting period to grant all phases of the QCE within a maximum of 5 years from the issuance of credits from CARB, provided that the buffer pool credit contributions will only be reduced at the conclusion, when all phases of the QCEs are granted. Like the situation addressed in the first recommendation, the Forest Owner must enter into a binding option prior to the end of the initial reporting period that commits the Forest Owner to make the grant of the easements in phases within the 5-year time period.

C. Justification Statement (Why):

The 2015 Forest Protocol and its predecessors have all recognized the added value of having a conservation easement associated with a forest offset project to assure permanence beyond 100 years and to mitigate risk of reversals due to ownership or management changes. Qualified Conservation Easements were intended to be an important approach to assure permanence and a multitude of co-benefits of Forest Offset projects. However, to date, only two carbon projects have made use of this important tool because of two major timing issues:

- The grant of a QCE over a property where a Forest Offset project is being undertaken provides a significant public benefit as it permanently assures the project's permanence and provides many other co-benefits, including for wildlife adaptation, wildfire mitigation, and water

security. The current Protocol requires that the grant of an easement associated with an offset project be made prior to the verification of a new project. This timing requirement presents a significant risk to a participating Forest Owner if they record the easement in reliance on the potential carbon project and then for some reason the project is never verified. This risk, along with the interagency conflict described in Recommendation 14.a., has virtually choked off the use of QCEs, to the detriment of the State's public policy goals. Our recommendation calls for a small shift in the deadline for the grant of the Easement so that the project can first succeed in being verified, allowing for the Easement grant to then be made at the time of request for issuance of CARB offset credits. This change would also provide assurance that the QCE will be granted by requiring the Forest Owner to enter into a binding option prior to the end of the initial reporting period, thereby committing to grant the Easement subject to successful verification of the project. Buffer credits can be calculated by the registry at the time of registry offset credit issuance, and once the qualified conservation easement has been verified as recorded, the registry can "refund" to the Forest Owner the buffer credits attributable to the qualified conservation easement, prior to the Forest Owner requesting issuance of CARB offset credits. This technical change will open the door to more Qualified Conservation Easements being granted.

- In addition, the scale and expense of many working forest conservation easements and the limits to public funding available each year for conservation leads to many such projects to phase in a series of conservation easements over a large property over time encumbering it in geographically logical chunks. This situation should not preclude the grant of a series of QCEs over a single large Forest Offset project if the Forest Owner has entered into a binding commitment to make the grants within a relatively short amount of time, which we recommend being a maximum of 5 years from initial CARB issuance. Accommodating this timing need will also ensure more Forest Offset projects are made truly permanent using a Qualified Conservation Easement.

D. Resources Used in the Development of the Recommendation:

Letter from California Council of Land Trusts (Nov. 22, 2019)

California Health & Safety Code Section 38500 *et. Seq*.; Subchapter 10 Climate Change, Article 5, §95801-96022, title 17, California Code of Regulations.

E. How the Recommendation Addresses/Meets AB 32 Requirements and/or Would Further Support AB 398 or AB 293

These changes to an approved Protocol that meets AB 32 requirements are intended to improve participation and better assure the permanence of climate benefits and co-benefits. The changes support attainment of AB 398 and AB 293 goals to expand participation and achieve multiple public benefits by eliminating this barrier to the use of Qualified Conservation Easements by Forest Owners.

More Forest Offset projects on properties subject to QCEs in California are likely to be undertaken if these changes are made, providing a multitude of Direct Environmental Benefits associated with the properties most of which are located in rural and economically depressed communities. DEBS from projects subject to Qualified Conservation Easements include protection of water quality and quantity, habitat for imperiled species, more options for wildlife adaptation and migration, and outdoor recreational opportunities for stakeholders including residents of Disadvantaged Communities, among others. In addition, it is likely more projects with QCEs will occur on working forestlands managed for timber, conservation, and carbon, supporting jobs and the rural resource-based economy. Removing these barriers to the use of QCEs will provide additional assurance that permanent climate benefits will be more lasting than under the Forest Protocol's usual 100-year offset life alone, without affecting the rigor of quantification or other important elements of the Protocol.

Recommendation 8. Verification: Projects with Few or No New Offset Accruals

A. Summary of Recommendation:

Reduce verification frequency and intensity for small offset issuances, and projects not seeking credit issuance.

B. Detailed Description of Recommendation:

Section 3.5(b)(1) of the Compliance Offset Protocol U.S. Forest Projects, adopted June 25, 2015, requires that all offset projects undergo third-party verification with site visits at least every six years for the duration of the project life. These site visit verifications can be one of the costliest aspects of project development and maintenance for 100 years or more.

The Protocol should be modified such that:

- Projects generating 10,000 or fewer credits in a reporting period may defer a site visit verification for up to 12 years, or until 120,000 credits have accumulated, whichever comes first. Projects may opt to conduct desk verifications in the intervening years between required site visit verifications.
- Any forest project not seeking credit issuance at the time of a required site visit verification is not required to undergo a site visit verification but must undergo a desk verification of all reporting periods since the last verification. If credit issuance is later sought for a subsequent reporting period, the project must undergo a site visit verification at that time.
- All projects that defer a site visit verification beyond six years must monitor and report canopy cover changes on an annual basis within the project area using satellite imagery, aerial imagery, or other remotely sensed data. If canopy cover declines by more than 5% in a reporting period, then that reporting period and all reporting periods since the last verification must be verified for a potential reversal. Please see the related subgroup recommendation on reversals for additional modifications regarding when a reversal should trigger a site visit verification.

C. Justification Statement (Why):

Third-party verification can be cost prohibitive for many offset projects. Streamlining and reducing verification costs without sacrificing offset integrity would reduce a substantial barrier to entry and encourage greater participation in the offset program from a wider variety of forest landowners. It is also important for reducing the long-term burden of maintaining carbon offset projects over the minimum 100 years of a project life. Costs for a full verification, including an in-person site visit and field-based sequential sampling test are especially expensive, particularly for projects that have moved into a “monitoring” phase and are no longer generating additional carbon offset credits. For projects that must merely maintain the carbon they have committed to sequester in their forest for 100 years, there are lower-cost monitoring methods available, such as the use of aerial imagery and remotely sensed data to demonstrate that obligated forest carbon is being maintained and no reversals have occurred.

The Climate Action Reserve has already adopted a modified verification schedule in Version 5.0 of the voluntary Forest Project Protocol for both smaller projects and for projects that have entered a monitoring phase and are no longer seeking additional credit issuance. For smaller projects that have annual credit generation below a certain threshold, the required site visit frequency changes from once every 6 years to once every 12 years, or once a certain number of credits have accumulated. For projects that have entered a monitoring phase and are no longer seeking additional credit issuance, projects must report canopy

cover changes on an annual basis using satellite images from within the last year and must undergo a desk verification of previously submitted annual monitoring reports at least once every 12 years. A decline in forest canopy cover of more than 5% would trigger a verification to evaluate any potential reversal.

The Cap-and-Trade Regulation already allows deferral of verification from 6 years to 12 years for sequestration offset projects that do not renew their crediting period, as long as the first verification following the final crediting period shows an increase in carbon stocks of at least 10%. This provision is a good start but is overly narrow and prescriptive. This provision should be removed and replaced with the above recommendation. The modifications proposed above would expand on the existing regulation by allowing more projects to defer verification and rely on lower-cost, more efficient means of monitoring and verification for the life of the project. The above recommendation would make the Compliance Offset Protocol for U.S. Forests more consistent with the Compliance Offset Protocols for livestock, rice, and mine methane capture projects, which currently allow smaller projects below a certain credit threshold to defer verification beyond the typical verification cycle. Most importantly, the modifications recommended above maintain the critical permanence standard for offsets, requiring that adequate monitoring and reporting of sequestered carbon be continued for a minimum of 100 years, and that any reversals be reported, verified, and compensated to ensure offset integrity.

D. Resources Used in the Development of the Recommendation:

Compliance Offset Protocol U.S. Forest Projects, adopted June 25, 2015

Climate Action Reserve Forest Project Protocol Version 5.0, adopted October 16, 2019

Cap and Trade Regulation: Cal. Code Regs. tit. 17, § 95800-96022, effective April 1, 2019

CAR Presentation to the Forestry Subgroup, May 29, 2020

E. How the Recommendation Addresses/Meets AB 32 Requirements and/or Would Further Support AB 398 or AB 293

AB 398 established the Compliance Offsets Protocol Task Force "*for the purpose of increasing offset projects with direct environmental benefits in the state while prioritizing disadvantaged communities, Native American or tribal lands, and rural and agricultural regions*." This recommendation would remove a substantial barrier to entry for small landowners and smaller sized projects and would reduce the long-term cost burden associated with maintaining projects for 100 years or more, which would benefit disadvantaged communities and landowners with limited financial means.

Recommendation 9. Project Boundary Changes

A. Summary of Recommendation:

Allow project area boundaries to be changed under certain circumstances to add or remove area following project registration with appropriate adjustments.

B. Detailed Description of Recommendation:

The Compliance Offset Protocol U.S. Forest Projects, adopted June 25, 2015, currently requires that improved forest management and avoided conversion projects finalize their project area by the conclusion of the initial verification (Protocol, Section 2.2(b) and Section 2.3(b)). Reforestation projects must finalize their project area by the conclusion of the second full verification (Protocol, Section 2.1(c)). The boundary that is set at that point shall thereafter be the Project Area boundary for the duration of the project life, and changes are not expressly allowed. If any project lands or timber rights are sold to an entity that does not elect to take over the forest project responsibilities and commitments, the project automatically terminates (Protocol, Section 3.5.1(b)(2)).

However, over the course of a 100+ year project life, situations are bound to arise in which land ownership changes, new land is acquired and/or existing land is traded or sold, and it would be beneficial to either 1) remove some portion of area from a carbon project without terminating the entire project, or 2) adding area to a carbon project from nearby parcels such as through land acquisition, mergers, etc.

CAR's 5.0 Forest Project Protocol allows project activities to be terminated on a portion of the project area and the reduction in acreage and carbon stocks are treated as a potential intentional reversal (CAR, Section 4.3). However, there is no mechanism for adding in acreage to a project. The Compliance Offset Protocol currently has no mechanism for either adding or subtracting acreage from a project after it is registered, unless it is discovered that there has been an error in mapping the project boundaries, in which case adjustments are dealt with on a case-by-case basis. Moreover, if a portion of a carbon project is sold to a landowner who does not commit to continuing the carbon project on their portion, then the entire project is terminated, with the requirement to replace all previously issued credits at an additional penalty rate depending on the length of time since the project start date.

While CAR's mechanism for removing area from a project is a good start, it should be expanded to provide a mechanism whereby forest area can be both added and subtracted from a project following registration under certain circumstances, as long as appropriate adjustments are made. The changes

below have been developed with the intent to provide additional flexibility to landowners while ensuring reasonable sidebars are in place to prevent wholesale swapping of project area or frequent changes that could undermine the purpose of undertaking a carbon offset project commitment.

The Compliance Offset Protocol should be modified for Improved Forest Management projects:

- Projects may add area to a registered project because of a new acquisition or merger; however, the area to be added must meet the same eligibility requirements as the existing project area, including that it must not span more than two adjacent supersections (i.e. ecologically based geographic regions). If the new area is above the common practice stocking, no credits will be awarded for carbon stocking that exceeds the common practice average, as this would require a re-assessment of the project baseline. Credits will only be awarded for net growth achieved during the reporting period in which the new area is added. This would be calculated as the difference in carbon stocks between the previous reporting period and the current reporting period on the revised project area footprint. For this analysis, inventory data will need to be collected on the new project area. If inventory data is not available on the new project area for the previous reporting period, then inventory data from the current reporting period would have to be grown back to the end of the previous reporting period using an approved modeling method to account for the net change.

- Projects may remove no more than 25% of a registered project area if the land is changing ownership to a non-affiliated entity. The removal would be conservatively treated as an intentional reversal; an analysis would be required to confirm the number of credits attributable to the portion of the Project Area being withdrawn and these credits would need to be compensated. If the change brought live tree carbon stocks on the revised project area below the baseline, the project would terminate per existing requirements. The area remaining within the project area would be assessed and credited with net growth by comparing current year stocks to previous year stocks on only the area that remains in the project.

- Project area adjustments that are the result of mapping errors in the original project boundary, updated information or new evidence coming to light regarding the correct placement of project boundaries should not be considered intentional reversals.

- A full site visit verification would be required whenever project area is added or subtracted from a project, except in the case of boundary adjustments due to mapping errors or new information coming to light.

Project area additions or removals other than boundary corrections would not be allowed more than once per crediting period (I.e., once every 25 reporting periods). Existing provisions requiring sustainable forest management on all forestland owned by the forest owners(s) and their affiliates would remain in place.

- Further consideration should be given to how project additions and subtractions could be incorporated into avoided conversion and reforestation projects after finalization of those project area boundaries.

C. Justification Statement (Why):

In Version 5.0 of the voluntary Forest Project Protocol, the Climate Action Reserve allows project activities to be terminated on a portion of the Project Area. If this happens, a new project area must be delineated and the change must be described in the project documentation, including with a revised project area spatial boundary and updated acreage. The inventory for the modified Project Area must also be updated and will be reviewed during the next regularly scheduled site visit verification. If it is determined that a reversal has taken place because of the project area change, the reversal is treated as an intentional reversal and must be compensated (CAR, Section 4.3).

CARB has already provided project-level guidance that removing acreage from a project is allowed under certain circumstances, such as if new evidence comes to light indicating that a portion of the existing project area falls on land that is ineligible for a project, such as federally owned land. In these cases, the project area may be adjusted to remove the acreage of overlap and the inventory and resulting estimate of carbon stocks can be adjusted accordingly. The above recommendation would build on this guidance and formalize a process by which project area may be changed following project registration under certain circumstances with appropriate sidebars and adjustments to assure conversative quantification and maintain offset integrity. This modification would give greater flexibility to projects over the course of a project life of 100 years or more and would ensure that more projects remain in the system for that duration as well.

D. Resources Used in the Development of the Recommendation:

Compliance Offset Protocol U.S. Forest Projects, adopted June 25, 2015

Cap and Trade Regulation: Cal. Code Regs. tit. 17, § 95800-96022, effective April 1, 2019.

Climate Action Reserve Forest Project Protocol Version 5.0, adopted October 16, 2019.

Comment Letter from the California Forest Carbon Coalition, July 10, 2020 Project developer input.

Public Comment – November 6, 2020 letter to the Compliance Offsets Protocol Task Force from FiniteCarbon.

Public Comment – November 6, 2020 letter to the Compliance Offsets Protocol Task Force from RenewWest.

E. How the Recommendation Addresses/Meets AB 32 Requirements and/or Would Further Support AB 398 or AB 293

AB 398 established the Compliance Offsets Protocol Task Force "*for the purpose of increasing offset projects with direct environmental benefits in the state while prioritizing disadvantaged communities, Native American or tribal lands, and rural and agricultural regions*." This recommendation would allow for increased program participation from forest landholders in California and around the country. It would also ensure that more projects remain enrolled in the system for the duration without terminating prematurely. In the long-term this will yield greater greenhouse gas reductions as well as greater environmental, social, and economic co-benefits that forest offset projects provide to rural and agricultural regions and communities.

Recommendation 10. Buffer Pool: Insurance

A. Summary of Recommendation:

Allow the use of private insurance policies or bonds to meet the regulatory buffer pool requirements for CARB offset credits issued under the Compliance Offset Protocol U.S. Forest Projects.

B. Detailed Description of Recommendation:

The California Code of Regulations, Title 17, Division 3, Chapter 1, Subchapter 10, Article 5, § 95983 – Forestry Offset Reversals states that for forest sequestration projects, a portion of portion of CARB offset credits issued to the forest offset project will be placed by CARB into the Forest Buffer Account.

CARB should allow the use of private insurance policies or bonds as alternative methods to meet the regulatory buffer pool requirements for CARB offset credits issued under the Compliance Offset Protocol U.S. Forest Projects.

C. Justification Statement (Why):

Current Regulation/Protocol:

California Code of Regulations, Title 17, Division 3, Chapter 1, Subchapter 10, Article 5, § 95983.

The Problem:

Currently, there is only one method allowed to satisfy the regulatory requirements of § 95983, which is to use a portion of CARB offset credits issued to a forest offset project to be placed into a Forest Buffer Account to protect again losses caused by reversals. A recent review indicated that about 16% of all offset credits issued to forestry projects are held in CARB's Buffer Account. The requirement to deposit somewhere between 10-20% of a project's issued offset credits significantly reduces the revenue generated by the project and can cause some projects to be uneconomical to operate, especially for smaller forested parcels. Allowing alternative methods to meet the regulatory requirements will reduce costs and will improve the project economics for small, forested parcels that are generally family-owned.

D. Resources Used in the Development of the Recommendation:

California Code of Regulations, Title 17, Division 3, Chapter 1, Subchapter 10, Article 5, § 95983.

Public Comment – Parhelion Underwriting Inc.

E. How the Recommendation Addresses/Meets AB 32 Requirements and/or Would Further Support AB 398 or AB 293

This recommendation meets AB 32 requirements through alternative methods of ensuring Forest Offset Reversals. This recommendation supports attainment of AB 398 and AB 293 goals to create more cost-efficient methods to operate the Cap-and-Trade Program and reduce barriers to entry of landowners in California. Allowing a more cost-effective and efficient alternative methods to meet the intent of the Forestry Offset Reversal regulatory requirements will reduce costs of participating in forest projects as the project operator can choose the least cost option to meet the regulatory requirements of § 95983.

Recommendation 11. Revise Inventory Sampling Design Standards

A. Summary of Recommendation:

Remove the requirement in Compliance Offset Protocol Section 6(e) that states "modifications to inventory methodologies must achieve an equal or greater accuracy relative to the original sampling design".

B. Detailed Description of Recommendation:

The Compliance Offset Protocol should be modified to remove the requirement in Section 6(e) that states "modifications to inventory methodologies must achieve an equal or greater accuracy relative to the original sampling design" as it is unnecessary and places an undue burden on projects, especially smaller ones.

C. Justification Statement (Why):

The Compliance Offset Protocol already includes a confidence deduction calculation that penalizes projects that do not achieve a certain level of accuracy. Thus, requiring that any new inventory achieves an iteratively higher and higher level of accuracy every time a methodology is updated is unnecessary and may place an undue burden on projects, especially smaller ones. It is highly possible that a well-designed inventory may not achieve higher levels of precision due to statistical variability, but that fact will only be determined after the field work has been completed. This may require additional plots to be added until a level is achieved greatly increasing the time and cost of this work. A confidence deduction is used to offset any reduction in accuracy and ensures the credibility of the project over its term.

D. Resources Used in the Development of the Recommendation:

Compliance Offset Protocol U.S. Forest Projects, adopted June 25, 2015

Public Comment – November 6, 2020 letter to the Compliance Offsets Protocol Task Force from FiniteCarbon.

E. How the Recommendation Addresses/Meets AB 32 Requirements and/or Would Further Support AB 398 or AB 293

AB 398 established the Compliance Offsets Protocol Task Force "*for the purpose of increasing offset projects with direct environmental benefits in the state while prioritizing disadvantaged communities, Native American or tribal lands, and rural and agricultural regions*." This recommendation would allow for increased program participation from forest landholders as project risk is reduced, benefiting rural regions in California and around the country.

B. Recommendations for 2021 CARB Administrative Action

Recommendation 12. Qualified Conservation Easements

A. Summary of Recommendation:

Require interagency cooperation between CARB and state funding agencies, in particular the Wildlife Conservation Board (WCB), to apportion responsibility for enforcement of a Qualified Conservation Easement (QCE).

B. Detailed Description of Recommendation:

The current Protocol requires any qualified conservation easement to "expressly acknowledge that CARB is a third-party beneficiary of the conservation easement with the right to enforce all obligations under the easement and all other rights

and remedies, including standing as an interested party in any proceeding affecting the easement, conveyed to the holder of the easement."

We recommend that this section of the Protocol be amended to state the following, requiring any qualified conservation easement to "expressly acknowledge that CARB is a third-party beneficiary of the conservation easement with the right to enforce obligations under the easement that directly affect the quantification of offset credits, ~~and~~ including all other rights and remedies, including standing as an interested party in any proceeding affecting the easement, conveyed to the holder of the easement; provided that all government agencies that are third-party beneficiaries of the easement reasonably cooperate with the other third party beneficiary agencies to assure coordination in the exercise of the rights that accrue to each agency under the terms of the Easement."

Further, if necessary, we recommend that the Governor's Office provide a directive or facilitate the creation of a standing programmatic Memorandum of Understanding committing each agency to a framework for cooperation in fulfilling their statutory and regulatory mandates pertaining to Qualified Conservation Easements.

C. Justification Statement (Why):

The 2015 Forest Protocol and its predecessors have all recognized the added value of having a conservation easement associated with a forest offset project to assure permanence beyond 100 years and to mitigate risk of reversals due to ownership or management changes. Qualified Conservation Easements were intended to be an important approach to assure permanence and a multitude of co-benefits of Forest Offset projects, yielding a reduced buffer pool contribution in recognition of the reduction in permanence risk. However, this tool is simply not being utilized largely due to a perplexing, unresolved inter-agency dispute. Currently, at least one major state conservation funding agency, the WCB, will not permit the Protocol's required language designating CARB as a third-party beneficiary, etc., in any easement receiving funding from WCB, unless CARB agrees to "subordinate" its third-party enforcement rights to WCB's enforcement rights. It is unclear what it means to subordinate an enforcement right: Arguably, each agency should have its own right to enforce and intervene, irrespective of another agency's right to enforce and intervene, and the more oversight and enforcement, the better for the long-term protection of the property. Typically, the WCB cooperates with many other funding agencies in funding a conservation project and to our knowledge has not required this kind of "subordination." Rather, each state agency that funds a project, such as the State Coastal Conservancy, Resources Agency, Department of Forestry and Fire Protection, and Department of Fish and Wildlife, records a Memorandum or Notice that declares its rights under an Easement or Grant Agreement. To our knowledge,

WCB has not required "subordination" from any other state funders that are third-party beneficiaries named in a WCB-funded conservation easement. CARB will not agree to the WCB subordination language because the Protocol does not contemplate subordination to another agency.

Because most conservation easements over working forests with a carbon project component will involve WCB funding due to the size and cost of these projects, this inter-agency disagreement has chilled the ability to qualify virtually any conservation easement for a buffer credit reduction. This jurisdictional dispute between WCB and CARB is particularly odd given typical cooperation among other state entities on conservation easement funding. We recommend that a Governor's Office Directive be issued, or a formal programmatic Memorandum of Understanding be entered into between all the Resource Agency and other state funders (such as Cal Fire) and CARB that clearly defines the roles and responsibilities of each entity, with facilitation by the Governor's Office, as CARB is not a Resource Agency and there are different statutory and regulatory mandates to fulfill. Where there is a will, there is a way if the State wishes to utilize Qualified Conservation Easements as envisioned to buttress permanence of Forest Offset projects within the Cap-and-Trade Program. It is time for these agencies to cooperate to accomplish multiple public benefits for climate.

D. Resources Used in the Development of the Recommendation:

Letter from California Council of Land Trusts (Nov. 22, 2019);

California Health & Safety Code Section 38500 *et. Seq.*; Subchapter 10 Climate Change, Article 5, §95801-96022, title 17, California Code of Regulations.

E. How the Recommendation Addresses/Meets AB 32 Requirements and/or Would Further Support AB 398 or AB 293:

These changes to an approved Protocol that meets AB 32 requirements are intended to improve participation and better assure the permanence of climate benefits and co-benefits. The changes support attainment of AB 398 and AB 293 goals to expand participation and achieve multiple public benefits by eliminating this barrier to the use of Qualified Conservation Easements by Forest Owners.

More Forest Offset projects on properties subject to QCEs in California are likely to be undertaken if these changes are made, providing a multitude of Direct Environmental Benefits associated with the properties most of which are located in rural and economically depressed communities. DEBS from projects subject to Qualified Conservation Easements include protection of water quality and quantity, habitat for imperiled species, more options for wildlife adaptation and migration, and outdoor recreational opportunities for stakeholders including residents of Disadvantaged Communities, among others. In addition, it is likely

more projects with QCEs will occur on working forestlands managed for timber, conservation, and carbon, supporting jobs and the rural resource-based economy. Removing these barriers to the use of QCEs will provide additional assurance that permanent climate benefits will be more lasting than under the Forest Protocol's usual 100-year offset life alone, without affecting the rigor of quantification or other important elements of the Protocol.

Recommendation 13. New Method for Inventory and Modeling

A. Summary of Recommendation:

The Compliance Offset Protocol should be modified to: 1) reflect regulatory language adopted in April 2019; 2) provide greater assurance for project proponents that want to innovate and use new methods for inventory and modeling based on evolving technologies; and 3) provide a publicly available list of approved models and methods that is regularly updated as new methods are approved.

B. Detailed Description of Recommendation:

The most recent Cap and Trade Regulation that went into effect April 1, 2019 contained a new provision around approving alternate methods for monitoring and measurement that were not in common use at the time the Compliance Offset Protocol was adopted (Regulation, Section 95976(g)). Remote sensing methods for forestry are listed as an example. Alternate methods must be determined by CARB to be at least reasonably equivalent to the accuracy of the method(s) commonly employed when the Compliance Offset Protocol was adopted, and capable of being verified to a reasonable level of assurance. This addition to the regulation is a great step forward because it opens the door for project proponents to be innovative, and to take advantage of technological developments that may assist in making project development more efficient or cost-effective. However, there are downsides to the current approach of seeking approval for an alternate methodology. The process and standards as laid out in the Regulation are vague, approval may only be initially granted on an interim basis for one reporting period, and CARB may rescind approval at any time if new information comes to light regarding the alternate method's accuracy or ability to be verified.

In addition, a detailed analysis must be provided to demonstrate how the alternate method is consistent with "the relevant requirements, and not explicitly prohibited by the applicable Compliance Offset Protocol" (Regulation, Section 95976(g)(1)(C)(3)). This language is vague and potentially problematic because the current Compliance Offset Protocol for U.S. Forest Projects requirements

regarding what a carbon inventory methodology should contain are heavily skewed towards traditional methods of field-based sampling and measurement.

On the modeling side, the Protocol is similarly prescriptive, only providing two options for modeling updates to inventory estimates: 1) using a growth and yield model from a limited, pre-approved list, or 2) updating diameter and height increments using a stand table projection method that follows a very prescriptive set of steps. It is not clear if other alternate methods would be allowed, despite the new language in the Regulation.

The Compliance Offset Protocol should be modified to provide greater assurance for project proponents that want to innovate and use new technologies and methods to develop projects in addition to traditional field-based methods alone. The Protocol should reference the new language in the Regulation regarding alternate methods for monitoring and measurement and should lay out a clear and efficient process whereby new methods could be reviewed and approved, including the specific standards and criteria that new methods would be required to meet. As part of this process, CARB should consider forming a technical committee comprised of experts in forestry, biometrics and modeling who can assist CARB on an ongoing basis in reviewing and approving new methodologies in a timely and efficient manner. Finally, CARB should consider providing a publicly available list of approved models and methods that is regularly updated as new methods are approved. This list should be provided and updated outside of the Protocol update process to ensure efficiency and predictability.

C. Justification Statement (Why):

CARB has already recognized that technological developments around measurement and monitoring forest carbon have continued to progress since adoption of the last Protocol. Methods such as remotely sensed data (e.g. LiDAR, satellite, and drone-collect data), data aggregation, cloud-based processing and machine learning have the potential to reduce the cost of project development while increasing the precision and accuracy of forest carbon estimates. In addition, there are many sound and viable options for modeling inventory updates between measurement cycles, and the Protocol need not be overly prescriptive if the modeling methods meet certain basic criteria and standards. CARB should establish a clear and objective process whereby projects would be free to pursue alternate methods that meet pre-determined criteria and standards. Additionally, the Protocol should not have to be revised every time there is a new method to include. Instead, CARB should consult with a technical committee of experts and provide a publicly available list of approved methodologies that is regularly updated as new methods are approved. A clear and objective process that is reflected in both the Regulation and the Protocol would reduce the financial risk of investment in new technologies and would allow for increased innovation and cost-savings in project development.

D. Resources Used in the Development of the Recommendation:

Compliance Offset Protocol U.S. Forest Projects, adopted June 25, 2015

Cap and Trade Regulation: Cal. Code Regs. tit. 17, § 95800-96022, effective April 1, 2019

American Carbon Registry stakeholder input, July 31, 2020

Public Comment – November 6, 2020 letter to the Compliance Offsets Protocol Task Force from FiniteCarbon.

E. How the Recommendation Addresses/Meets AB 32 Requirements and/or Would Further Support AB 398 or AB 293

AB 398 established the Compliance Offsets Protocol Task Force "*for the purpose of increasing offset projects with direct environmental benefits in the state while prioritizing disadvantaged communities, Native American or tribal lands, and rural and agricultural regions*." This recommendation would allow for increased program participation from all forest landholders, benefiting rural regions in California and around the country.

Recommendation 14. Carbon Projects on CALFIRE Map of Assets at Risk

A. Summary of Recommendation:

CARB should consult with CALFIRE to add forest carbon projects to the list of mapped "Assets at Risk" which are considered for protection during wildfire suppression activities.

B. Detailed Description of Recommendation:

CARB should consult with CALFIRE to add forest carbon projects to the list of mapped "Assets at Risk" which are considered for protection during wildfire suppression activities. Projects could be included on the maps of each CALFIRE Unit like other identified high value assets, alerting fire planners and crews to the existence of the project and allowing special consideration for protection when possible.

C. Justification Statement (Why):

Carbon projects are a significant investment in time, money, and commitment by a forest owner to achieve critical public benefits, including contributing to achievement of state-wide greenhouse gas emission goals. Thus, if the geographic locations of forest carbon offset projects are tracked on the CALFIRE map of Assets at Risk, when feasible and practical, special consideration can be

given to protect these project areas by fire planners and crews when making decisions during wildfire incidents.

D. Resources Used in the Development of the Recommendation:

Discussions among Forestry subgroup members

E. How the Recommendation Addresses/Meets AB 32 Requirements and/or Would Further Support AB 398 or AB 293

This recommendation does not change AB 32 requirements. This recommendation supports attainment of AB 398 and AB 293 goals to expand participation by California landowners by incentivizing development of forest carbon offset projects within California.

C. Recommendations for CARB Expert-Stakeholder Work Groups

Recommendation 15. Verification: Sequential Sampling

A. Summary of Recommendation:

CARB should review and evaluate the technical appropriateness and project economics of sequential sampling under the Compliance Offset Protocol U.S. Forest Projects, as well as determine if one or more alternative statistical methods should be approved to verify if project stocks reported by the project operator are in agreement with verification body stock estimates and, if needed, sufficient accuracy of the measurement data exists.

B. Detailed Description of Recommendation:

The Compliance Offset Protocol U.S. Forest Projects (Section 8.1.1) details the requirements for using sequential statistical methods to confirm agreement among project inventory estimates submitted by the project operator and inventory estimates determined by a verification body. The intent of these methods is to minimize the verification effort when verification and project sample data agree. However, in practice, these methods create uncertainty in the amount of time and cost required to meet the Protocol requirements.

CARB should review and evaluate the technical appropriateness and project economics of sequential sampling under the Compliance Offset Protocol U.S. Forest Projects. Consideration of changes in the sequential sampling process should include:

- If a null plot is selected first in a sequence and the verifier's measurements agree it is a null plot, either the plot should be considered a pass or a new

plot should be substituted as there are no measurements to be compared and including the plot expands the number of plots that will need to be compared.

- More detailed guidance for determining in and out trees and allow some flexibility for not including in-growth in certain cases.
- Excluding recently disturbed plots from sampling for one reporting period, up to 5% of plots.
- Evaluating separate stopping rules for height and diameter.
- Reducing the number of plots in a row that must pass, especially for inventories with very low sampling error, which is more in line with leading references on sequential sampling.

In addition, CARB should determine if one or more alternative statistical methods could be used to verify if project stocks reported by the project operator agree with a verification body stock estimate. In other words, is there a more efficient and cost-effective alternative method to demonstrate statistical agreement among project inventory estimates submitted by the project operator and inventory estimates determined by a verification body? One example is using a paired t-test, which is used in voluntary forest carbon projects.

CARB should, at minimum, confirm that the required verification method for "paired" and "unpaired" sequential sampling tests are consistent with leading references on sequential sampling methodology[5].

C. Justification Statement (Why):

Current Regulation/Protocol:

Compliance Offset Protocol U.S. Forest Projects, adopted June 25, 2015

The Problem:

The Compliance Offset Protocol U.S. Forest Projects requires the use of sequential sampling, in which the verification body is tasked with confirming agreement with project operator's inventory stock estimates. CARB intended this process to be efficient. However, sequential sampling is one of the most uncertain and costly components of a verification (sometimes comprising half or more of total verification costs). There is no fixed sample size; rather there are stopping rules to indicate either agreement or potential bias. This means that there is no way for a verification body to estimate the amount of time and cost to complete the sequential sampling process.

[5] Nitis Mukhopadhyay and Basil M. DeSilva, CRC Press, 2008, pp. 63-66

Currently, the CARB sequentially sampling process requires six passing plots in a row for each stratum verified. It appears this is an arbitrary number of plots not supported in the scientific literature. CARB should evaluate eliminating a mandatory number of plots that must be remeasured and consider allowing the data to drive the decision of how many plots need to be remeasured for each stratum.

Project developers report that the sequential sampling process is challenging to apply in real forest inventory situations. For example, if the initial forest inventory plot measurements are in complete agreement (no difference in measurements) among the project operator and the verifier and the next few plots are in less agreement (maybe a borderline tree not counted in the original inventory, however it has grown into the plot and measured by the verifier), it is difficult to near impossible to pass on the minimum number of plots. This is because the trend is moving away from agreement. However, if you reverse the order of the plots measured, the sample would be heading towards agreement, and passage is attainable. In this case, it is the luck of the draw on which plots are used to initiate the verification sample. This example demonstrates one challenge with the sequential sampling method.

Project developers have identified that where an inventory sampling error (SE) is small (i.e. less than 5%), passing sequential sampling becomes more difficult due to less variability in the inventory. It seems that the tighter the SE, the less rigorous the sequential sampling process is needed to ensure the integrity of the inventory.

D. Resources Used in the Development of the Recommendation:

Compliance Offset Protocol U.S. Forest Projects, adopted June 25, 2015

Public Comment – July 10 ,2020 letter to the Compliance Offsets Protocol Task Force from the California Forest Carbon Coalition.

Conversations with carbon registries and project developers engaged in CARB forestry project development.

E. How the Recommendation Addresses/Meets AB 32 Requirements and/or Would Further Support AB 398 or AB 293

This recommendation does not change AB 32 requirements. This recommendation supports attainment of AB 398 and AB 293 goals to expand participation by California landowners by creating more efficiency and certainty around the process, time, and cost to verify a forest inventory.

Recommendation 16. Reforestation Baseline

A. Summary of Recommendation:

Streamline the process to establish a project baseline for reforestation projects.

B. Detailed Description of Recommendation:

CARB should streamline the process to establish a project baseline for reforestation projects. We recommend that CARB evaluate and consider creating a look-up table that provides baseline values by supersection and assessment area based on FIA data, like the IFM common practice table. Then a project proponent would have an option to use the look-up table or to use the existing process contained in the *Compliance Offset Protocol U.S. Forest Projects.*

C. Justification Statement (Why):

Current Regulation/Protocol:

Compliance Offset Protocol U.S. Forest Projects adopted June 25,2015

The Problem:

Currently, the qualitative description and estimate of the forest project's baseline onsite carbon stocks can be deferred until the submission of the Offset Project Data Report that will undergo the second site-visit verification. This is because, in most cases, it takes about a decade after tree planting for trees to grow large enough inventory. These inventory stocks are used as a starting point for baseline modeling.

This means that a reforestation project baseline will not be verified for a decade or more after the project start date. This creates significant risk to landowners because until a baseline is created and verified, it is difficult to estimate how many credits will be created by a project activity. Thus, project economics (return on investment) add to project uncertainty and this creates increased risk to landowners, especially smaller landowners. This has been a significant deterrent to more reforestation projects being undertaken through the Compliance Offset Protocol U.S. Forest Projects in spite of the need for and benefits of reforestation, especially after catastrophic wildfire.

By establishing a look-up baseline table for reforestation projects, project uncertainty is reduced, and landowners can list projects having a more reasonable estimate of a project's potential credit issuance and therefore return on the considerable combined investment of reforestation and offset project development.

D. Resources Used in the Development of the Recommendation:

Public Comment – July 10 ,2020 letter to the Compliance Offsets Protocol Task Force from the California Forest Carbon Coalition.

Public Comment – November 6, 2020 letter to the Compliance Offsets Protocol Task Force from RenewWest.

Compliance Offset Protocol U.S. Forest Projects adopted June 25,2015

E. How the Recommendation Addresses/Meets AB 32 Requirements and/or Would Further Support AB 398 or AB 293

This recommendation does not change AB 32 requirements. This recommendation supports attainment of AB 398 and AB 293 goals to expand participation by California landowners by simplifying project requirements and reducing cost, especially for small forestland owners.

Recommendation 17. Non-Federal Public Lands Baseline

A. Summary of Recommendation:

Simplify the method for estimating baseline onsite carbon stocks for an improved forest management project on lands owned or controlled by non-federal public agencies.

B. Detailed Description of Recommendation:

The *Compliance Offset Protocol U.S. Forest Projects* should be modified to simplify the method for estimating baseline onsite carbon stocks for an improved forest management project on lands owned or controlled by non-federal public agencies.

The following options should be considered by CARB.

A) Convene a workgroup to review the current barriers (real or perceived) to forest-owning non-federal public agencies' participation in improved forest management projects and make recommendations to modify the method used for estimating baseline onsite carbon stocks for this project type, and/or

CARB could:

1) establish criteria to guide growth-and-yield modeling simulations to satisfy the Section 5.2.2 "comparable forested area" requirements, such as:

- the simulation would utilize the most recent version of the Assessment Area attributes for Native Tree Species and Site Class available from the CARB U.S. Forest and Urban Forest Resources page[6]

- a 60-year growth simulation would be initiated from bare ground with regenerating native tree species composition based on the relevant Assessment Area(s) in which the project was located

- the 60-year growth trajectory would be influenced by the relevant site classes found in the project area; and

2) provide guidance on what attributes a modeled silvicultural management regime must meet in order to satisfy the "relatively free of harvest" requirement in Section 5.2.2. Proposed guidance could include:

- timber harvesting removals would never lead to a decrease in simulated carbon stocks across the project area in any 10-year period (per CARB FP Section 3.8.3) over a 60-year simulation horizon; and

- silvicultural treatments used in the model will be limited to salvage logging of dead and down material, removals of hazard trees, pre-commercial thinning, or

- the complete absence of any silvicultural activity (similar to areas managed as wilderness areas or for recreation purposes).

At the completion of this modeling, the Project Operator would have a start value with which to begin a 100-year baseline forecast.

3) in cases where a non-federal public entity acquired a private forest that had a history of management within the past 15 years, the start date should be the acquisition date and the baseline should be calculated the same as 5.2.1. Estimating Baseline Onsite Carbon Stocks – Private Land.

Alternatively, CAR Protocol 5.0, Section 6.1.3 Estimating Baseline Onsite Carbon Stocks – Public Lands could be used to establish a project baseline. The CAR approach to public lands baseline development is based on COLE (Carbon Online Estimator), which was built by National Council for Air and Stream Improvement (NCASI) in partnership with the Forest Service. COLE uses FIA plots and packages summaries in a standardized way. The baseline is developed for a public forest by determining carbon levels in the Project Area with the assumed condition that the entire forest is at a rotation age common for the forest community (by Assessment Area).

C. Justification Statement (Why):

[6] ARB Forest and Urban Forest Resource page: http://www.arb.ca.gov/cc/capandtrade/protocols/usforestprojects.htm

Current Regulation/Protocol:

The *Compliance Offset Protocol U.S. Forest Projects* adopted June 25, 2015, Section 5.2.2. details the method required for estimating baseline onsite carbon stocks for an improved forest management project on lands owned or controlled by non-federal public agencies.

The Problem:

There are no instances where a non-federal public agency has registered an improved forest management project under the *Compliance Offset Protocol U.S. Forest Projects.* However, there are instances where non-federal public agencies have registered improved forest management projects under voluntary methodologies.

Section 5.2.2 of the *Compliance Offset Protocol U.S. Forest Projects* requires future stock changes to carbon stocks within the project area by extrapolating from historic trends. These extrapolations are not feasible.

For project areas with declining stocks, the baseline must be defined by the average of the carbon stocks over the previous ten years; however, there is no guidance on how to determine past carbon stocks; for example when there is no previous inventory data.

For project areas with increasing stocks over the previous ten years, the baseline must be defined by modeling a growth trajectory of the baseline to achieve a stand composition that is consistent with a comparable forested area that has been relatively free of harvest over the past 60 years. It is often not feasible to obtain forest inventory data from a comparable forest within the same assessment area and it is not clear what is meant by “relatively free of harvest”. CARB has not provided clarification or guidance to this issue since initial stakeholder inquiries beginning in 2013.

Forestland owned by water districts, universities, cities, counties, open space districts, etc. will not be able to participate in the compliance offset market unless changes to non-federal public baseline requirements are adopted. Public forests that do not have conservation easements are potentially subject to local government/board action to be disposed, converted to others uses or placed into intensive forest use (selling timber rights for example). Thus, there needs to be a path to incentivize maintaining non-federal public forest as working forests with increasing carbon stocks. A key to this is revising the non-federal public lands baseline process.

D. Resources Used in the Development of the Recommendation:

Compliance Offset Protocol U.S. Forest Projects adopted June 25, 2015

CAR Presentation to the Forestry Subgroup, May 29, 2020

Conversations with project developers and carbon registries

E. How the Recommendation Addresses/Meets AB 32 Requirements and/or Would Further Support AB 398 or AB 293

This modification to an approved Protocol meets AB 32 requirements, as the intent of the law was not to exclude non-federal public lands from participating in the Cap-and-Trade Program. This change supports attainment of AB 398 and AB 293 goals to expand participation by landowners – in this case non-federal public agencies. Also, revenue generated by public agencies through the sale of the carbon offsets would benefit citizens served by these public agencies.

V. OTHER POTENTIAL PROPOSALS NOT RECOMMENDED

This section contains ideas identified and developed into proposals that were reviewed and discussed but where consensus was not reached by the subgroup, and therefore not recommended to the Task Force at this juncture in the process. This includes: 1) using a default baseline as an alternative baseline approach; 2) using a dynamic baseline as an alternative baseline approach; and 3) proposing a new offset protocol for the avoidance of wildfire emissions.

Non-Consensus Item 1. Default Baseline for Private Land IFM Projects

A. Summary of Recommendation:

Review and consider adopting an alternative default baseline approach that may be used by smaller private forestland owners.

B. Detailed Description of Recommendation:

Currently, Section 5.2 of the Compliance Offset Protocol U.S. Forest Projects includes a single method to model a final 100-year average baseline for onsite carbon stocks that is valid for the duration of the project life unless: 1) a correctable error of greater than 5 percent to the baseline or to quantified GHG reductions/removals is detected in a subsequent verification and/or 2) the project seeks a renewal for an additional crediting period. This process is often complicated, expensive, and requires specialized expertise to perform model runs to derive a 100-year average baseline that includes all legal, financial, and operational constraints.

CARB should review and consider adoption of an alternative baseline approach that uses default values to establish a project baseline for smaller forestland owners.

CARB should consider Climate Action Reserve's (CAR) Forest Project Protocol (version 5) that provides a default option to estimate baseline onsite carbon stocks for improved forest management projects on private land.

Section 6.1.1 of the CAR Forest Carbon Protocol provides the method to estimate the baseline using a standardized set of assumptions to project-specific conditions. A project must determine a start date inventory and consider how legal and financial constraints affect the baseline carbon stocks. Furthermore, performance standard criteria are applied to Improved Forest Management Projects based on Common Practice statistics. This conservative default approach eliminates the modeling effort required for baseline estimation.

The steps are:

1. Determine the start date inventories of aboveground standing live carbon stocks, belowground standing live carbon stocks, aboveground standing dead carbon stocks, and belowground standing dead carbon stocks for the Project Area.
2. Determine Common Practice for the Project Area. Determine the project's initial baseline, based on whether initial carbon stocks are above or below the Common Practice value.
3. Determine the applicable level of legal and financial constraints applicable to the Project Area based on the guidance below and adjust the initial baseline accordingly.
4. Determine the baseline harvest volume based on the guidance below.
5. Combine the results to produce the final baseline for all required carbon stocks.

C. Justification Statement (Why):

Current Regulation/Protocol:

Compliance Offset Protocol U.S. Forest Projects, adopted June 25, 2015

The Problem:

Currently, Section 5.2 of the Compliance Offset Protocol U.S. Forest Projects includes a single method to model a 100-year average baseline for onsite carbon stocks. This method requires specialized knowledge and skills to complete modeling runs to estimate the final baseline which incorporates all required onsite carbon pools. The modeling process is often complicated, expensive, and time consuming, adding to the overall cost and time to develop IFM projects. These requirements and expenses are deterrents to program participation by smaller private landowners.

Also, baseline modeling for IFM projects that start with carbon stocks above the common practice, in nearly all cases, have modeled to within 2.5% of common

practice for the project area (CAR, pers. comm.). Thus, using a default baseline value for smaller private landowners that is derived from common practice values would reduce costs while ensuring a similar outcome.

D. Resources Used in the Development of the Recommendation:

Climate Action Reserve – Forest Project Protocol Version 5.0. October 2019 *https://www.climateactionreserve.org/how/protocols/forest/*

CAR Presentation to the Forestry Subgroup, May 29, 2020

Compliance Offset Protocol U.S. Forest Projects, adopted June 25, 2015

E. How the Recommendation Addresses/Meets AB 32 Requirements and/or Would Further Support AB 398 or AB 293

This recommendation is not inconsistent with AB 32 requirements. This recommendation supports attainment of AB 398 and AB 293 goals to reduce barriers to entry of landowners in California. It also offers a more cost-effective and efficient way for small, non-industrial forestland owner to participate in forest projects.

Non-Consensus Item 2. Dynamic Baseline for Private Land IFM Projects

A. Summary of Recommendation:

Review and consider adopting an alternative dynamic baseline approach that may be used by project proponents that is responsive to exogenous factors (e.g. policy changes, timber markets, and climate change) over time that does not require hypotheticals (no growth and yield modeling or derivation of long-term averages).

B. Detailed Description of Recommendation:

Currently, Section 5.2 of the Compliance Offset Protocol U.S. Forest Projects includes a single method to model a final 100-year average baseline for onsite carbon stocks that is valid for the duration of the project life unless: 1) a correctable error of greater than 5 percent to the baseline or to quantified GHG reductions/removals is detected in a subsequent verification and/or 2) the project seeks a renewal for an additional crediting period. This process is often complicated, expensive, and requires specialized expertise to perform model runs to derive a 100-year average baseline that includes all legal, financial, and operational constraints.

CARB should review and consider adoption of an alternative dynamic baseline approach that uses a dynamic baseline which is responsive to exogenous factors (e.g. policy changes, timber markets, and climate change) over time.

The only dynamic baseline approach available is a new Improved Forest Management methodology under Verra developed by American Forest Foundation and The Nature Conservancy to support its Family Forest Carbon Program – *Methodology for Improved Forest Management*.

The methodology is applicable to a wide range of improved forest management (IFM) practices and employs standardized approaches for demonstration of additionality and derivation of project baselines to simplify the application of the methodology.

The focus of accounting is on estimation of GHG emissions and/or carbon stock change on permanent plots, not on estimation of stocks *per se*, therefore improving the precision of reported GHG emission reductions and/or removals. Thus, no hypotheticals based on growth and yield modeling or derivation of long-term averages are required.

This methodology utilizes a baseline that is responsive to exogenous factors (e.g. policy changes, timber markets, and climate change) over time. This is because the baseline is composed of a composite control - which is a collection of FIA plots representing the baseline scenario, located outside of the project area. A composite control is paired to each sample plot used to monitor the project scenario and monitored over time to establish a dynamic performance benchmark for additionality and crediting baselines. Each composite control is derived as the optimally weighted combination of plots that matches the initial conditions of its paired project sample plot.

Matching is achieved by deriving weights for constituent plots in the composite control to produce a weighted combination that conforms to the initial conditions of the paired treatment plot. Matching conditions are defined referencing one or more covariates representing biophysical and anthropogenic factors driving stock change.

The process for selection and matching FIA plots is as follows:

- Identify the nearest 100+ FIA plots to the treatment plot/stand
- Constrain FIA plot selection to be in the same ecological section, within the same forest type group, of the same land ownership class (public, private), with uniform (one) condition code, and not located within a registered carbon project (if this can be determined)
- Derive a weight for each plot to produce a collective match in terms of the following initial (< 10 years from start date) conditions:
    - Stand age
    - Site productivity
    - Regeneration stocking (1-4.9” dbh)
    - Commercial stocking (≥ 5” dbh)

    - Elevation
- To ensure match quality, for each initial condition, the composite control value must deviate by less than 10% for the paired treatment and the composite control must not be dominated by a small number of heavily weighted plots

FIA plot selection and weights are fixed for the duration of a crediting period. At each verification, FIA re-measurement data is retrieved, and weighted total stock change reported as baseline.

C. Justification Statement (Why):

Current Regulation/Protocol:

Compliance Offset Protocol U.S. Forest Projects, adopted June 25, 2015

The Problem:

Currently, Section 5.2 of the Compliance Offset Protocol U.S. Forest Projects includes a single method to model a final 100-year average baseline for onsite carbon stocks. This method requires specialized knowledge and skills to complete modeling runs to estimate the final baseline which incorporates all required onsite carbon pools. The modeling process is often complicated, expensive, and time consuming, adding to the overall cost and time to develop IFM projects. These requirements and expenses are deterrents to program participation by smaller private landowners.

Finally, the current baseline estimate is fixed for the initial crediting period (25 years), rather than being responsive to exogenous factors (e.g. policy changes, timber markets, and climate change) over time. Forest systems are not static and using a static baseline does not reflect changing dynamics in a baseline that is being compared to dynamic project scenario. Thus, IFM project crediting is not reflective of changing forest carbon stocks between the baseline and the project scenario during a crediting period.

D. Resources Used in the Development of the Recommendation:

Verra – Verified Carbon Standard – Methodology for Improved Forest Management
https://verra.org/methodology/methodology-for-improved-forest-management/

Ferraro, P.J. and Hanauer, M.M., 2014. *Advances in measuring the environmental and social impacts of environmental programs*. Annual review of environment and resources, 39, pp.495-517.

E. How the Recommendation Addresses/Meets AB 32 Requirements and/or Would Further Support AB 398 or AB 293

This recommendation is not inconsistent with AB 32 requirements. This recommendation supports attainment of AB 398 and AB 293 goals to reduce barriers to entry of landowners in California. It also offers a more cost-effective and efficient way for small, non-industrial forestland owner to participate in forest projects.

Non-Consensus Item 3. New Protocol Type: Avoided Wildfire

The avoided wildfire emissions protocol would provide significant DEBS through reducing wildfire size and severity and beneficial use of excess biomass -- much beyond those of the existing protocol which strongly disincentivizes fuels reductions to restore long term resiliency to natural disturbances. There is a noticeable absence of existing forest carbon projects in the Sierra Nevada and many other forested regions of California that are at significant risk for catastrophic wildfire and where fuels reduction is critically needed, and funds and resources are significantly lacking. The avoided wildfire protocol was not supported by some subgroup members for reasons including: fuels reductions do not provide carbon benefits; fuels reductions are better funded through other means including cap and trade auction revenues; immediate and short term carbon loss of fuels treatments; incentivizing cutting trees or prescribed burning; and/or issuance of credits “ex-ante” prior to their accrual.

Avoided Wildfire Protocol

A. Role of project type in climate change mitigation

Identify the greenhouse gases (GHG) that are released during business-as-usual (baseline) activities that the project is designed to reduce. Include a description of the activities that release GHGs (e.g., methane from coal mining), and what is currently happening with these GHGs (e.g., released to the atmosphere).

Wildfires emit significant quantities of carbon dioxide, methane, carbon monoxide, and non-methane volatile organics, and are consistently the largest source of black carbon emissions in the state.

Uncharacteristically large and high-severity wildfires (“megafires”) kill trees which prevents carbon sequestration and their subsequent decay and rot and produce carbon dioxide and methane and other volatile organics. Megafires also convert forest to long-term grassland and shrubland, severely limiting capacity for carbon sequestration.

B. Development of project type

Describe the resources used to develop the project type (e.g., review of existing voluntary market offset protocols, stakeholder input or data, peer reviewed literature).

Forest fuel thinning (also referred to as a fuel “treatment” or fuel “reduction”) -- including prescribed burning or mechanical thinning activities -- changes fire behavior and

reduces wildfire emissions in treated as well as adjacent untreated forest stands. A fuel treatment project GHG off-set protocol has been developed over the past 10 years – with technical work conducted and led by Spatial Informatics Group (and support from UC Berkeley, University of San Francisco, and TSS Consultants), and funding from the US Forest Service, CAL FIRE, Sacramento Municipal Utility District, Sierra Pacific Industries, and Placer County Air Pollution Control District. The protocol has been vetted by a wide range of stakeholders, including forest scientists, regulatory agencies, conservation groups, offset registries, and land managers.

The protocol incorporates the latest science in forest growth and wildfire dynamics, and it combines field data with probability-based wildfire models. The protocol has been used to demonstrate GHG benefits in a case-study evaluation of simulated fuel treatments in the Eldorado National Forest

The protocol is a more comprehensive version of the Quantification Methodology that is an approved part of CARB's GHG GGRF Program.

In October 2018, the protocol (and case-study) were submitted to the American Carbon Registry for consideration to be adopted as a "voluntary" protocol. An anonymous peer review panel conducted numerous reviews. In October 2019, a decision was made by ACR to not move forward with the protocol due to: (1) issuance of GHG credits prior to achieving emission reductions; (2) temporary increase in GHG emissions above the no-project baseline; (3) high GHG risk due to very large treatment project land size; and (4) use of models that require site-specific inputs and those that reply on uncertain and probabilistic wildfire ignition and wildfire behavior.

In November 2019, the protocol was submitted for adoption into the Climate Action Reserve's Climate Forward GHG Registry and Trading program. They are interested, and protocol proponents are determining funding requirements and a review/adoption schedule.

C. Description of project type

Describe the project type: information such as how the project provides GHG emissions reductions or provides GHG removal enhancements from applicable sources, sinks, or reservoirs.

The forest fuel treatment project type is enhanced forest management and restoration of forests that are unnaturally overstocked and dense with high fuel loads (including surface fuels and small diameter trees) resulting from fire suppression, drought, insect attack, or past harvesting history, and are at high risk for megafires. The project is selective mechanical thinning and fuels reduction and use of by-product materials for wood products and bioenergy; and/or use of prescribed fire.

Fuel treatments are comprehensively demonstrated to modify wildfire behavior, particularly reducing their severity and size (wildfire "treatment shadow effect") -- for

example, see Tubbesing et al. 2018, Liang et al., 2018, Moghaddas et al. 2010, Stephens et al. 2012, and 2009, and Safford et al. 2009.

Fuels treatments can provide GHG benefits where wildfire threat is significant and the probability of future interaction between wildfire and treatments is likely – for example, see Liang et al. 2017, Krofcheck et al. 2018, Winford and Gauthier 2012, North and Hurteau 2011, Hurteau and North 2009, and Hurteau et al. 2008.

GHG benefits are gained through:

- Reducing wildfire emissions and increase in stored carbon on the project area over time, particularly in larger, more fire-resistant trees. This results from reducing individual wildfire size and severity on both the directly treated areas as well as untreated areas through fuel limitation. Treating even a small portion of the landscape can result in a decrease in probability of areas outside those treated areas being burned severely, referred to as the “treatment shadow effect”.
- The thinned forest grows at an enhanced rate compared with the untreated stagnant forest due to a reduction in competition for water, nutrients, and light.
- Preservation of forest. High intensity fires in forests, particularly uncharacteristically severe active and passive crown fires, can cause high levels of tree mortality and soil impacts that result in delayed reforestation and at least a temporary vegetation type change from forest to grassland or shrub types lasting from several decades to permanent change. Fuel treatments can reduce the amount of forest that is redirected compared to the baseline, through moderating fire size and severity. This protocol provides a methodology to quantify delayed reforestation related GHG emissions.
- Wood products and renewable energy. Utilization of fuel treatment byproducts as long-lived wood products that sequester carbon and displace fossil fuel intensive alternatives to wood products, such as concrete and steel; and renewable energy production that displaces fossil fuel energy alternatives.
- Fossil fuel emissions required for harvesting and processing of wood requires accounting for fossil fuel emissions associated with harvest and processing of wood products.

The methodology calculates GHG emissions using coupled vegetation and wildfire models for probabilistic wildfire occurrences over the project term timeframe for both the baseline and fuel treatment project scenarios. It includes the following components:

1. Project area. Define the geographic boundary of the project. Quantify the forest condition -including tree stands, tree list, species, height, and diameter, and surface fuels - in the project area existing at the start of the project through site characterization measurements.

2. Management scenario development. Define the details of the fuel treatment - including fuel reduction harvesting levels, procedures, location, timing, and fate of residuals.
3. Forest carbon. Project the growth of the forested land over the project term at five year intervals using a vegetation model (such as Forest Vegetation Simulator).
4. Forest removals life cycle assessment. Determine sequestration in wood products and avoided/displaced fossil fuels from wood products and bioenergy.
5. Fire ignition probability. Determine the project area's expected fire return interval. Use the fire return interval to determine statistical fire probability over the project term.
6. Weather data. Define weather conditions under which to simulate fire over the project term.
7. Wildfire emissions. Determine emissions from wildfire that burns the entire project area, at five-year intervals over the project term, using inventory and growth data, and a wildfire model (such as First Order Fire Effects Model) and conduct a Monte Carlo random wildfire simulation to determine fire size reduction (using a model such as FLAMMAP). Amortize the emissions by the statistical fire probability.
8. Delayed reforestation. Quantify the area and emissions associated with project land over the project term converted from forestland to grass or shrubland following high severity fire.
9. Aggregated emissions accounting. Determine the difference between the baseline and project scenario GHG emissions, for each five-year interval period over the project term.

These assessment steps prior to conduct of the fuel treatment are followed by two post-implementation steps:

10. Fuel treatment project measurements. Over the project term, measure and document all applicable operational parameters, including fossil fuel engine usage, tree and brush removal rates, wood products generation, bioenergy 3, prescribed fire, and open pile burning. Use these to refine/adjust the aggregate emissions.
11. Project site inventory. At ten-year intervals, perform site measurements to characterize on-the-ground carbon. Use these to refine/adjust the aggregate emissions.

D. AB 32 criteria

Describe how the project type meets the Global Warming Solutions Act of 2006, Assembly Bill 32 (AB 32) criteria: real, additional, quantifiable, permanent, verifiable, and enforceable (section 95802 of the Cap-and-Trade Regulation provides a definition for each criteria). If it does not meet all AB 32 criteria, describe why, what are the information/data gaps, and what is needed to meet regulatory requirements. Include discussions to support the AB 32 criteria, such as a review of the best available science for quantification, and analysis of quantification risk and uncertainty.

a. *Real*
b. *Additional*
c. *Quantifiable*
d. *Permanent*
e. *Verifiable*
f. *Enforceable*

Real: Fuel treatments provide direct GHG benefits through modifying wildfire behavior, forest growth, and wood products and bioenergy that sequesters carbon and displaces fossil fuel. These are accounted for through field measurements and documentation. On-the-ground measurement confirmation and verification of models is used to ensure benefits are accurate and conservative and contains uncertainty bounds. There is initially a carbon deficit due to the fuel reduction. However, over time carbon stocks are stabilized, and carbon benefits will accumulate and become positive. Credits will be issued after the initial fuel treatment project has been implemented, but “ex ante” prior to the carbon benefit accruing. There is no chance for leakage – in fact, fuel treatments will reduce leakage as they will produce increased amount of wood products and bioenergy compared with the baseline.

Additional: There are no regulatory requirements to conduct fuels treatments. The site-specific cost to conduct the fuel treatment must be shown to be greater than any potential revenues for biomass by-products.

Quantifiable: The protocol uses well-established data and model inputs including on-the-ground tree lists, topography, climate/weather, and fire return interval. Uncertainties are quantified, and inputs are conservative to ensure carbon benefits are realized.

Permanent: Fuel treatments typically have a longevity of around 15 years. During these years the treatments provide an effective measure to change fire behavior and reduce wildfire emissions. Follow-up treatments are required to maintain desirable stand structure. These follow up treatments frequently are associated with a significant reduction in treatment costs since the desirable stand characteristics are already established following the first treatment (removal of unmerchantable small diameter trees). Under such a forest management, the benefits will become permanent and in fact grow exponentially compared to a business-as-usual baseline (no or very limited fuel treatments) for decades into the future.

Verifiable: Fuel treatments are readily confirmed through on-the-ground monitoring that is easy to document and highly transparent.

Enforceable: Fuel treatments are directly enforceable through contract agreements.

E. Direct environmental benefits in the State (DEBS)

Describe how the project type could provide direct environmental benefits in the State. Specifically, describe whether the project type provides for the reduction or avoidance of emissions of any air pollutant that would not be credited pursuant to the protocol in the State or a reduction or avoidance of any pollutant that is not credited pursuant to the protocol that could have an adverse impact on waters of the State.

Fuel treatments provide very significant California DEBS through directly reducing wildfire severity and size. Wildfires are well established to be a very large (likely largest) source of air pollutant emissions in rural California, and more recently have severely impacted suburban and urban areas. Fuel treatments also provide incredibly valuable benefits to water quantity and quality and timing through reducing the impact of erosion and water forest uptake.

F. Disadvantaged communities, Native American or tribal lands, and rural and agricultural regions

Describe how project type prioritizes disadvantaged communities, Native American or tribal lands, and rural and agricultural regions; further discussion of environmental justice issues can be included here.

Fuels treatments are most needed and appropriate in heavy forested regions which are in rural disadvantaged lands.

G. Cost barriers

Describe the cost barriers for participants, including smaller participants, and recommendations for reducing these barriers.

Fuel treatments can cost $400-$2,000 per acre. Low per-acre costs are driven by a larger fraction of merchantable timber being harvested and partially offsetting costs or the application of prescribed burns without mechanical treatments while the upper cost limit can be reached on challenging topography (accessibility, slopes, etc.) and the absence of harvestable trees of merchantable dimensions.

H. Market/demand implications

Describe the potential U.S. and California offset supply, and the number of potential projects. A discussion of barriers to participation, other than cost could be included.

In California alone, almost 20 million acres of California forest land are at extreme risk for catastrophic wildfire and will benefit from fuels treatments. This is the result of decades of fire suppression, timber management, grazing policy, and climate change.

The Forest Carbon Plan estimates for California that approximately ten million acres of federal lands and five million acres of private and other public lands ranked as high priority for reducing wildfire threats to maintain ecological health. Much of the at-risk forest land is Sierra Nevada conifers where less than 20% of the critically needed fuel treatments are getting accomplished. There is a need to increase fuel treatment acreage considerably from the current baseline business as usual of around 130,000 acres/year. Conservatively, we would assume that the 15 million acres would change wildfire behavior on a minimum of 45 million acres (i.e. one third of a fireshed being treated and accounting for the wildfire shadow effect). If the goal would be to treat 15 million acres within the next ten years and each acre would provide emission reductions of only two tCO2 on average across the 45 million acres directly or indirectly affected by treatments, the California market alone would consist of at least 45 million acres * 2 tCO2e/acre = 90 million tCO2e of emission savings.

I. Joint development of projects

Describe how groups of project owners could jointly develop projects. The discussion should address how to lower project transaction costs for participants and enable a greater number of project owners to participate while protecting program integrity and transparency.

The protocol will directly allow for forest landowners to cooperate on a joint project submission.

J. Leakage

Describe potential leakage associated with the project type and how it will be quantified and conservatively accounted for.

Leakage effects through activity shifting or market effects will not occur and are not considered in the protocol because the fuel treatment project activity will include greater harvesting and production of forest products than the baseline, based on application of the conservativeness principle.

K. Perverse incentives

Describe potential perverse actions the project type may incentivize and their probability of occurring. A discussion of solution for any high likelihood perverse incentives should be included.

Cutting down trees solely for the monetary value through selling as merchantable (lumber or other timber products) or non-merchantable (bioenergy) products is prevented through requiring detailed economic evaluation of monetary value of thinning byproducts. This is also restricted by the requirement to comply with all applicable California forest practice laws.

L. Jobs

Describe the project type's effect on job creation.

Forest fuel treatment projects require support of rural contractor jobs for planning and implementing projects – including labor for tree/brush removal, biomass hauling, and lumber manufacturing, and bioenergy operations.

M. Environmental Impacts

Describe potential environmental impacts of the project type. Using Section III of the linked Mine Methane Capture document (above) as an example, provide as much detail as possible on the Regulatory Settings, Beneficial Impacts, and Resource Area Impacts, including any potential Mitigation Measures.

A multitude of co-benefits exist when fuels treatments transition forests back into a resilience where megafires are avoided and low-severity fires with patches of high-severity wildfire activity can be observed. Fuel treatments reducing surface fuel or restoration treatments with a focus on structural stand change also reduce water stress or susceptibility to beetle infestations.

Incredibly valuable eco-system service benefits from fuels treatments include: improved hydrological features (e.g. water quantity, quality and discharge); soil conservation; air quality (respiratory concerns, reduced public health impact of mega-wildfires); reduced damage to built infrastructure; reduced fire suppression costs, reduced damage to built infrastructure including hydro-electricity infrastructure (reduced debris as well as siltation of streams and dams); protection of recreational forested lands; protection of ecological ecosystems and wildlife habitat; and reduced merchantable tree loss due to drought and insect infestations (reduced stand density improves individual tree health).

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Stephens SL, JJ Moghaddas, BR Hartsough, EE Moghaddas, NE Clinton (2009) Fuel treatment effects on stand-level carbon pools, treatment-related emissions, and fire risk in a Sierra Nevada mixed-conifer forest. Can. J. For. Res. 39, 1538–1547. https://doi.org/10.1139/X09-081

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VI. REFERENCES

A list of resources is included within each recommendation in Sections IV and V of this report.

VII. CHAPTER APPENDICES

Chapter appendices are included in the Appendix section of this report.

Chapter 4: Analysis and Recommendations on Livestock, Agriculture, and Rangeland

I. EXECUTIVE SUMMARY

The Livestock, Agriculture, and Rangeland Subgroup of the Compliance Offsets Protocol Task Force (Task Force) met seventeen (17) times between April 1 and September 24, 2020, to evaluate and recommend strategies for incentivizing climate friendly agricultural practices with California regulatory offset protocols. While members of the Subgroup brought with them vital knowledge and experience related to the tasks at hand, the group also spent a significant amount of time seeking additional information to support the analysis and recommendations in this report. This analytical process included interviews with experts within the global carbon market community; soil, range and animal scientists from the University of California, Davis; animal nutrition companies and other experts in the dairy and cattle industries; as well as a review of the scientific literature. The Subgroup is grateful to all who provided time and expertise to inform our findings.

An important threshold question for the Subgroup was, what constitutes "agricultural lands"? Though explained in more detail below, the Subgroup decided to evaluate practices and protocols that are appropriate for use on agricultural lands within the State of California. While we focused on practices and protocols that would be useful in California, we recognize that creation of a regulatory protocol could also encourage use of these practices outside California. We defined those lands as areas where domestic ruminants graze, where irrigated and cultivated crops are grown, and confined livestock operations, including those that manage lands to grow forage crops for their animals. Importantly, although forests are sometimes included in the definition of agricultural lands, this Subgroup did not include forests in its analysis because another Task Force Subgroup was formed to analyze those opportunities. The only land use change practice we considered was the avoided conversion of grazing land to croplands.

The Subgroup included lands associated with agricultural lands in its evaluations, such as the creeks running in between fields, the edges of fields, and non-productive lands in the same parcels that are also managed by the producer. These areas of agricultural lands provide significant environmental benefit that should not be ignored in the agricultural context and the development of offset protocols.

In all, our Subgroup identified seven (7) agricultural practices which we expect that increased adoption would generally benefit the climate. These were:

1. Addition of compost to grazed grasslands
2. **Avoided conversion of grasslands**
3. **Feed additives to reduce enteric emissions of methane from cattle**
4. Subsurface drip irrigation with delivery of nutrients
5. **Diversion of manure storage from anaerobic systems ("alternative manure management")**
6. Limited or no-till agriculture
7. Use of cover crops

While all the above practices show significant promise to deliver climate benefits, the Subgroup recommends that the three bolded above (avoided conversion of grasslands, feed additives to reduce enteric emissions of methane from cattle, and diversion of manure storage from anaerobic systems) be prioritized for development of regulatory protocols in the near term. There were three chief findings that supported these conclusions. First, the scientific basis for quantification of emissions reductions or permanent carbon sequestration is strong in all three (3) cases. Second, the Subgroup concluded that creation of a regulatory offset protocol would create an economic signal strong enough to speed up adoption of the practice. Third, there is an existing voluntary offset protocol which could be used as the basis for a regulatory protocol.

For the remaining practices, the Subgroup identified existing barriers that should be overcome before effort is invested in developing a regulatory protocol. For example, although the Subgroup identified significant potential climate benefits for addition of compost to grazed grasslands, the cost of implementing this practice is much higher than the climate or other benefits realized. Without identifying ways to reduce costs further, or identifying other benefits, it does not appear that a regulatory offset program would drive adoption of this practice. In a similar fashion, the Subgroup found that the other practices examined still hold promise for producing climate and other benefits, but unfortunately – due to economic barriers or lack of detailed scientific basis to aid in quantification of climate benefits in specific situations – do not yet appear to justify investment in developing a regulatory offsets protocol.

II. INTRODUCTION AND BACKGROUND ON TASK FORCE SUBGROUP

The purpose of the Livestock, Agriculture, and Rangeland Subgroup was to identify potential greenhouse gas (GHG) protocols, CARB protocol updates and additional research that generate climate benefits from the livestock, agriculture, and rangeland sectors. The subgroup reviewed scientific research, stakeholder and industry reports, and conducted interviews with a diverse group of experts and stakeholders. Through these meetings and research, the subgroup identified specific practices and associated protocols that have the potential to generate reductions in carbon dioxide (CO_2), nitrous oxide (N_2O), and methane (CH_4) as well as practices that maintain or increase the sequestration of carbon in soils. A complete list of the reports and research reviewed by subgroup members can be found in the Bibliography.

The Subgroup met seventeen (17) times between April 1 and September 24, 2020. The agenda for these meetings included internal deliberations and presentations from the following organizations:

- American Carbon Registry (ACR)
- Climate Action Reserve (Reserve)
- Dairy Management, Inc. (DMI)
- DSM
- Gold Standard

- University of California, Davis (UC Davis)
- Verra

The carbon offset registries provided recommendations on what protocols the Subgroup should evaluate and consider recommending to CARB for adoption into California's Cap-and-Trade program. A list of those protocols is presented in Table 7. The registries also provided recommendations about how to improve existing regulatory protocols and identified additional research that should be pursued to develop future offset protocols.

Table 7 - Existing Voluntary Protocols Recommended by Stakeholder Interviews

Protocol Category	Organization who developed the Protocol
Agricultural Land Management	Verra
Avoided Grassland Conversion	Reserve and ACR
Compost Addition to Grazed Grasslands	ACR
Enteric Fermentation	Gold Standard and Verra
Nitrogen Management	Reserve
Soil Enrichment	Reserve and Verra

The scientists from UC Davis provided information on the latest research about practices that have and could reduce GHG emissions, or increase carbon sequestration in agriculture. Their recommendations have been incorporated into this report.

The Subgroup reviewed the recommendations from the external stakeholders, conducted independent research, deliberated on the recommendations and prepared the present report for consideration by the full Task Force, CARB, and the public.

III. SETTING: CALIFORNIA'S LIVESTOCK, AGRICULTURAL LANDS AND RANGELANDS

There are 69,400 farms and ranches in California which total 24.3 million acres.[7] Removing woodlands from this total brings the total land managed as farms and ranches to 22.7 million acres.[8] The average farm size in the state is 350 acres, slightly smaller than the national average of 443 acres. These 69,400 farms and ranches grow more than 400 different agricultural commodities.[9] California farmers and ranchers

[7] California Department of Food and Agriculture. California Agricultural Production Statistics (2019a). [accessed 2020 September 18] https://www.cdfa.ca.gov/statistics/
[8] United States Department of Agriculture. Census of Agriculture, California State and County Data, Volume 1, Part 5, Table 8 (2017). [accessed 2020 September 18] https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_1_State_Level/California/cav1.pdf
[9] California Department of Food and Agriculture (2019a). op. cit.

received more than $50 billion in 2018 for their diverse commodity output; making California the leading state in cash farm receipts and representing more than 13% of the U.S. total.[10] The top ten commodities for 2018 are found in Table 8.

California agricultural lands are dominated by cropland at 39 percent (9.60 million acres), permanent pasture and rangeland at 47 percent (11.6 million acres)[11], and dairy cattle and milk production at 3.5 percent (0.848 million acres).[12] Approximately 32 percent (7.86 million acres) of California crops are irrigated.[13]

Table 8 - Top 10 California Commodities for 2018[14]

Commodity	2018 Value ($1,000)
Milk and Cream	6,372,437
Grapes	6,254,211
Almonds (shelled)	5,468,040
Miscellaneous Crops[15]	4,725,764
Cattle & Calves	3,189,177
Pistachios	2,615,550
Berries, All Strawberries	2,340,315
Lettuce, All	1,814,809
Floriculture	1,215,997
Tomatoes, All	1,197,642

Leading researchers across California and the nation have identified many agricultural practices that reduce greenhouse gases (GHGs) such as CO_2, N_2O, CH_4 and sequester soil carbon. Based on interviews with scientists at UC Davis and carbon offset registries, the Subgroup identified three practices for potential inclusion in carbon offset protocols to be adopted by CARB:

- Avoided conversion of grasslands
- Feed additives to reduce enteric emissions of methane from cattle
- Diversion of manure storage from anaerobic systems ("alternative manure management").

The opportunity to increase carbon sequestration that is included in voluntary carbon offset protocols is currently limited to the addition of compost to grazed grasslands.

[10] California Department of Food and Agriculture. Agricultural Production Statistics Review 2018-2019, 4 (2019b). [accessed 2020 September 18] https://www.cdfa.ca.gov/statistics/PDFs/2018-2019AgReportnass.pdf
[11] United States Department of Agriculture. op. cit. Table 8.
[12] Ibid., Table 48.
[13] Ibid., Table 9.
[14] California Department of Food and Agriculture (2019a). op. cit. 4.
[15] Includes nursery/greenhouse crops (excluding Floriculture), Christmas trees, seed crops, and miscellaneous field, vegetable, berry, tree fruit, and nut crops.

There are other practices, such as planting of trees and shrubs on field borders or as windbreaks,[16] that could generate net GHG benefits if included in future protocols. Avoiding the conversion of grasslands to croplands preserves carbon in the soil and almost 200,000 tons of offset credits have been generated through the end of August 2020. The majority of croplands across California and the nation use some form of fertilizer to produce the food we eat. With a global warming potential 265 times that of CO_2,[17] a small reduction in N_2O emissions has significant global warming benefit. Finally, ruminant animals, primarily cattle, are responsible for 55 percent of the CH_4 emissions in the state.[18] The CH_4 generated from cows has its impact in the twelve years after release to the atmosphere.[19] These opportunities are discussed in more detail in the following sections.

IV. OVERVIEW OF PRACTICE/PROJECT EVALUATION

The Subgroup focused its efforts on identifying GHG mitigation and carbon sequestration practices that can be implemented within California's agricultural landscape as described above (livestock operations, intensively cultivated/irrigated agriculture and non-forested rangelands/grasslands), evaluating practices that are not currently incentivized by California's adopted regulatory carbon offset protocols.

Only two CARB-adopted regulatory protocols apply to the California agricultural setting described here:

- "Compliance Offset Protocol: Livestock Projects: Capturing and Destroying Methane from Manure Management Systems" (adopted 2011 and revised 2014) and
- "Compliance Offset Protocol: Rice Cultivation Projects" (adopted 2015).

The above protocols[20] focus on a) the use of anaerobic digesters to capture and destroy methane from livestock waste, and b) the use of various planting and irrigation water management techniques to reduce methane emissions from rice fields. Because they

[16] Carbon Cycle Institute, DRAFT Carbon Farm Plan — ABC Ranch (March 10, 2015 draft). [accessed 2020 December 29] https://www.carboncycle.org/carbon-farming/draft-carbon-farm-plan/
[17] Myhre, G., D. Shindell, F.-M. Bréon, W. Collins, J. Fuglestvedt, J. Huang, D. Koch, J.-F. Lamarque, D. Lee, B. Mendoza, T. Nakajima, A. Robock, G. Stephens, T. Takemura and H. Zhang, Anthropogenic and Natural Radiative Forcing. In: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. (2013)
[18] California Air Resources Board, GHG Short-Lived Climate Pollutant Inventory. [accessed 2020 September 18] https://ww2.arb.ca.gov/ghg-slcp-inventory
[19] Mitloehner, F., Kebreab, E., Boccadoro, M. Methane, Cows, and Climate Change: California Dairy's Path to Climate Neutrality. UC Davis Clear Center (September 2, 2020) [access 29 December 2020] https://clear.ucdavis.edu/sites/g/files/dgvnsk7876/files/inline-files/CLEAR-Center-Methane-Cows-Climate-Change-Sep-2-20_6.pdf
[20] California Air Resources Board, Compliance Offset Program website. [accessed 2020 September 18] https://ww2.arb.ca.gov/our-work/programs/compliance-offset-program

were already incentivized via an adopted regulatory offset protocol, these practices were not considered by the present Subgroup. However, we did consider updates and modifications to the protocols.

Through the experience of Subgroup members, along with review of published research or voluntary offset protocols, and interviews with academic and carbon offset registry experts, the Subgroup identified and evaluated practices for their potential to generate offsets and create Direct Environmental Benefits (DEBS). The evaluation was not limited to practices in California, but to practices that would provide benefits to California producers while at the same time providing benefits to producers outside of California.

The Subgroup identified and evaluated seven specific types or groups of GHG mitigation/carbon sequestration practices, currently not incentivized by regulatory carbon offset protocols, that have the potential to become part of "new Compliance Offset Protocols for the Cap-and-Trade Program to generate compliance offset credits available for compliance use from 2021 through 2030, and specifically, protocols that have direct environmental benefits in California"[21]:

1. Addition of compost to grazed grasslands
2. **Avoided conversion of grasslands**
3. **Feed additives to reduce enteric emissions of methane from cattle**
4. Subsurface drip irrigation with delivery of nutrients
5. **Diversion of manure storage from anaerobic systems ("alternative manure management")**
6. Limited or no-till agriculture
7. Use of cover crops

Other practices may generate net GHG benefits, but the Subgroup identified the above seven practices as those that have the largest potential to generate net GHG benefits for agricultural producers in California and across the country. Other approaches, such as the use of biochar or combining multiple practices into a single, comprehensive protocol, have been considered and are being piloted by proponents. However, the practices considered are those where there is current or emerging research to support net GHG benefits and have largest potential GHG opportunity. The practices the Subgroup recommends have protocols that have been or could be modified and adopted by CARB as compliance offset protocols. If other practices and their associated protocols can demonstrate that they provide net GHG benefits that meet the AB 32 requirements under California cropping conditions, they should be considered in the future for regulatory protocols.

[21] California Air Resources Board. Compliance Offset Task Force website. [accessed 2020 September 18] https://ww2.arb.ca.gov/our-work/programs/compliance-offset-program/compliance-offset-protocol-task-force

Section V of this report focuses on the first five[22] of the above practices individually, providing a detailed description of how these practices provide climate benefits and describing the scientific basis for such assumptions. Each section:

- Describes the practice and its supporting scientific basis.
- Examines the costs associated with implementing the practice and describes existing barriers to adoption, along with potential solutions to those barriers.
- Estimates, where possible, the overall climate benefits that may be available when implementing the practice in California agricultural lands with and without current economics considered, and whether offsets could overcome economic barriers.
- Following this, we discuss whether the practice could be implemented through a regulatory offset program while meeting the following AB 32 criteria for climate benefits:
    - Real
    - Additional (regulatory surplus, common practice and implementation barriers)
    - Quantifiable
    - Permanent
    - Verifiable
    - Enforceable
- Finally, we recommend steps for CARB to take for each of the five (5) practices. This includes the examination of whether the existing voluntary protocols, with adaptions, provide an adequate basis for a regulatory protocol to support generating offset credits for the practice.

With respect to the AB 32 criteria for offset protocol enforceability, none of the protocols evaluated met the Cap-and-Trade requirements for "ARB to hold a particular party liable and to take appropriate action if any of the provisions of this article are violated."[23] Therefore, the adoption of any of the protocols in this report would need to be updated to include criteria to enforce regulatory compliance associated with the protocol.

At an average size of 350 acres per farm, the development of many agriculture carbon projects is cost prohibitive. Therefore, joint project development for agricultural producers is critical to their adoption. The current regulations allow for an Offset Project

[22] For reduced or limited tillage and cover crops, while there is evidence that these practices may have a role in increasing or preserving carbon stocks, the Subgroup did not perform a detailed analysis for several reasons. This includes a high amount of variability in how these practices are implemented, lack of research supporting quantification of long-term benefits in irrigated agriculture in California, and general concerns about enforceability and permanence. The Subgroup instead recommends that research be conducted to better specify practices and quantify long-term benefits in a California agriculture setting.

[23] California Code of Regulations, Title 17 Public Health, Chapter 1. Air Resources Board, Subchapter 10. Climate Change, Article 5. California Cap on Greenhouse Emissions and Market Based Compliance Mechanisms to Allow for the Use of Compliance Instruments Issued by Linked Jurisdictions § § 95802. Definitions (2014)

Operator to designate an Authorized Project Designee, who is responsible for performing all activities to meet the requirements to create a project. While this is a helpful approach, it still requires every project to separately list and verify their project. This does not provide substantial cost savings for projects. The rationale for this approach is to avoid the invalidation of all producers and fields if one field in the project is investigated and results in the invalidation of some or all of their credits. We recommend that CARB allow for full joint development of projects including the development of a single Offset Project Data Report, Verification, and Offset Verification Statement for the project. Through this approach, agricultural producers would need to accept the risk of full project invalidation as a trade-off to lowering transaction costs. This would encourage the development of additional projects by the agriculture community through reducing the redundant development of Offset Project Data Report, Verification, and Offset Verification Statement for each participant in the project.

Two of the registries, ACR and the Reserve, have developed standards that CARB could use for guidance. According to Chapter 10 of ACR's Validation and Verification Standard, "Aggregation — the pooling of activities at more than one project site into a single GHG project — is an important mechanism to make it feasible for smaller project participants to participate in carbon markets. Aggregation may provide transaction cost efficiencies for initial inventory, monitoring, and verification, and may also diversify risk."[24]

Two of the Reserve's protocols, the Grassland Project Protocol and Nitrogen Management Project Protocol, include an option for a "Cooperative Developer" – an entity that manages reporting and verification for two or more individual grassland projects that report and verify jointly. The Grassland Project Protocol states that "A cooperative may consist of grassland projects involving multiple Project Owners."[25] The Cooperative Developer performs two critical functions: 1) they coordinate the submittal, monitoring, and reporting activities required by the protocol for all projects in the cooperative and 2) they coordinate the verification for all grassland projects enrolled in the cooperative.

The design of joint project development is a critical consideration. While allowing landowners to cooperate and develop a project jointly will increase the number of producers implementing practices that reduce net GHG emissions reductions, poor design of the joint development rules could result in selective participation of fields from a producer. This could result in the enrollment of fields with the highest net GHG emission reduction potential while leaving out other fields with lower reductions. The joint development requirements should be designed to avoid such "cherry picking" of

[24] American Carbon Registry, ACR Validation and Verification Standard, Version 1.1, 40. (May 2018). [accessed 2020 September 18] https://americancarbonregistry.org/carbon-accounting/standards-methodologies/acr-validation-and-verification-standard-1/acr-vv-standard_v1-1_may-31-2018.pdf
[25] Climate Action Reserve. Grassland Project Protocol. Version 2.1, 10. (February 13, 2020). [accessed 2020 September 18] http://www.climateactionreserve.org/how/protocols/grasslands/

producers or fields. Unfortunately, neither the ACR nor the Reserve provided guidance on the avoidance of cherry picking in their joint development guidance.

In Section VI, we discuss the proposed practices in aggregate to evaluate the following issues:

- Regulatory setting
- Benefits and impacts to disadvantaged communities, Native American or tribal lands, and rural and agricultural regions
- Environmental impacts
- Perverse incentives

V. DISCUSSION OF INDIVIDUAL PROJECTS/PRACTICES

A. Compost Application to Grazed Grassland/Rangelands (Sequesters Carbon)

i. Practice/Project Description and Scientific Basis

Adding compost to grazed grasslands has been proposed as an effective way to increase soil carbon sequestration. This practice takes compost and applies it to grazed grasslands. Research has shown than many grasslands in the U.S. are marginal and some have been degraded from overgrazing, which can lead to decreases in soil carbon.[26] Increasing soil organic carbon levels has additional benefits including improved soil structure, increased water holding capacity, and increased soil fertility.[27] The addition of compost has been shown to generate net GHG sinks that persist for several decades.[28] A recent study of fifteen (15) rangelands across California demonstrated the sequestration of 0.84 ton carbon dioxide equivalent (tCO_2e) per acre in the soil from a one-time application of 0.25 inch of compost. The long-term effects of compost were explored, and the results show that the overall climate benefit of compost amendments peaks 15 years after application.[29]

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[26] Conant, R., Paustian, K. Potential soil carbon sequestration in overgrazed grassland ecosystems, *Global Biogeochem. Cycles*, 16(4), 1143 (2002) https://doi:10.1029/2001GB001661

[27] Sanford, G.R., Posner, J.L., Jackson, R.D., Kucharik, C.J., Hedtcke, J.L., Lin, T.L. Soil carbon lost from Mollisols of the North Central U.S.A. with 20 years of agricultural best management practices, *Agric. Ecosyst. Environ.*, vol. 162, pp. 68–76 (Nov. 2012) https://doi: 10.1016/j.agee.2012.08.011

[28] Ryals, R., Hartman, M.D., Parton, W.J., DeLonge, M.S., Silver, W.L., Long-term climate change mitigation potential with organic matter management on grasslands, *Ecological Applications*, 25(2), 531-54 (2015). [accessed 2020 September 18] https://doi.org/10.1890/13-2126.1

[29] Silver, W.L., Vergara, S.E., Mayer, A., Carbon Sequestration and Greenhouse Gas Mitigation Potential of Composting and Soil Amendments on California's Rangelands, *California's Fourth Climate Change Assessment* (2018). [accessed 2020 September 18] https://pdfs.semanticscholar.org/aa66/22e603b65cd5f63a34a77708d671462afedc.pdf

ii. Costs/Implementation Barriers

The Subgroup reviewed three peer-reviewed papers[30,31,32] and two state reports[33,34] to estimate the cost to apply compost to rangelands. This review determined the breakeven cost would require free transportation and payments over $900/ metric ton. This analysis assumes 0.25-inch (0.635 cm) application, transporting the compost between 45 km (28 miles) and 135 km (84 miles), paying $32 per metric ton of compost, and spreading cost of $31 per metric ton. Based on this analysis, this practice is not currently cost effective to implement and an offset protocol is not likely to incentivize adoption of the practice.

iii. Quantification of Potential Emissions Reductions or Carbon Sequestration

In 2014, ACR developed and adopted a protocol based on the above research. The protocol does not prescribe a specific quantification approach to calculate changes in soil organic carbon and soil N_2O emissions. Any model may be used in conjunction with the protocol provided: (1) the model is sufficiently accurate for the project area and (2) an appropriate uncertainty deduction is applied to the project.[35] As of September 1, 2020, no projects have used the protocol to generate offset projects.

According to research by Whendee Silver at the University of California, Berkeley, a "one-time 0.25-inch compost amendments can lead to a net savings of more than 8 $MtCO_2e$ over 15 y if applied to just 6% of California's rangelands."[36]

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[30] Harrison, B.P., Chopra, E., Ryals, R. Campbell, J.E. Quantifying the Farmland Application of Compost to Help Meet California's Organic Waste Diversion Law, *Environmental Science and Technology*, (54), 4545-4553 (2020) https://doi.org/10.1021/acs.est.9b05377

[31] DeLonge, M.S., Ryals, R., Silver, W.L. A Lifecycle Model to Evaluate Carbon Sequestration Potential and Greenhouse Gas Dynamics of Managed Grasslands, *Ecosystems* (16) 962–979 (2013) https://doi.org/10.1007/s10021-013-9660-5

[32] Ryals, R., Silver, W.L. Effects of organic matter amendments on net primary productivity and greenhouse gas emissions in annual grasslands. *Ecol. Appl.* 23(1), 46–59. (2013) https://doi.org/10.1890/12-0620.1.

[33] Baker, S. E. et. al. Getting to Neutral: Options for Negative Carbon Emissions in California, Lawrence Livermore National Laboratory, LLNL-TR-796100 (2020) [accessed January 11, 2021] https://www-gs.llnl.gov/content/assets/docs/energy/Getting_to_Neutral.pdf.

[34] Silver, W.L., Vergara, S.E., Mayer, A. Carbon Sequestration and Greenhouse Gas Mitigation Potential of Composting and Soil Amendments on California's Rangelands, California's Fourth Climate Change Assessment (2018). [accessed 2020 September 18] https://pdfs.semanticscholar.org/aa66/22e603b65cd5f63a34a77708d671462afedc.pdf

[35] American Carbon Registry. Methodology for Compost Additions to Grazed Grasslands. Version 1, 24. October 2014. [accessed 2020 September 18] https://americancarbonregistry.org/carbon-accounting/standards-methodologies/methodology-for-greenhouse-gas-emission-reductions-from-compost-additions-to-grazed-grasslands/compost-additions-to-grazed-grasslands-v1-0_final.pdf

[36] Silver, op. cit.

iv. AB 32 Criteria

i. **Real** – *GHG reductions or GHG enhancements result from a demonstrable action or set of actions, and are quantified using appropriate, accurate, and conservative methodologies that account for all GHG emissions sources, GHG sinks, and GHG reservoirs within the offset project boundary and account for uncertainty and the potential for activity-shifting leakage and market-shifting leakage*. The addition of compost to grasslands is a demonstrable action that increases the carbon sequestered in soils. According to the protocol, "[t]he carbon (C) content of applied compost will lead to a direct increase in soil organic carbon (SOC) content of the Grazed Grasslands where the compost is applied. Even though the carbon added through compost additions will gradually decompose over time, a significant portion will end up in stable carbon pools."[37] The protocol also includes the calculation of the baseline emissions of the "waste material at the landfill or waste storage pond under the baseline scenario."[38]

ii. **Additional** – *GHG emission reductions or removals that exceed any greenhouse gas reduction or removals otherwise required by law, regulation or legally binding mandate, and that exceed any greenhouse gas reductions or removals that would otherwise occur in a conservative business-as-usual scenario.* The addition of compost to grasslands is not required by any law, regulation or legally binding mandate. It is not common practice and therefore it exceeds any carbon sequestration that would otherwise occur in a conservative business-as-usual scenario. The protocol specifically states that the "additionality of emission reductions from direct or indirect increases in SOC related to the addition of compost to Grazed Grassland can be tested in a straightforward fashion using ACR's standard three-prong approach, based on Regulatory Surplus, Common Practice, and Implementation Barriers."[39]

iii. **Quantifiable** – *Means, in the context of offset projects, the ability to accurately measure and calculate GHG reductions or GHG removal enhancements relative to a project baseline in a reliable and replicable manner for all GHG emission sources, GHG sinks, or GHG reservoirs included within the offset project boundary, while accounting for uncertainty and activity-shifting leakage and market-shifting leakage.* The carbon sequestered by the application of compost to grasslands can either be quantified through soil samples or using a

[37] American Carbon Registry (2014) op. cit., 6.
[38] Ibid., 27.
[39] Ibid., 22.

biogeochemical model. The protocol requires that any process-based models used for quantification must appear in at least three peer-reviewed publications, be validated for the conditions of the project, and include data from at least five sites across two years.

iv. **Permanent** – *Means, in the context of offset credits, either that GHG reductions and GHG removal enhancements are not reversible, or when GHG reductions and GHG removal enhancements may be reversible, that mechanisms are in place to replace any reversed GHG emission reductions and GHG removal enhancements to ensure that all credited reductions endure for at least 100 years.* Disturbance of soils after the application of compost could release the carbon that has been sequestered. Like the CARB Compliance Offset Protocol for U.S. Forest Projects, any sequestration of carbon in the soil would need to contribute to a buffer pool to avoid the unintentional release of carbon into the atmosphere. Securing the land with a conservation easement to prevent the conversion to cropland will help ensure that the carbon sequestered by the application of compost is not reversed.

v. **Verifiable** – *Means that an Offset Project Data Report assertion is well documented and transparent such that it lends itself to an objective review by an accredited verification body.* The verification requirements for ACR protocols are listed in the ACR Validation and Verification Standard, and are well documented and transparent. All projects must undergo an objective review by an accredited verification body. The ACR protocol states that a desk-based verification audit is required prior to the issuance of credits. A full verification including a field visit is required at the first verification and again at least every 5 years. The standard also includes an entire chapter on the verification of aggregated projects. For aggregated projects, a risk-based assessment is required. The verifier also is allowed to develop a random sample of projects for site visits. "ACR does not require the VVB to visit every site or to conduct a minimum number of measurements."[40] An additional option for ACR projects is the Programmatic Development Approach, which allows for incrementally adding sites into the project over time through the use of cohorts. Each cohort has a common baseline and start date. "[S]ite visits should include a mix of new sites and sites from previously validated cohorts."[41]

vi. ***Enforceable*** – *Means the authority for ARB to hold a particular party liable and to take appropriate action if any of the provisions of this article are violated.* The Subgroup sees no reason why such

[40] American Carbon Registry (2018), op. cit., 40
[41] Ibid. 41.

measures could not be included in a protocol adopted by ARB, though as is the case with all voluntary protocols, such provisions are not built in, and any voluntary protocol considered would need to be adapted.

v. Evaluation of Existing Protocols and Recommendations Related To Adaptation or Adoption

The ACR Methodology for Compost Additions to Grazed Grasslands includes only one project activity – compost addition to grazed grasslands. The protocol states that "[a]dding compost to Grazed Grasslands can be an effective way to increase soil carbon sequestration."[42] It goes on to state that:

> "Many grasslands in the US have been degraded through overgrazing which in some cases can lead to declines in soil organic matter (Conant and Paustian 2002). However, research also suggests that with improved management, grassland soils can also offer considerable potential to aid greenhouse mitigation efforts through additional soil carbon sequestration (Lal 2002; Conant and Paustian 2002; Derner and Schuman 2007)."[43]

The protocol identifies research that "indicates that the application of these organic materials can often have positive impacts on the amount of carbon stored in both grassland (Walter et al. 2006; Ippolito et al. 2010; Kowaljow et al. 2010; Ryals et al. 2014) and cropland soils (Canali et al. 2004; Celic et al. 2004; Montovi et al. 2005; Cai and Qin 2006)."[44]

The protocol was developed through the ACR offset protocol approval process. The primary author of the protocol was Terra Global Capital with support from EDF, the Marin Carbon Project, and the Whendee Silver Lab at the UC Berkeley. It was adopted by ACR in October 2014. The protocol is based on several long-term grassland experiments, which have found that the effect of compost application on soil carbon can persist for more than a decade. The data used to develop the calculation methodology in the protocol was based on research conducted by the Silver Lab at UC Berkeley.

This protocol credits the increase in carbon sequestered on grazed grasslands through the application of compost. The sources, sinks, and reservoirs that are included in the protocol are listed in Table 9.

[42] American Carbon Registry (2014), op. cit. 4
[43] Ibid. 5.
[44] Ibid. 5.

Table 9 - Sources, Sinks, and Reservoirs for Compost Additions to Grazed Grasslands

Source, Sink, Reservoir	Requirement
Soil on the grassland of the project	I
Emissions from landfilling organic waste	O
Livestock grazing	I
Fossil fuel emissions from transporting organic waste	E
Fossil fuel emissions from forage transport	E
Emissions due to leaching	E
Emissions from composting	I (CH4)
Aboveground non-woody biomass	E
Belowground non-woody biomass	E
Litter	E
Deadwood	E

I = Included, E = Excluded, O = Optional

vi. Recommendation

According to a multi-agency report, SB 1383 "will require that about 20 million [tons per year] of additional organic waste material be diverted from landfills by 2025."[45] A large portion of this diverted organic waste will be turned into compost and uses will need to be found for this compost. In addition, the 5.2 million cattle and calves in California generate significant amounts of manure, some of which could be turned into compost.[46]

The application of this compost to grazed grasslands has the potential to sequester a significant amount of carbon. The protocol developed by ACR provides a method for generating revenue for the application of this compost to grasslands. Unfortunately, this practice is not currently economic. Unless the economics can be improved for this protocol, the Subgroup recommends that CARB does not adopt this protocol.

[45] California Air Resources Board, California Air Pollution Control Officers Association, CalRecycle. Composting in California: Addressing Air Quality Permitting and Regulatory Issues for Expanding Infrastructure (October 2018). [accessed 2020 September 18] http://californiacompostcoalition.org/wp-content/uploads/2018/11/FINALC1-1.pdf.
[46] United States Department of Agriculture, op. cit. Table 11.

B. Avoided Grassland Conversion (Avoids Loss of Existing Soil Carbon Stocks)

i. Practice/Project Description and Scientific Basis

Between 2008 and 2012, there has been substantial transformation of marginal grasslands to croplands. These lands had not been previously used for crop agriculture since at least the early 1970s.[47] Grasslands function as significant reservoirs of carbon. However, when grasslands are disturbed, such as when the land is tilled for crop cultivation, a portion of the stored carbon is released as CO_2 into the atmosphere. A study of the grasslands in the northern Great Plains calculated an average carbon sequestration of 20.9 tCO_2e per acre over 20 years for their preservation.[48] A study on the carbon sequestration capacity of grasslands in California found that they may be more reliable carbon sinks than forests in California.[49] Preserving these lands as grasslands preserves the carbon stored in the soil. In addition to avoiding the conversion of grasslands to croplands, avoiding the conversion of agricultural lands to urban uses saves more than 70 times the emission of GHGs as demonstrated by recent research analyzing local GHG inventories using the methods prescribed by the Intergovernmental Panel on Climate Change.[50]

ii. Costs/Implementation Barriers

The largest barrier for the adoption of avoided grassland conversion projects is establishing a "conservation easement" on the land. A conservation easement is required to ensure that the grassland is not converted to cropland over the permanence of a project. Easements can cost between $70,000 to $150,000 and take between 9 and 18 months to implement.[51] Land trusts and government grants can often defray the costs of the easement and the landowner receives a

[47] Lark, T.J., Salmon, J.M., Gibbs, H.K., Cropland expansion outpaces agricultural and biofuel policies in the United States, *Environmental Research Letters*, 10(4) (2015) https://doi:10.1088/1748-9326/10/4/044003
[48] Ahlering, M., Fargione, J., Parton, W., Potential carbon dioxide emission reductions from avoided grassland conversion in the northern Great Plains. *Ecosphere*, 7(12) (2016) https://doi:10.1002/ecs2.1625m
[49] Dass, P., Houlton, B.Z., Wang, Y., Warlind, D. Grasslands may be more reliable carbon sinks than forests in California. *Environmental Research Letters*, 13 (2018) https://doi.org/10.1088/1748-9326/aacb39
[50] Haden, V.R., Dempsey, M., Wheeler, S., Salas, W., Jackson, L.E. Use of local greenhouse gas inventories to prioritise opportunities for climate action planning and voluntary mitigation by agricultural stakeholders in California, *Journal of Environmental Planning and Management*, (2012) http://dx.doi.org/10.1080/09640568.2012.689616
[51] Western Landowners Alliance, Conservation Easements website. [accessed 2020 September 18] https://westernlandowners.org/conservation-easements/

one-time tax deduction. However, government grant programs are routinely oversubscribed with multi-year waiting lists.

iii. Quantification of Potential Emissions Reductions or Carbon Sequestration

The Reserve and ACR have each developed a protocol that quantifies emission reductions from the avoided conversion of grasslands. The Reserve protocol uses default emission factors developed through a probabilistic composite modeling approach.[52] This approach uses Major Land Resource Areas for the identification of emission factors. These include grazing lands in the Sierra Nevada Foothills, Siskiyou-Trinity Area, Southern California Coastal Plain, and Mojave Desert. As of September 1, 2020, the Reserve protocol has generated 112,129 tCO_2e of credits from nine projects in three states – Oregon, Montana, and Colorado. There are an additional five projects in development.[53]

The ACR protocol allows the use of two types of models for the quantification of emission reductions: process-based biogeochemical models and empirical models based on time series measurements and proxy sites. The DAYCENT model is specifically approved for use with the methodology and "[e]mpirical models may be approved on a case by case basis where available."[54] Appendix B of the protocol includes 18 California counties that are eligible for the protocol, including Fresno, Imperial, San Luis Obispo, and Tulare. The protocol has generated 81,917 tCO_2e of credits from one project in North Dakota.

iv. AB 32 Criteria

i. **Real** – *GHG reductions or GHG enhancements result from a demonstrable action or set of actions, and are quantified using appropriate, accurate, and conservative methodologies that account for all GHG emissions sources, GHG sinks, and GHG reservoirs within the offset project boundary and account for uncertainty and the potential for activity-shifting leakage and market-shifting leakage*. The preservation of grasslands avoids the release of carbon into the atmosphere by avoiding the conversion of grasslands to annual croplands. According to the Reserve's Grassland Project Protocol, "[t]hrough sustainable management and protection, grasslands can play a positive and significant role to help address global climate

[52] Climate Action Reserve (2020), op. cit., 35.
[53] Climate Action Reserve website, Project Database. [accessed 2020 September 18] https://thereserve2.apx.com/myModule/rpt/myrpt.asp?r=111
[54] American Carbon Registry. Methodology for the Quantification, Monitoring, Reporting and Verification of Greenhouse Gas Emissions Reductions and Removals from Avoided Conversion of Grasslands and Shrublands to Crop Production. Version 2.0, 29 (October 2019) [accessed 2020 September 18] https://americancarbonregistry.org/carbon-accounting/standards-methodologies/methodology-for-avoided-conversion-of-grasslands-and-shrublands-to-crop-production

change. [These protocols are] designed to take advantage of grasslands' unique capacity to sequester, store, and emit CO_2 and to facilitate the positive role that grasslands can play to address climate change."[55]

ii. **Additional** – *GHG emission reductions or removals that exceed any greenhouse gas reduction or removals otherwise required by law, regulation or legally binding mandate, and that exceed any greenhouse gas reductions or removals that would otherwise occur in a conservative business-as-usual scenario.* The preservation of grasslands is not required by law, regulation or legally binding mandate. In many counties, the common practice has been to convert these grasslands to croplands. Therefore, their preservation exceeds any carbon sequestration that would otherwise occur in a conservative business-as-usual scenario. Both protocols require projects to meet a performance standard test and a legal requirement test. The Reserve protocol includes limits on payment and credit stacking as a third additionality requirement. The performance standard test is based on conversion rates in the county in which the project is located. The legal requirements test states that the project must "not be mandated by any law, statute or other regulatory framework. Specifically, there must not be any federal, state, or local regulations for the project region/area (pre-existing or subsequent), nor other pre-existing legally binding contracts, deed restrictions or encumbrances that require the project fields to be maintained as grassland."[56] For payment and credit stacking, the Reserve provides specific requirements and limits on what type of credits and payment can co-exist with the carbon project.

iii. **Quantifiable** – *Means, in the context of offset projects, the ability to accurately measure and calculate GHG reductions or GHG removal enhancements relative to a project baseline in a reliable and replicable manner for all GHG emission sources, GHG sinks, or GHG reservoirs included within the offset project boundary, while accounting for uncertainty and activity-shifting leakage and market-shifting leakage.* The carbon sequestered by avoiding the conversion of croplands can be quantified through either emission factors or models. The Reserve protocol quantifies emissions using default emission factors developed through a probabilistic composite modeling approach. The protocol uses 14 equations to calculate the emission reductions for a project.

The ACR protocol allows the use of two types of models for the quantification of emission reductions: process-based biogeochemical

[55] Climate Action Reserve (2020), op. cit., 5.
[56] American Carbon Registry (2019), op. cit., 5.

models and empirical models based on time series measurements and proxy sites. The DAYCENT model is specifically approved for use with the methodology and "[e]mpirical models may be approved on a case by case basis where available."[57]

iv. **Permanent** – *Means, in the context of offset credits, either that GHG reductions and GHG removal enhancements are not reversible, or when GHG reductions and GHG removal enhancements may be reversible, that mechanisms are in place to replace any reversed GHG emission reductions and GHG removal enhancements to ensure that all credited reductions endure for at least 100 years.* As long as the grasslands are not converted to croplands, the carbon, which has built up in the soils for decades is permanent. For all projects using the ACR protocol "… the Project Area must be subject to a qualified Land Conservation Agreement (LCA) entered into by the Project Participant prohibiting the conversion of the land from Grassland or Shrubland for the duration of the minimum Project Term or longer."[58] The ACR protocol also requires proponents to "… conduct a risk assessment addressing internal, external and natural risks using the most recently approved ACR Risk Assessment Tool."[59] The Tool "…produces a total risk rating for the project which equals the percentage of offsets that must be deposited in the ACR buffer pool to compensate for reversal or termination (unless another ACR approved risk mitigation mechanism is used in lieu of buffer contribution)."[60]

The Reserve protocol requires projects "… to employ a Qualified Conservation Easement (QCE) (Section 3.5.1) and a Project Implementation Agreement (Section 3.5.2)."[61] The Reserve protocol also requires all projects to make contributions to a buffer pool for unavoidable reversals.

v. **Verifiable** – *Means that an Offset Project Data Report assertion is well documented and transparent such that it lends itself to an objective review by an accredited verification body.* The verification requirements for ACR protocols are listed in the ACR Validation and Verification Standard, which states that a desk-based verification audit is required prior to the issuance of credits. A full verification including a field visit is required at the first verification and again at least every 5 years. The Standard also includes an entire chapter on the verification

[57] Ibid. 29.
[58] Ibid. 11.
[59] Ibid. 64.
[60] Ibid. 65.
[61] Climate Action Reserve (2020), op. cit., 26

of aggregated projects. The verifier is allowed to develop a random sample of projects for site visits. "ACR does not require the VVB to visit every site or to conduct a minimum number of measurements."[62] An additional option for ACR projects is the Programmatic Development Approach, which allows for incrementally adding sites into the project over time through the use of cohorts. Each cohort has a common baseline and start date. "[S]ite visits should include a mix of new sites and sites from previously validated cohorts."[63]

For the Reserve protocol, the initial verification covers the first reporting period (up to 24 months). Subsequent verifications may cover between 1-6 reporting periods at a time, meaning the minimum frequency of verification is at least once every six (6) years. Site visits during verification are strongly recommended but are not mandatory for grassland projects. Projects which have never had a verification site visit must apply an additional 5% contribution to the reversal risk buffer pool. For verifications that do not include a site visit, the verification body must follow the same standards and procedures but is not required to physically visit the project site. Desk review verifications must achieve the same standard of reasonable assurance. Projects aggregated together and managed as "cooperatives" may conduct a single verification process for multiple projects. They must verify a single time period, resulting in a single verification report that provides sufficient detail for all of the underlying projects.

vi. ***Enforceable*** – *Means the authority for ARB to hold a particular party liable and to take appropriate action if any of the provisions of this article are violated.* The Subgroup sees no reason why such measures could not be included in a protocol adopted by ARB, though as is the case with all voluntary protocols, such provisions are not built in, and any voluntary protocol considered would need to be adapted.

v. Evaluation of Existing Protocols and Recommendations Related To Adaptation or Adoption

Two protocols have been developed that credit the avoided conversion of grasslands to croplands – one by ACR and one by the Reserve. Version 1.0 of the ACR methodology was developed by Ducks Unlimited (DU), The Nature Conservancy (TNC), The Climate Trust, EDF, and Terra Global Capital LLC. Version 2.0 of the protocol was developed by the University of Wisconsin, the University of California, Santa Barbara, TNC, and DU. Financial support to

[62] American Carbon Registry (2019), op. cit. 4.
[63] Ibid. 41.

develop both the original and updated methodology was provided by a USDA Natural Resources Conservation Service Conservation Innovation Grant (NRCS CIG).

The Reserve methodology was developed by the Reserve with support of a workgroup. The workgroup consisted of members from: Colorado State University, SES, DU, The Climate Trust, EDF, TNC, Environmental Services, and USDA NRCS. Version 2.0 of the protocol was developed with the support of a USDA NRCS CIG. As of September 1, 2020, the Reserve protocol has generated 112,129 credits from 14 projects in three states.[64]

For the ACR protocol, emissions are quantified by using either a process-based biogeochemical model (e.g., DAYCENT) or empirical models based on time series measurements and proxy sites.[65] As of September 1, 2020, the ACR protocol has generated 81,917 tCO_2e of credits from one project in North Dakota.[66]

Both protocols credit the emissions avoided by preventing the conversion of grasslands to annual crop production. Only the amount of reduced emissions from avoided conversion to annual croplands is credited by the protocols. The conversion of grasslands to orchards and vineyards is not an eligible activity under the protocol. Tree canopy may not exceed 10% of the land area on a per-acre basis. A complete list of the sources, sinks, and reservoirs that are included in the protocol is found in Table 10.

[64] Climate Action Reserve website. Project Database [accessed 2020 September 18] https://thereserve2.apx.com/myModule/rpt/myrpt.asp?r=111
[65] Ibid. 29.
[66] American Carbon Registry website. Project Database. [accessed 2020 September 18] https://acr2.apx.com/myModule/rpt/myrpt.asp?r=111

Table 10 - Sources, Sinks, and Reservoirs for Avoided Grassland Conversion Protocols

Source, Sink, Reservoir	ACR	Reserve
Tree biomass (above-ground, below ground)	E	E
Above-ground non-tree, woody biomass	O	E
Above-ground non-tree, non-woody biomass	O	E
Litter	E	E
Below-ground, non-tree biomass	O	I
Soil organic carbon	I	I
Dead wood	E	E
Wood products	E	E
Agricultural equipment	O	I
Burning	E	I
Soil N dynamics and fertilization	I	I
Irrigation	I	I
Livestock	O	I

I = Included, E = Excluded, O = Optional

vi. Recommendation

The avoided conversion of grasslands to croplands has significant potential for avoided release of sequestered carbon. Over decades, grasslands have stored significant amounts of carbon. Avoiding the conversion of these lands maintains the carbon in the ground. There may also be potential to avoid emissions through avoiding the conversion of croplands to urban uses.

Two protocols have been developed for the avoided conversion of grasslands to croplands and have seen significant uptake since their adoption five years ago. The quantification of GHG emission reductions can be achieved through straightforward emission factors. Both protocols are designed to allow for the development of projects with DEBS.

Because land conversion is primarily based on commodity crop prices, the pressure to convert grasslands to croplands will change over time. Therefore, as a part of considering this protocol, the Subgroup recommends that CARB develop criteria or processes to routinely reevaluate the grassland conversion rates in the counties where the protocol is applicable.

The Subgroup recommends that CARB consider the adoption of a protocol, which credits avoiding the conversion of grasslands to croplands and evaluate the potential for the development of a protocol which credits avoiding the conversion of grasslands or croplands to the built environment.

C. Cattle Feed Additives to Reduce Enteric Emissions (Reduces Emissions of Methane, a GHG)

i. Practice/Project Description and Scientific Basis

About 30 percent of California's annual methane emissions come from beef and dairy cattle enteric emissions (i.e. belching).[67] Researchers at UC Davis have confirmed that promising feed additives exist or are in development which, if included in feed rations, could significantly reduce enteric methane emissions. A recent UC Davis report to CARB, titled: "Strategies to Reduce Emissions from Enteric and Lagoon Sources,"[68] recommended at least one compound, 3-nitrooxypropanol (3NOP) by DSM, "for use pending FDA approval," and suggested its use across the California dairy herd could result in methane reductions of approximately 2.33 million tCO_2e ($MtCO_2e$). The same report identified other compounds such as Mootral[69] and macroalgae (seaweed), as promising potential feed additives to achieve enteric methane reductions, though further research was recommended. Published research has shown reductions of enteric methane of about 30 percent when 3NOP is fed at rates between 40 and 80 mg per kg of dry matter, with maximum mitigation taking place between 100 and 200 mg/kg dry matter.[70] Other compounds such as Agolin make claims of enteric methane reduction, but publications are in the process of undergoing peer review.

Approval of 3NOP is pending with the U.S. Food and Drug Administration (FDA) and is not expected for about two to three years.[71] Limited research on other products and compounds suggests they can also provide enteric methane reductions, though more research is needed and regulatory approval by the FDA is required. Research is continuing and the Subgroup concludes that additional methane-reducing feed additives are likely to become available over time, some in the relatively near future. It is likely that as new compounds become available, they will vary in performance, some being less effective than 3NOP and others potentially more effective.

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[67] California Air Resources Board, GHG Short-Lived Climate Pollutant Inventory. [accessed 2020 September 18] https://ww2.arb.ca.gov/ghg-slcp-inventory
[68] Kebreab, E., Feng, X. contract #17RD018 (June 2020)
[69] MOOTRAL website. [accessed 2020 September 18] https://www.mootral.com/
[70] Hristov, A. N., et. al. An inhibitor persistently decreased enteric methane emission from dairy cows with no negative effect on milk production,", Proceedings of the National Academy of Sciences (August 2015). [accessed 2020 September 18] https://www.pnas.org/content/112/34/10663 . See also "Dose-response effect of 3-nitrooxypropanol on enteric methane emissions in dairy cows," Melgar et al., April 2020
[71] According to officials of DSM, manufacturer of 3NOP, interviewed by Subgroup members. personal communications, May 27, 2020

ii. Cost/Implementation Barriers

Because they are not widely in use outside a research setting, costs for use of methane-reducing feed additives are not yet known. Likewise, other potential reasons to use (or avoid using) methane-reducing feed additives, such as potential impact to animal health, milk production, or consumer acceptance have generally not been thoroughly researched or evaluated. Recent research suggests that 3NOP does not negatively impact cattle health or milk production,[72] but more studies are under way to support FDA consideration. The following barriers apply generally to dairy owner/operators choosing to feed methane-reducing additives:

- Lack of FDA approval and/or market availability,
- Absence of recommendation from trusted sources (e.g., University of California) that a product is safe and effective, including for reducing methane,
- Even when products are proven safe and effective, they will come with costs; without external financial incentives, dairy operators may be resistant to using the products unless other positive economic outcomes are documented (e.g., increased animal health, milk production, etc.),
- Potential barriers exist regarding acceptance of feed additives in the market and/or among consumers. Feed additives must be perceived as healthy and safe or they could potentially face resistance in the marketplace (similar to use of Bovine Growth Hormone, rBST, to increase milk production in the past, or genetically modified crops).

Companies developing feed additives have taken different approaches for regulatory approval of their products. Evaluation of these approaches is beyond the scope and expertise of this Subgroup, but will be a factor in the development of the products.

iii. Quantification of Emission Reductions

As noted above, one UC Davis study for CARB indicated that use of 3NOP in the California dairy herd could reduce methane emissions by about 2.33 million tCO_2e. According to the CARB inventory,[73] 2017 emissions of methane were approximately 39.9 $MtCO_2e$, with about 28 percent of that (11.2 $MtCO_2e$) coming from enteric emissions. Assuming the widely reported figure of approximately 30 percent reductions be achieved by using one or more additives in the future, and extending that use to both dairy and beef cattle, feed additives could be

[72] Hristov et al. op. cit.
[73] California Air Resources Board website. [accessed 2020 September 18] https://ww3.arb.ca.gov/cc/inventory/background/ch4.htm

reasonably seen – without consideration of economics – as having potential to achieve more than 3.3 $MtCO_2e$ of reductions.

The question of how much of these potential emission reductions could be achieved economically with the help of a carbon offset program will depend on the cost of purchasing and delivering the additives, as well as the value of the offset credits and transaction costs in generating them. Assuming 2.33 $MtCO_2e$ (as identified by Kebreab) are achievable across the dairy herd of 1.7 million cows, that suggests about 1.35 tCO_2e per milking cow is achievable. Assuming a floor price of $20 for allowances when a protocol is in place, and a (minimum) 35 percent reduction in value to the dairy operator to account for transaction costs for offsets and the difference in market value of offsets compared to allowances, the revenue per cow via an offset program would be around $17.55 per year ($13 per ton of emission reduced with 1.35 tCO_2e reduced per cow per year), which would provide about 4.8 cents per day per cow to pay for the feed additive. So long as the feed additive costs about that or less, there is an economic signal to the dairy to use the additive. If monetary values can be established for other factors resulting from additives (increased e.g., animal health, milk production), then the cost of the additive could potentially increase above 4.8 cents per day.

As shown above, there are major unknowns in several areas of the economic analysis – cost of the additives, offset transaction costs, and value of co-benefits. Until these are established, there will be large uncertainties about whether an offset program can provide an effective incentive to use methane-reducing feed additives. Despite these uncertainties, there is strong technical potential for feed additives and an offset program cannot be ruled out at this time as potentially playing an important role in achieving significant reductions from a major source of methane emissions.

iv. AB 32 Criteria

As stated in CARB's Cap-and-Trade Regulation,[74] new protocols can only be considered for project types that meet certain requirements. We evaluate those requirements (requirements in underline and italics as follows) in the context of methane-reducing cattle feed additives:

i. ***Real*** – *GHG reductions or GHG enhancements result from a demonstrable action or set of actions, and are quantified using appropriate, accurate, and conservative methodologies that account for all GHG emissions sources, GHG sinks, and GHG reservoirs within the offset*

[74] California Code of Regulations, Title 17 Public Health, Chapter 1. Air Resources Board, Subchapter 10. Climate Change, Article 5. California Cap on Greenhouse Emissions and Market Based Compliance Mechanisms to Allow for the Use of Compliance Instruments Issued by Linked Jurisdictions § 95801-96022 (2014).

project boundary and account for uncertainty and the potential for activity-shifting leakage and market-shifting leakage. The reductions occur from a demonstrable action, namely purchasing and feeding cattle methane-reducing additives. For at least one additive, research exists to support development of accurate and conservative quantification methods. It should be possible to include a conservative margin within a protocol to account for possible variability in feeding/dosing, to consider margins of error in supporting research for each additive, and similar variables. Enteric methane emissions originate within the confines of a dairy or cattle operation, and the area in which the cattle are housed should constitute the project boundary. The emissions reductions resulting from use of a feed additive also occur within that boundary. The protocol should not consider changes in emissions outside that boundary and thereby this criterion would be met. The Subgroup does not believe there is potential for activity-shifting or market-shifting leakage.

ii. ***Additional*** – *GHG emission reductions or removals that exceed any greenhouse gas reduction or removals otherwise required by law, regulation or legally binding mandate, and that exceed any greenhouse gas reductions or removals that would otherwise occur in a conservative business-as-usual scenario.* Enteric emissions from cattle are not covered by the AB 32 cap and are not subject to a compliance obligation or regulation. Use of methane-reducing feed additives is not business-as-usual in the cattle industry at this time, largely due to reasons stated above regarding availability, regulatory approval and documentation/widespread recommendation of safety and effectiveness.

iii. ***Quantifiable*** – *Means, in the context of offset projects, the ability to accurately measure and calculate GHG reductions or GHG removal enhancements relative to a project baseline in a reliable and replicable manner for all GHG emission sources, GHG sinks, or GHG reservoirs included within the offset project boundary, while accounting for uncertainty and activity-shifting leakage and market-shifting leakage.* In the case of at least one methane-reducing feed additive, extensive research has been conducted to quantify reductions of enteric methane at different doses. Emissions reductions from use of additives that have such supporting research would clearly be quantifiable. Project boundaries are straightforward (cattle housing areas) and there does not appear to be any likelihood of leakage.

iv. ***Permanent*** – *Means, in the context of offset credits, either that GHG reductions and GHG removal enhancements are not reversible, or when GHG reductions and GHG removal enhancements may be reversible, that mechanisms are in place to replace any reversed GHG emission reductions and GHG removal enhancements to ensure that all credited reductions endure for at least 100 years.* Once enteric emissions are

avoided through use of a feed additive, there is no opportunity for a reversal of the avoided emissions. Therefore, all reductions during use of feed additives are permanent.

v. ***Verifiable*** – *Means that an Offset Project Data Report assertion is well documented and transparent such that it lends itself to an objective review by an accredited verification body.* Verification of use of methane-reducing feed additives should be straightforward. It would include the project's selection of an additive that has been documented to produce a quantifiable emissions reduction, and documentation of purchase and feeding of the additive (through documents such as invoices and ration formulation sheets).

vi. ***Enforceable*** – *Means the authority for ARB to hold a particular party liable and to take appropriate action if any of the provisions of this article are violated.* The Subgroup sees no reason why such measures could not be included in a protocol adopted by ARB, though as is the case with all voluntary protocols, such provisions are not built in, and any voluntary protocol considered would need to be adapted. Documenting use of a feed additive should be relatively straightforward, e.g. demonstrating that the additive was in fact purchased in amounts necessary to support the herd in question.

v. Evaluation of Existing Protocols and Recommendations Related To Adaptation or Adoption

There is no existing CARB regulatory protocol that the Subgroup felt could be modified to support use of methane-reducing feed additives. Therefore, the Subgroup examined two voluntary protocols that credit the reduction of methane generated through enteric fermentation: "Reducing Methane Emissions from Enteric Fermentation in Dairy Cows Through Application of Feed Supplements by the Gold Standard, version 0.9 (for Road Testing)," released December 2018 and "Methodology for the Reduction of Enteric Methane Emissions from Ruminants through the Use of 100% Natural Feed Supplement (VM0041) by Verra under the Verified Carbon Standard, version 1.0," adopted November 22, 2019.

These protocols quantify the "reduction of methane (CH_4) emissions from enteric fermentation for dairy cows." The Verified Carbon Standard "methodology focuses on application of natural plant-based feed supplements." The Gold Standard protocol includes "application of organic or non-organic products" and requires the quantification of the "impacts on emissions from manure handling."

The Gold Standard protocol was developed by TREES Consulting LLC and DSM Nutritional Products LTD, Animal Nutrition and Health (DSM is the manufacturer of the 3NOP product described earlier in this section). The Verified Carbon

Standard protocol was developed by Mootral (a name shared by the company and the product they sell) with feedback from the Climate Neutral Group and Allcot AG.

These protocols credit the decrease in methane generated by ruminants (Verified Carbon Standard) or cows (Gold Standard). The sources, sinks, and reservoirs that are included in each protocol are listed in Table 11 below.

Table 11 - Sources, Sinks, and Reservoirs for Enteric Fermentation Protocols

Source, Sink, Reservoir	Gold Standard	Verified Carbon Standard
Enteric fermentation	I (CH_4)	I (CH_4)
Manure management	I (CH_4 & N_2O)	E
Supplement manufacture	I	E

I = Included, E = Excluded, O = Optional

These protocols credit the decrease in methane from enteric fermentation resulting from providing the animals a feed additive and, in the case of the Gold Standard, the management of manure. The VCS protocol requires two steps to demonstrate additionality – regulatory surplus and positive list. Project proponents must demonstrate that the use of the feed additive is not required by law. For the positive list, VCS has determined that "no country has an activity penetration rate higher than 5% at this time." These requirements are likely irrelevant, because for a protocol to adopted as a California regulatory protocol, the more important considerations will be whether there are regulatory requirements that apply to operations in California, and whether the penetration of the technology has occurred in the United States.

The Gold Standard protocol requires that all projects "demonstrate that they would not have been implemented without the benefits of carbon certification." The Gold Standard also has "[s]pecific rules and guidelines on how to assess additionality [which] can be found in the Additionality section of Gold Standard for the Global Goals Land-use & Forests Activity Requirements and the Gold Standard for the Global Goals AGR Additionality (AGR projects) Template."

Both protocols quantify emission reductions using either direct measurement or an emission factor approach. To determine baseline and project emissions under the Gold Standard protocol, the project proponent must either measure the methane emissions for a sample group of cows in the project environment or use "… locally applicable research that has been published in peer-reviewed scientific journals or through national or subnational authorities for GHG accounting…" to develop the baseline emission factor. Manure emissions are calculated in a manner similar to the CARB's Livestock Projects protocol.

Therefore, use of a similar system for calculating emissions reductions in a California setting seems plausible.

Because the VCS protocol allows for the calculation of methane emissions from multiple ruminants, their quantification methodology is more detailed. Three options are available to calculate baseline emissions: direct measurement, using an IPCC Tier 2 method, or using specific emission factors in the protocol. Project emissions are calculated by one of two methods, either applying the "default enteric emission reduction factor estimated by the manufacturer of the feed supplement" or through direct measurement, although the protocol does not state a process of procedure for direct measurement. Because CARB has invested in developing improved enteric methane emissions estimates for California, and has updated its inventory as a result, the Subgroup recommends that at an adapted protocol utilize the California-specific emissions factors.

The Gold Standard has five steps to verify all projects. They are:

i. The Project Developer appoints a verifier.
ii. The verifier conducts a Validation or Verification of the Project. This involves team appointment, audit planning, site visit, assessment of conformity to the Gold Standard Principles & Requirements or earlier versions of Gold Standard and associated documents, and ultimately the provision of a Validation or Verification Report to Gold Standard.
iii. If the Validation or Verification Report is positive, then a review is initiated by Gold Standard. The documentation is also posted for review and comment by the Gold Standard Technical Advisory Committee (TAC) and NGO Supporter community.
iv. Certification is provided if:
    a. The verifier provided a positive Validation or Verification Report.
    b. The Gold Standard Secretariat peer review is satisfied that all issues are fully resolved (including any associated with TAC, NGO Supporter, or stakeholder inputs as below).
    c. There are no outstanding TAC or NGO Supporter comments unresolved.
v. The certification decision and any certificates are published to the Gold Standard Registry as confirmation.
vi. The VCS Standard has a detailed section on the verification of projects. It includes a risk-based process, conformance with ISO 14064-3:2006 and ISO 14065:2013, and selection of samples of data and information.

vi. Recommendation

While the potential for implementing methane-reducing feed additives in California dairy and beef herds is still developing and will be several years away, there appears to be significant GHG mitigation potential in this area. There is a growing body of evidence that feed additives work or can work with further refinement, and this is not limited to a single compound or product – at least three commercially available additives are planned or already in use (Mootral, 3NOP and Agolin) and there is a high level of academic and entrepreneurial interest in other potential additives, such as macroalgae (seaweed). The overall potential reductions are large in scale, perhaps more than 3 $MtCO_2e$ annually in California if all cows are eventually fed additives that reduce enteric fermentation. Emission reductions would be ongoing and permanent and would appear to be "pay-as-you-go" rather than requiring capital-intensive upfront costs as are needed with many manure management strategies, such as anaerobic digesters. Unlike digesters, however, there is no clear revenue stream from renewable energy sales and credits. Most feed additives do not yet have well-documented tangible economic benefits such as creating operational costs savings, increasing milk production, or similar. Absent other reliable, tangible economic benefits, an offsets protocol could provide additional incentive for cattle operators to try feed additives for the purpose of reducing methane and determining whether other benefits occur reliably.

Both voluntary protocols (Gold Standard and VCS) provide a potential pathway and foundation for CARB to develop, adapt and adopt a regulatory offsets protocol for enteric fermentation. The Subgroup recommends that CARB evaluate these protocols and undertake, perhaps with partners, an effort to develop a technology-neutral regulatory protocol that will allow use of any feed additive, available now or in the future, that meets minimum standards for safety and effectiveness. The Subgroup believes there should be a level playing field for the inclusion of feed additives in offset protocols. Feed additives should be evaluated using the same set of criteria for determining efficacy in reducing GHGs and ensuring food safety and animal health.

D. Subsurface Drip Fertigation with Manure or Synthetic Fertilizer (Reduces Emissions of Nitrous Oxide, a GHG)

i. Practice/Project Description and Scientific Basis

Application of manure and synthetic fertilizers to agricultural soils results in emissions of nitrous oxide (N_2O), a greenhouse gas with a global warming potential (GWP) 265 times that of carbon dioxide. CARB's inventory estimates 13 MMT of N_2O were emitted in 2017, about 3.1 percent of the state's GHG emissions. While there are non-agricultural sources of N_2O, such as transportation (25 percent) and industrial sources (9 percent), agricultural

sources make up more than half the state's N_2O emissions, with the application of manure to crops (23 percent), synthetic fertilizers and crop residues on agricultural soils (19 percent) and manure management (11 percent) being the chief sources.[75]

Nitrous oxide emissions derive from soil management practices like fertilization, irrigation, and tillage. Biological and chemical processes that produce N_2O include ammonia oxidation pathways (i.e., nitrifier nitrification, nitrifier denitrification and nitrification coupled denitrification), heterotrophic denitrification and abiotic chemodenitrification.[76] Subsurface drip irrigation (SDI) has been shown to significantly reduce emissions of N_2O, in addition to providing other benefits such as water and nutrient use efficiency and reduced weed pressure. The potential mechanisms of reduction appear to include drier soil surfaces, which reduce microbiological activity that facilitates increased emissions of N_2O.[77]

In California, a handful of dairies working with USDA's Natural Resources Conservation Service (NRCS), NGOs and a private company have piloted the use of SDI using manure.[78] This is a new technology in use on only three dairies in California; however, additional installations are expected. Research performed by scientists at UC Davis showed dramatic reductions (approximately 80 percent) in N_2O emissions when manure SDI was used compared to a flood irrigation control.[79]

There is significant evidence that converting from less efficient surface irrigation methods to more efficient irrigation, including microsprinklers, drip and SDI, can result in large reductions in N_2O emissions. However, the Subgroup was unable to locate sufficient research measuring or estimating emissions reductions, emissions factors, or other work that systematically compared N_2O emissions in SDI to other irrigation methods in specialty, commodity or forage crops. It was

[75] California Air Resources Board website. [accessed 2020 December 29] https://ww3.arb.ca.gov/cc/inventory/background/n2o.htm
[76] Barker, Z. X., et. al. Soil Management Practices to Mitigate Nitrous Oxide Emissions and Inform Emission Factors in Arid Irrigated Specialty Crop Systems, *Soil Systems* (November 2019). [accessed 2020 September 18] *https://doi.org/10.3390/soilsystems3040076*
[77] Gao S., Hendratna A., Cai Z., Duan Y., Qin R., Corbala-Tirado R. Subsurface Drip Irrigation Reduced Nitrous Oxide Emissions in a Pomegranate Orchard, *International Journal of Environmental Science and Development,* Vol. 10, No. 3 (March 2019). [accessed 2020 September 18] http://www.ijesd.org/vol10/1151-D760.pdf
[78] Sustainable Conservation, Project Awardee, Conservation Innovation, Grant Project# 69-3A75-17-53, Subsurface Drip Irrigation System, Utilizing Dairy Manure Effluent, website. [accessed 2020 September 18] https://suscon.org/wp-content/uploads/2020/07/Manure-Subsurface-Drip-Irrigation-Summary-Evaluation.pdf
[79] Burger, M., Rivers, D., Horwath, W. Final Report, Department of Land, Air, and Water Resources, University of California, Davis, Rivers Consulting, Stockton, California. Nitrous oxide emissions in subsurface drip and flood irrigated dairy forage production systems (November 30, 2016). [accessed 2020 September 18] https://suscon.org/wp-content/uploads/2018/09/Final-Report.pdf

not clear to the Subgroup that reliable emissions reductions predictions can be made with the currently available science.

ii. Cost/Implementation Barriers

Subsurface drip irrigation systems have significant pros and cons. Advantages include more efficient water use, water application uniformity, reduced risk of runoff and leaching of nutrients, improved plant health and yields, and more. Disadvantages include high up-front costs, system maintenance demands, clogging, and lack of system visibility because components are underground. The Subgroup was unable to locate data on adoption rates for these systems. For California dairies, manure SDI systems are "money losers" without incentives. According to a case study by the California-based nonprofit Sustainable Conservation, converting from standard flood irrigation to manure SDI without incentives would result in a net income loss of approximately $190 per acre. However, with the help of the USDA Environmental Quality Incentives Program (EQIP) program, growers can improve their bottom line from a loss of $190 per acre to a net income gain of $97 per acre.[80]

Other factors, such as an individual grower's cost of water, also impact the affordability of manure SDI and conventional SDI systems. The Sustainable Conservation case study noted that when water costs reach approximately $212 per acre foot, then reduced costs attributable to water savings from SDI make installation of the manure SDI "break even" even without EQIP support. It should be noted that EQIP funding is limited in any year, and availability can vary from year to year.

iii. Quantification of Emissions Reductions

As noted above, the Subgroup did not identify systematic estimates or emissions factors to quantify N_2O emissions reductions when growers convert from one type of irrigation system to another. In the Subgroup's opinion, significant variability would be expected depending on the crops grown, types of cultivation and irrigation practices used to determine the baseline, and perhaps other factors. While the research reviewed and experts interviewed led the Subgroup to conclude that a significant emissions reduction opportunity exists when growers can convert from flood irrigation to SDI, it is unclear how that would be estimated with current information.

In the UC Davis research project noted above, an 80 percent reduction in N_2O emissions was noted (reduction from 4.5 kg N_2O/acre/year to 0.89 kg/acre/year)

[80] Sustainable Conservation, Project Awardee, Conservation Innovation, Grant Project# 69-3A75-17-53, Subsurface Drip Irrigation System, Utilizing Dairy Manure Effluent, website. [accessed 2020 September 18] https://suscon.org/wp-content/uploads/2020/07/Manure-Subsurface-Drip-Irrigation-Summary-Evaluation.pdf

when a dairy's conventional flood irrigation with manure lagoon water was replaced with manure lagoon water SDI. When N_2O's GWP of 265 is considered, a reduction in emissions of this magnitude would translate to about 0.94 tCO_2e per acre. Assuming a floor price of $20 for allowances when a protocol is in place, and a (minimum) 35 percent reduction in value to the grower to account for transaction costs for offsets and the difference in market value of offsets compared to allowances, the revenue to the grower would be about $12.22 per acre for the achieved emissions reductions. This would be a relatively weak economic signal compared to EQIP funding (which added about $287 per acre) or to water costs/savings. Regardless, this estimate depends on being able to reliably measure or estimate baseline (pre-project emissions) as well as ongoing emissions in a variety of situations.

iv. AB 32 Criteria

As stated in CARB's Cap-and-Trade Regulation,[81] new protocols can only be considered for project types that meet certain requirements. We evaluate those requirements (requirements in underline and italics as follows) in the context of manure SDI and conventional SDI:

i. ***Real*** *– GHG reductions or GHG enhancements result from a demonstrable action or set of actions, and are quantified using appropriate, accurate, and conservative methodologies that account for all GHG emissions sources, GHG sinks, and GHG reservoirs within the offset project boundary and account for uncertainty and the potential for activity-shifting leakage and market-shifting leakage*. The GHG reductions result from a demonstrable action, namely installation and use of SDI in replacement of surface flood or furrow irrigation. The N_2O emissions originate from the surface of irrigated croplands where manure or synthetic fertilizer is applied, or crop residues break down within agricultural soils. This is within the bounds of the croplands of a farm or dairy, and those croplands should constitute the project boundary. The emissions reductions resulting from the use of SDI, whether manure SDI or conventional, also occur within that boundary. The protocol should not consider changes in emissions outside that boundary, such as reduced fertilizer production elsewhere, and thereby this criterion would be met.

ii. ***Additional*** *– GHG emission reductions or removals that exceed any greenhouse gas reduction or removals otherwise required by law, regulation or legally binding mandate, and that exceed any greenhouse gas reductions or removals that would otherwise occur in a conservative*

[81] California Code of Regulations, Title 17 Public Health, Chapter 1. Air Resources Board, Subchapter 10. Climate Change, Article 5. California Cap on Greenhouse Emissions and Market Based Compliance Mechanisms to Allow for the Use of Compliance Instruments Issued by Linked Jurisdictions § 95801-96022 (2014).

business-as-usual scenario. Use of SDI (manure or conventional) is not required by any regulation and agricultural operations are not covered by the State cap. Reduction of N_2O emissions from agricultural lands are not required by any regulation. Manure SDI has only been implemented to date on three dairies in the state and has required substantial financial incentives so far, and therefore cannot yet be considered "business as usual." Conventional SDI is more common in other crops, such as annual row crops and to a growing degree in orchards. However, conventional SDI appears to be utilized less often than other precision irrigation techniques such as sprinklers, microsprinklers, or above-surface drip systems. Also, a large percentage of California agricultural acreage remains under flood or furrow irrigation.

iii. ***Quantifiable*** – *Means, in the context of offset projects, the ability to accurately measure and calculate GHG reductions or GHG removal enhancements relative to a project baseline in a reliable and replicable manner for all GHG emission sources, GHG sinks, or GHG reservoirs included within the offset project boundary, while accounting for uncertainty and activity-shifting leakage and market-shifting leakage.* Additional work is needed to create baseline and post-project scenarios and estimates that are reliable and have calculated margins of uncertainty. Until those exist, it is difficult to determine any accurate estimate of reductions, including conservative estimates. Recurring field measurements of N_2O emissions would be technologically and economically infeasible, thus emissions changes would need to be based on modeling, estimates or emissions factors. Monitoring would need to involve periodic verification that the SDI project continues to be implemented and properly maintained, and not reverted to flood irrigation or surface fertilization practices.

iv. ***Permanent*** – *Means, in the context of offset credits, either that GHG reductions and GHG removal enhancements are not reversible, or when GHG reductions and GHG removal enhancements may be reversible, that mechanisms are in place to replace any reversed GHG emission reductions and GHG removal enhancements to ensure that all credited reductions endure for at least 100 years.* Once N_2O emissions are avoided through use of SDI, which among other things reduces the microbial activity on the soil surface that helps produce N_2O, there is no opportunity for a reversal of the avoided emissions.

v. ***Verifiable*** – *Means that an Offset Project Data Report assertion is well documented and transparent such that it lends itself to an objective review by an accredited verification body.* Verification should be a straightforward process. Use of manure or conventional SDI creates visible and verifiable infrastructure on the farm and could be easily documented through review of invoices and other farm records such as irrigation schedules.

vi. ***Enforceable*** – *Means the authority for ARB to hold a particular party liable and to take appropriate action if any of the provisions of this article are violated.* The Subgroup sees no reason why such measures could not be included in a protocol adopted by ARB, though as is the case with all voluntary protocols, such provisions are not built in to voluntary protocols, and as such, any voluntary protocol considered would need to be adapted.

v. Evaluation of Existing Protocols and Recommendations Related To Adaptation or Adoption

The Subgroup was only able to identify one voluntary market protocol that could be applied to reducing N_2O emissions from agriculture in California; however, the Subgroup did not find this protocol to be a good fit for California. The Nitrogen Management Project Protocol, version 2.0, was adopted by the Reserve on October 17, 2018. It credits the reduction of N_2O emissions from the reduction in nitrogen rate and either the application of nitrification inhibitor or the conversion from conventional fertilizer(s) to slow release fertilizer.

The protocol was developed by the Reserve with support of a workgroup. The practices in the protocol were developed through:

a. The results of a literature review of nitrogen management practices shown to consistently reduce N_2O emissions;

b. The data available for the development of performance standard tests for additionality; and

c. The capabilities of an applicable quantification approach.[82]

Like other Reserve protocols, it included a workgroup as part of its development process. The workgroup consisted of members from: Carbon Credit Solutions, Climate Smart Group, Cornell University, EDF, Environmental Services, International Plant Nutrition Institute, Michigan State University, Stanford Law School, The Climate Trust, The Fertilizer Institute, UC Davis, USAID, and Veri6.

The protocol uses emission factors to credit reduction of N_2O emissions from the reduction in nitrogen rate and either the application of nitrification inhibitor or the conversion from conventional fertilizer(s) to slow release fertilizer. The eligible crops and regions are found in Table 12 below.

[82] Climate Action Reserve website. (2018). Nitrogen Management Practices Protocol, Version 2.0. 5. [accessed 2020 September 18] https://www.climateactionreserve.org/wp-content/uploads/2018/10/Nitrogen_Management_Project_Protocol_Version_2.0.pdf

Table 12 - Eligible Crops and Regions for Nitrogen Management Project Protocol

Crop	Region
Barley	AZ, CA, CO, ID, MN, MT, ND, OR, PA, VA, WA, WY
Corn (Grain)	CO, GA, IL, IN, IA, KS, KY, MI, MN, MO, NE, NY, NC, ND, OH, PA, SD, TX, WI
Corn (Silage)	IA, MN, NY, ND, PA, WI
Cotton	AR, GA, MS, MO, NC, TN, TX
Oats	IL, IA, KS, MI, MN, NE, NY, ND, OH, PA, SD, TX, WI
Sorghum (Grain)	CO, KS, NE, OK, SD, TX
Spring Wheat (Durum)	MT, ND
Spring Wheat (excluding Durum)	MN, MT, ND, SD
Tomatoes (Processing)	CA
Winter Wheat	CO, ID, IL, KS, MO, MT, NE, OH, OK, OR, SD, TX, WA

In reviewing this protocol, the Subgroup found it to lack utility as a foundation for a regulatory protocol in California for several reasons, including the fact that the protocol only contemplates two of California's nearly 400 crops, processing tomatoes and barley. Most importantly, it does not include SDI (conventional or manure) as a credited practice.

vi. Recommendation

The Subgroup believes that broader implementation of conventional and manure SDI would benefit California agriculture and water resources while reducing N_2O emissions by applying the fertilizer below the surface of the soil rather than on the surface. There are significant challenges in the short term with developing a carbon offset protocol to achieve this goal. Those challenges include:

- Lack of a voluntary market protocol aligned with this activity,
- Lack of a robust quantification methodology for calculating reductions of N_2O compared to baselines in various crops,
- Ability of a protocol to apply to a significant number of crops or acreage of crops in the state, and
- Uncertainty of the amount of N_2O reduced on many crops to justify the benefit for farmers to make use of a protocol.

To begin to overcome these challenges, the Subgroup recommends specific, prioritized research to quantify N_2O reductions achieved when growers adopt SDI versus their baseline practices. As this information becomes available, we believe it may be necessary for CARB, CDFA, commodity organizations, or

others to sponsor development of a protocol that can be utilized by California-based growers who are considering switching to conventional or manure SDI.

E. Diversion/Conversion of Cattle Manure Storage from Anaerobic Systems to Aerobic Systems (Avoids or Reduces Emissions of Methane, a GHG)

i. Practice/Project Description and Scientific Basis

Anaerobic storage of dairy manure results in a substantial portion of California's methane emissions inventory. Of the 39.8 $MtCO_2e$ of methane estimated to be in the inventory in 2020, 10.34 $MtCO_2e$ or 26% is attributed to manure management (manure storage).[83] The principal factors affecting methane emission from livestock manure are the amount of manure that is produced and the portion of the manure that decomposes anaerobically (that is, decomposes in an oxygen-starved environment, such as under water). The total amount of manure produced can be estimated using an average amount of manure produced per animal multiplied by the number of animals. The type of manure management system used and the climate (primarily temperature) are the primary factors that determine the extent of anaerobic decomposition.[84]

California, led by the California Department of Food and Agriculture (CDFA) and CARB, has developed two primary strategies for reducing emissions of methane from manure storage into the environment:

- Allow the emissions to occur but capture them in anaerobic digesters and use the methane as renewable fuel, and
- Avoid the emissions by changing the way manure is stored on dairies to increase the amount of time and/or amount of manure that is stored in an oxygen-rich (aerobic) environment, which reduces or eliminates methane emissions from manure.

These strategies are the basis of two of CDFA's landmark climate improvement programs, the DDRDP and the AMMP. DDRDP provides incentives to build anaerobic digesters on dairies, capturing methane, while AMMP provides incentives for projects that reduce methane emissions by avoiding their creation in the first place. Such projects vary greatly in design, but have a common theme of reducing the amount of manure in anaerobic storage lagoons, the length of time that manure is stored in such lagoons, or both. Lagoons are used to store manure and process water until they can be applied to crops; AMMP

[83] California Environmental Protection Agency, Air Resources Board website. Short Lived Climate Pollutant Methane Emission Inventory (2015). [accessed 2020 September 18] https://ww3.arb.ca.gov/cc/inventory/slcp/data/slcp_ch4_100yr1.pdf
[84] Jun, P., Gibbs, M., Gaffney, K. CH4 and N2O Emissions from Livestock Manure. [accessed 2020 September 18] https://www.ipcc-nggip.iges.or.jp/public/gp/bgp/4_2_CH4_and_N2O_Livestock_Manure.pdf

projects divert manure solids to another form of storage and processing until it can be used beneficially. Typically, such diverted manure may be dried in windrows, composted, separated from its liquid fraction and then dried, or similar processes. This may require the farmer to change other practices on the dairy, such as how the farmer applies fertilizer to crops or pastures, and cleans barns where animals are housed. Both these practices help capture the nitrogen generated on dairies, move them toward whole-farm nutrient balances, and create healthy soils on nearby farms by increasing the organic matter in those soils.[85]

Practices that generally can be described as "AMMP" or otherwise fit into this section of the report include, according to CDFA: "…pasture-based management; solid separation or conversion from flush to scrape in conjunction with some form of drying or composting of collected manure."[86] Approved practices only include those that reduce the generation of methane from the business as usual practice.

The scientific basis for establishing emissions reductions from these practices is extensive and well documented, and both CDFA and CARB rely on this basis in important ways. For example, CARB adopted in 2011, and revised and re-adopted in 2014, its "Compliance Offset Protocol, Livestock Projects, Capturing and Destroying Methane from Manure Management Systems" (hereafter "CARB Livestock Protocol")[87]. The CARB Livestock Protocol depends extensively on methane emission factors developed by IPCC and U.S. EPA, which are in turn based on extensive academic work (see for example tables in Appendix A of CARB Livestock Protocol, beginning on page 46, especially Table A5, beginning on page 49).

The CARB Livestock Protocol, though currently only used for generating offset credits for use of anaerobic digesters, includes extensive information needed for calculating emissions from any manure management source on dairies. These are used to calculate the change in emissions when manure is stored in a covered digester instead of, for example, an uncovered anaerobic lagoon. Under warm temperatures, an anaerobic storage lagoon is expected to reach about 80 percent of the maximum potential to convert volatile solids (VS) in manure to methane. In comparison, if that same manure were composted in a static pile, it would only reach about one-half of one percent of the methane-forming potential

[85] Cativiela, J.P., Angermann, T., Dunham, T. Summary Representative Monitoring Report, Central Valley Dairy Representative Monitoring Program (April 19, 2019) [accessed December 28, 2020] https://www.waterboards.ca.gov/centralvalley/water_issues/confined_animal_facilities/groundwater_monitoring/srmr_20190419.pdf
[86] Ibid.
[87] California Environmental Protection Agency, Air Resources Board. Compliance Offset Protocol Livestock Projects, Capturing and Destroying Methane from Manure Management Systems, Adopted November 14, 2014. [accessed 2020 September 18] https://ww3.arb.ca.gov/regact/2014/capandtrade14/ctlivestockprotocol.pdf

of manure (about 160 times less methane than the lagoon). As such, diverting manure from a storage lagoon to a compost pile has significant potential to reduce methane but is not incentivized through a regulatory offset program at this time.

Table A5 of the CARB Livestock Protocol identifies Methane Conversion Factors (MCFs) for all types of manure storage on dairies and cattle feedlots, and therefore provides a solid basis for estimating emissions changes when diversion of manure from anaerobic systems to aerobic systems is performed. Furthermore, AMMP practices could be combined with anaerobic digester or possibly even enteric fermentation projects and reduce the costs of project development and verification leading to more cost effective and larger GHG reductions from dairy farms.

ii. Cost/Implementation Barriers

There are significant economic and operational barriers to adopting practices that divert or convert manure away from anaerobic storage systems. Anaerobic storage lagoons are very common on California dairies, and serve a combination of critical functions. These include:

- Storage for process water (wastewater after it is used for washing cows, milking parlors and housing areas, such as barn floors);
- Storage for manure that is washed from barn floors;
- Source of recycled water for washing concrete floors in housing areas; and
- Source of plant nutrients and water to be added as fertilizer to forage crops on the dairy.

Lagoons are thus central to a system that allows dairy operators to efficiently and effectively maintain clean barns, store excess water and manure nutrients until they are needed for growing crops, and then efficiently transport that water and nutrients via pipelines to be mixed with irrigation water and applied to crops.

Significant changes to manure management on dairies, such as AMMP projects, bring with them a need to adapt the overall management of the dairy while still maintaining clean animal housing and delivering manure nutrients to crops where and when they are needed.

Specific types of manure diversion/AMMP projects bring with them different advantages and disadvantages. For example, manure solids-liquids separation (SLS) systems have the advantage of allowing the dairy to continue using a flush system to clean barns efficiently and to continue using a lagoon, while reducing the amount of manure VS that enters the lagoon, thereby eliminating the portion of methane that would be created if the VS were allowed to enter the lagoon. Instead of going to a lagoon, the separated solids are dried or composted and

can be used as animal bedding or as a soil amendment. However, solid separators are expensive to install and operate. Also, their performance can vary widely depending on how the dairy is designed, how the system is operated and the specific configuration of the system – a research report commissioned by CDFA and carried out by UC Davis researchers showed methane reduction performance ranged from as little as 1.4 percent to as much as 83.4 percent depending on a number of factors. Those factors included the operator's ability and willingness to manage process water flow rates over screen separators to ensure their efficient operation, which can include maintaining a well-functioning process pit prior to the screen to assist in regulating flow.[88] Cost can vary widely with separators, again depending on the dairy and system size, configuration and design, with costs ranging from $26.33 per cow per year to as high as $73.41 per cow per year.[89] According to another UC Davis report, SLS "offers moderate mitigation potential at moderate mitigation cost, though sale of solids as compost or use as bedding may improve the economics of solid separation systems."[90]

Another example of a diversion/AMMP project includes converting from a baseline system that collects manure from animal housing areas via flushing to a lagoon, to an alternative system where manure is scraped or vacuumed for stockpiling and drying. Although scraped manure contains less water than if it is flushed with water, it still contains a large percentage of water (as much as 90 percent) and therefore drying this manure can be difficult and expensive, especially during wet times of year. This practice is generally more expensive than anaerobic digesters in terms of methane reduced per dollar spent. According to the UC Davis report:

> "Conversions to increased scraped manure collection with various drying and composting alternatives generally have higher GHG mitigation costs than the digester scenarios. Major impacts to a dairy operation shifting to Scrape-and-Dry manure management include increased operating costs for labor and equipment to manage fresh manure slurry, solid and bulking material, and increased costs related for solid manure application compared to conveyance and application through lagoon discharge."[91]

Dry manure also provides less flexibility for a dairy operator – it can usually only be applied to crops "pre-plant," and thus its nutrients may not be plant-available in sufficient forms or quantities through the crop's life cycle. In contrast, water

[88] Zhang, et al. Effect of Solid Separation on Mitigation of Methane Emission in Dairy Manure Lagoons, pg. 7 (June 2019)
[89] Ibid., 7.
[90] Kaffka, S., Barzee T., El-Mashad, H., Williams R., Zicari, S., Zhang R. Evaluation of Dairy Manure Management Practices for Greenhouse Gas Emissions Mitigation in California. Final Technical Report to the State of California Air Resources Board, Contract #14-456 (2016) [accessed 2020 September 18] https://biomass.ucdavis.edu/wp-content/uploads/ARB-Report-Final-Draft-Transmittal-Feb-26-2016.pdf
[91] Ibid., 13.

and nutrients from manure lagoons may be added to forage crops via fertigation (mixing nutrients into irrigation water) throughout the growing season, with rates and timing that better meet the crop's nutritional needs.

Overall, AMMP practices have been popular with dairy operators when incentivized. AMMP projects are funded by CDFA on a competitive basis and the program, which offers up to $750,000 per project, remains oversubscribed. As of August 2020, CDFA has funded 105 AMMP projects on the state's dairies, which are expected to reduce about 1.1 $MtCO_2e$ of methane over the next five years, a cost of about $49 per ton of emissions reduced.[92]

iii. Quantification of Emissions Reductions

There is a solid foundation for estimating emissions reductions from AMMP/manure diversion practices. CARB in 2019 updated and published "Quantification Methodology, California Department of Food and Agriculture, Alternative Manure Management Program."[93] This Quantification Methodology (QM) provides a way to calculate emissions reductions from various projects, including SLS, compost-bedded pack barns, and conversion to scrape with drying or daily spread. The QM provides baseline emissions for anaerobic storage practices as well as for non-anaerobic storage management. This QM, combined with the CARB Livestock Protocol, provides a solid foundation for calculating emission reductions from projects.

Nevertheless, precise quantification of changes in GHG emissions from a manure management baseline pre- and post-project are confounded by several difficulties, including but not limited to:

- Seasonal and diurnal variability driven by temperature and other climate factors,
- Difficulty and inherent inaccuracies in measuring flux emissions from these sources, and
- Variability driven by differences in operation type and management.[94]

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[92] Dairy Cares website. Dairy Methane Reduction Programs: Providing great bang for the buck (August 2020). [accessed 2020 September 18] https://www.dairycares.com/post/dairy-methane-reduction-programs-providing-great-bang-for-the-buck

[93] California Air Resources Board. Quantification Methodology, California Department of Food and Agriculture Alternative Manure Management Program, California Climate Investments. Final Version 2 (February 8, 2019) [accessed 2020 September 18] https://ww2.arb.ca.gov/sites/default/files/classic//cc/capandtrade/auctionproceeds/cdfa_ammp_finalqm_2-8-19.pdf?_ga=2.144924724.1803365359.1599508479-311510648.1557704652

[94] Leytem A.B., Dungan, R.S., Bjorneberg D.L., Koehn, A. Emissions of Ammonia, Methane, Carbon Dioxide, and Nitrous Oxide from Dairy Cattle Housing and Manure Management Systems, *Journal of Environmental Quality* (June 2010). [accessed 2020 September 18] https://www.researchgate.net/publication/51597700_Emissions_of_Ammonia_Methane_Carbon_Dioxide_and_Nitrous_Oxide_From_Dairy_Cattle_Housing_and_Manure_Management_Systems

These difficulties can likely be addressed by ensuring minimum standards in how a practice is carried out, calculating a likely range of variable emissions when such standards are practiced and inclusion of conservative margins to ensure reductions are not overestimated.

As noted above, 105 AMMP-funded projects to date are expected to result in emissions reductions of 1.1 $MtCO_2e$ over five years, a cost of $49 per ton, and the program is oversubscribed. To calculate the possible additional emissions reductions that could occur utilizing AMMP/diversion from anaerobic practices, we assumed that AMMP projects are still possible on up to 845 additional dairies.[95] If the projects on those additional dairies on average reduce emissions at a similar "per-dairy" scale to current projects, an additional 8.8 $MtCO_2e$ of emissions reductions could be achieved.

How much would a regulatory offset program drive additional AMMP projects on dairies? Assuming a floor price of $20 for allowances when a protocol is in place, and a (minimum) 35 percent reduction in value to the dairy operator to account for transaction costs for offsets and the difference in market value of offsets compared to allowances, the revenue per ton of emissions reduced via AMMP would be about $13, generating as much as $114 million in offset revenue if 8.8 $MtCO_2e$ of reductions were realized. This would be a significant addition to the $49 per ton average project subsidy provided through AMMP and would extend what can be done with limited AMMP funding and spur faster project development. Existence of an offset program for AMMP-type projects could build confidence among dairy owners and project developers to increase matching amounts (co-investments) in AMMP projects, which could have the result of stretching limited AMMP dollars over more projects and accelerate development of such projects.

iv. AB 32 Criteria

As stated in CARB's Cap-and-Trade Regulation,[96] new protocols can only be considered for project types that meet certain requirements. We evaluate those requirements (requirements in underline and italics as follows) in the context of projects that divert manure from anaerobic to non-anaerobic storage:

i. ***Real*** *– GHG reductions or GHG enhancements result from a demonstrable action or set of actions, and are quantified using appropriate, accurate, and conservative methodologies that account for all GHG emissions sources, GHG sinks, and GHG reservoirs within the offset*

[95] Assumes 1,300 dairies in California today, minus 105 dairies where AMMP practices are already installed, estimates that 250 dairies will build anaerobic digesters instead of AMMP projects, and that an additional 100 dairies will go out of business before building either type of project.
[96] California Code of Regulations, Title 17 Public Health, Chapter 1. Air Resources Board, Subchapter 10. Climate Change, Article 5. California Cap on Greenhouse Emissions and Market Based Compliance Mechanisms to Allow for the Use of Compliance Instruments Issued by Linked Jurisdictions § 95802, Definitions (2014).

project boundary and account for uncertainty and the potential for activity-shifting leakage and market-shifting leakage. Diverting manure from anaerobic storage involves demonstrable actions, such as installing and using an SLS system, purchasing and utilizing equipment to vacuum or scrape manure, and drying of manure or manure separated solids via composting, stacking, windrowing, daily spread, or a similar method. Appropriate and accurate methods for estimating both baseline and post-project emissions exist in CARB's AMMP QM, as well as within the CARB Livestock Protocol. These methodologies account for sources, sinks, and reservoirs in the project boundary, which is limited to the portion of the cattle facilities where manure is stored, and animals are housed. The Subgroup does not see potential for leakage.

ii. ***Additional*** – *GHG emission reductions or removals that exceed any greenhouse gas reduction or removals otherwise required by law, regulation or legally binding mandate, and that exceed any greenhouse gas reductions or removals that would otherwise occur in a conservative business-as-usual scenario.* Diversion of manure from anaerobic systems is not required by law, regulation, or mandate. Such diversion does not represent business-as-usual and is in fact the opposite of business-as-usual trends in the California dairy industry, which has trended toward greater use of freestall barns with flush systems over the past decades. An exception to this general trend is increased use in recent years of SLS systems, which are estimated to be in use on approximately 30 percent of the state's dairies, especially larger and newer dairies. As noted above, performance of such systems was found to be highly variable. Average performance is unknown, as is distribution of high-performing systems.

iii. ***Quantifiable*** – *Means, in the context of offset projects, the ability to accurately measure and calculate GHG reductions or GHG removal enhancements relative to a project baseline in a reliable and replicable manner for all GHG emission sources, GHG sinks, or GHG reservoirs included within the offset project boundary, while accounting for uncertainty and activity-shifting leakage and market-shifting leakage.* As noted above, CARB has an existing QM for these types of projects and the CARB Livestock Protocol also contains methodologies for quantifying emissions.

Recurring field measurements of methane emissions would be technologically and economically infeasible, thus emissions changes would need to be based on modeling, estimates or emissions factors. Monitoring would need to involve periodic verification that implementation of the AMMP project continues, and that critical systems are operable and maintained.

iv. ***Permanent*** – *Means, in the context of offset credits, either that GHG reductions and GHG removal enhancements are not reversible, or when GHG reductions and GHG removal enhancements may be reversible, that mechanisms are in place to replace any reversed GHG emission reductions and GHG removal enhancements to ensure that all credited reductions endure for at least 100 years*. The Subgroup concluded that reductions from AMMP-related projects are generally not considered reversible because they lead to aerobic rather than anaerobic degradation of volatile carbons in manure. The primary products of aerobic decomposition of manure are CO_2 and water,[97] which cannot revert to methane.

v. ***Verifiable*** – *Means that an Offset Project Data Report assertion is well documented and transparent such that it lends itself to an objective review by an accredited verification body*. AMMP practices are verifiable by an accredited verification body. Projects are visible on site. SLS systems operate daily and their output products are stacked nearby for example, and drying and composting is generally conducted on site. Visible attributes of the system can be supplemented with records from the facility, such as service and maintenance records, pump logs, manifests for exported manure and manure solids, or similar data.

vi. ***Enforceable*** – *Means the authority for ARB to hold a particular party liable and to take appropriate action if any of the provisions of this article are violated*. The Subgroup sees no reason why such measures could not be included in a protocol adopted by ARB, though as is the case with all voluntary protocols, such provisions are not built in to voluntary protocols, and as such, any voluntary protocol considered would need to be adapted.

v. Evaluation of Existing Protocols And Recommendations Related To Adaptation And Adoption

The CARB Livestock Protocol presents a considerable opportunity for adaptation. The protocol already contains the appropriate project boundaries and emission estimation methodologies for most types of manure management on dairies. Currently, use of this protocol is limited to transferring emissions from baseline conditions (any type of manure management but typically anaerobic storage lagoons) to only one type of emission reduction mechanism, the anaerobic digester, where the emissions are captured and destroyed. With minimal adjustments the protocol could allow for transferring manure VS from anaerobic lagoons to other types of manure management with different emissions factors, such as composting or solid storage, with those destinations – already in the protocol boundaries – becoming (and replacing the digester) as the “project.”

[97] Newport A., Coming up for Air. Beef Magazine (April 2006). [accessed 2020 September 18] https://www.beefmagazine.com/mag/beef_coming_air

This would allow the resulting emission reductions, which are a result of avoiding conditions that create methane rather than capturing and destroying those emissions, to be credited. In other words, emission factors for low-methane management practices that are currently in the protocol to serve as baselines could now also be used as post-project emission estimates.

Additional adjustments may be necessary. For example, the protocol does not include emission estimates specific to separated solids piles; there are emission estimates for solids storage and it would need to be determined whether these can be used for separated solids. Because post-project emissions may be variable, appropriate conservative margins should be determined.

vi. Recommendation

AMMP/anaerobic storage diversion projects provide a clear pathway to further reduce methane emissions on dairies, one that has already resulted in significant and cost-effective reductions. Despite progress so far, there appears to be far more potential emission reductions through this program than have been realized so far (we estimate above that less than 15 percent of potential AMMP reductions have been realized). It is well established that economic viability of digesters is sensitive to the size of dairy operations[98] and that digesters are not likely to be viable on all dairies. Because CDFA's AMMP program is oversubscribed, availability of funding for AMMP projects remains an important bottleneck in achieving further emission reductions. The AMMP program has faced reductions in available funding – after CDFA awarded $30 million in 2019, only an estimated $5.2 to $9.2 million is available in 2020. The program remains oversubscribed, with 79 applications received this year totaling $50.8 million in funding requests.[99] A regulatory offsets program could provide significant funding, and the pathway to having one is straightforward – the current CARB Livestock Protocol is well suited for adaptation to provide offsets for AMMP-style projects. The Subgroup recommends that CARB pursue this option.

F. Other Practices Considered By Subgroup – Reduced/Limited Tillage and Cover Crops

The Subgroup considered but for several reasons did not fully analyze agricultural practices such as limited/no-till agriculture and cover crops as potential pathways to increase carbon sequestration and possible candidates for a regulatory offset protocol.

[98] Kaffka et al., op. cit. 6 and Table 1.1
[99] California Department of Food and Agriculture, Alternative Manure Management Program website. [accessed 2020 September 18] https://www.cdfa.ca.gov/oefi/AMMP/

No-till agriculture is broadly recognized as a way to improve soil health, including preventing erosion, preserving soil structure, and water-holding capacity and savings in fuel devoted to cultivation.[100] Adding organic matter (carbon) to the soil is among the benefits, according to the USDA NRCS.[101] Despite broad promotion of low- and no-till agriculture as a method of improving soil health, whether this practice establishes long-term carbon storage remains controversial:

> "Adoption of no-till management on croplands has become a controversial approach for storing carbon in soil due to conflicting findings. Yet, no-till is still promoted as a management practice to stabilize the global climate system … We evaluated the body of literature surrounding this practice, and found that SOC storage can be higher under no-till management in some soil types and climatic conditions even with redistribution of SOC, and contribute to reducing net greenhouse gas emissions. However, uncertainties tend to be large, which may make this approach less attractive as a contributor to stabilize the climate system compared to other options. Consequently, no-till may be better viewed as a method for reducing soil erosion, adapting to climate change, and ensuring food security, while any increase in SOC storage is a co-benefit for society in terms of reducing greenhouse gas emissions."[102]

Subgroup members interviewed soil experts at the UC Davis and received a similar perspective – that tillage practices can result in increased soil health, but long-term storage of carbon is difficult to quantify accurately, and reversible if management changes. The Subgroup was unable to find any reliable information pertaining to California crops, soils and climate suggesting reliable estimation methods for increasing carbon stocks via changes in tillage. Even if

[100] Miller, S. United States Department of Agriculture, Natural Resources Conservation Service website. Using No-Till this Fall[accessed 2020 September 18] https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/newsroom/features/?cid=nrcseprd1367450
[101] United States Department of Agriculture, Natural Resources Conservation Service website. No-Till/Strip Till. [accessed 2020 September 18] https://www.nrcs.usda.gov/wps/portal/nrcs/detail/null/?cid=nrcseprd415270
[102] Ogle S.M., Alsaker, C., Baldock, J., Bernoux, M., Breidt J.F., McConkey, B., Regina, K., Vazquez-Amabile G.G. Climate and Soil Characteristics Determine Where No-Till Management Can Store Carbon in Soils and Mitigate Greenhouse Gas Emissions, *Scientific Report* (2019). [accessed 2020 September 18] https://www.nature.com/articles/s41598-019-47861-7#:~:text=Introduction,in%20a%20field%20without%20ploughing

such information were available, the Subgroup had concerns about whether growers would likely commit to long-term practices that would assure permanence of the carbon storage. One meta-analysis of 27 research studies was identified which determined an annual increase of 0.13 tCO_2e per acre at a depth of 22 cm for up to 54 years.[103] However, only four of the 27 studies were done in the United States after 2000, mostly in the Southeastern U.S., where soils and climates are very different than California. No California studies were included in the meta-analysis.

Similarly, cover crops have long been advanced as a method for improving soil health, including tilth, water-holding capacity, erosion prevention, and depending on the cover crops used, pollinator forage and habitat and nitrogen fixing in the soil.[104] Research studies in Canadian (humid) and Midwest climates have concluded that cover crops can play a role in building soil carbon stocks over time, but that income losses could result from using cover crops, depending on the cropping pattern. In the case where income losses occurred, researchers suggest carbon offsets of $50 per ton could offset the economic losses. One study determined that carbon sequestration of four to eight tons per acre was possible.[105, 106] To demonstrate the permanent sequestration of carbon in the soil from no till, a robust sampling program would be necessary.

The Subgroup was unable to find scientific evidence that demonstrates and quantifies a permanent increase in carbon stocks as a result of using cover crops in California cropping systems, climate and soils. Professor William Horwath of UC Davis, interviewed by the Subgroup, found that most research results "have been obtained from carefully planned studies at research institutions and less so on farmer fields. As suggested, this may overestimate SOC sequestration due to omitting economic constraints that farmers are confronted with as well as not addressing the variability in management practices and soils resources that effect SOC. However, both research plots

[103] Poeplau, C., Don, A. Carbon sequestration in agricultural soils via cultivation of cover crops – A meta-analysis. Agriculture, Ecosystems and Environment. 200 (2015) 33–41. [accessed 2020 September 18] https://doi.org/10.1016/j.agee.2014.10.024
[104] United States Department of Agriculture Natural Resources Conservation Service website. Cover Crops - Keeping Soil in Place While Providing Other Benefits. [accessed 2020 September 18] https://www.nrcs.usda.gov/wps/portal/nrcs/detail/ny/technical/?cid=nrcs144p2_027252#:~:text=A%20cover%20crop%20will%20increase,reducing%20nutrient%20runoff%20and%20leaching
[105] Chahal, I., Vyn, R.J., Mayers, D., Van Eerd L.L., Cumulative impact of cover crops on soil carbon sequestration and profitability in a temperate humid climate, I.), Scientific Reports (August 2020). [accessed 2020 September 18] https://www.nature.com/articles/s41598-020-70224-6
[106] Olson, K., Ebelhar S.A., Lang J.M. Long-Term Effects of Cover Crops on Crop Yields, Soil Organic Carbon Stocks and Sequestration. Open Journal of Soil Science, 4, 284-292 (2014). [accessed 2020 September 18] https://www.scirp.org/journal/paperinformation.aspx?paperid=48993

and farmer data show there is potential to sequester SOC in California to improve soil health."[107]

Absent additional research conducted under real-world conditions (on farm) and reliable models for estimating carbon sequestration under climate, soil and cropping scenarios relevant to California, the Subgroup found itself unable to analyze how much carbon storage could be accomplished within California agriculture by utilizing the above practices, whether such storage would be permanent, and whether developing regulatory offsets would help encourage use of these practices.

i. Recommendation

More research is needed to determine the potential of reduced tillage and use of cover crops to increase carbon storage in California soils, climate and cropping systems. Depending on the findings of such research and ability to quantify increased storage using specific cover crops, tillage patterns, etc., in California cropping systems, CARB may wish to revisit considering a regulatory offset protocol in the future.

VI. DISCUSSION OF OTHER CRITICAL FACTORS RELATED TO PRACTICE RECOMMENDATIONS

A. Environmental Regulatory Setting

Environmental regulation on agricultural lands in California varies by geography and intensity of land use, and includes a mix of local, regional, state, and federal laws. The descriptions below are not intended to be comprehensive, but instead provide an overview of the types of environmental regulations currently in place for different agriculture operations.

i. Environmental Regulations in Low-Intensity Areas (Grazing, Non-Irrigated Lands)

Non-cultivated, non-irrigated lands typically enjoy the lowest level of environmental regulations. However, such lands are nevertheless regulated for species protection (federal and state Endangered Species Acts), pesticide use (generally regulated at the local level through County Agricultural Commissioners), controlled burns/smoke management (through local Air Districts) and may also be subject to certain water quality protection regulations.

[107] Horwath W.R., Boswell, J.G. How much can soil organic matter realistically be increased with cropping management in California?" *Proceedings of the CA Plant and Soil Conference, 2018. Doubletree Inn, Fresno, CA. Feb. 6-7, 2018. pp. 32-37.* [accessed 2020 September 18] https://ucanr.edu/sites/calasa/files/290856.pdf

The Bureau of Land Management (BLM) and U.S. Forest Service regulate grazing on public lands. BLM normally limits grazing allotments to 472,000 animal unit months each year. BLM collects fees for grazing on approximately 6.1 million acres of public lands in California, using some of the collected fees to construct fences, cattle guards, wells, and similar improvements.

ii. Environmental Regulations in Highly Productive, Irrigated and Intensively Cultivated Areas

Cropland farmers across California face numerous environmental regulations, including those listed above. In addition, they face Waste Discharge Requirements for applying fertilizer to irrigated croplands. Central Valley and Central Coast farmers meet these requirements through the Irrigated Lands Regulatory Program, which requires reporting of nutrient application through farmer coalitions. Most farmers are also subject to regulation via the Sustainable Groundwater Management Act (SGMA), which requires local Groundwater Sustainability Agencies (GSAs) to develop plans to restrict over-pumping of aquifers. In most air basins, including the San Joaquin Valley Air Pollution Control District, South Coast Air Quality Management District and others, farmers must obtain permits to operate and are regulated under various rules that require dust control, smoke management, controlling vapors from petroleum and chemical storage and reducing emissions or smoke from stationary equipment. Farmers in the Central Valley are newly subject to regulations related to controlling accumulations of salt and nitrates in groundwater and surface water.

iii. Additional Environmental Regulations for Confined Animal Facilities (CAFs)

In addition to most of the regulations listed above, operators of CAFs in many parts of the state (particularly populated areas like the San Joaquin Valley) are subject to additional regulations related to manure management and storage, application of manure to croplands, and air pollution control measures related to manure and feed storage. While general farming is generally considered a “by right” land use in unincorporated areas (outside city limits), animal agriculture, especially CAFs, generally require a conditional use permit or special use permit, a type of land use permit granted by local authorities. This permit must be approved before an operation can commence, and because it is a discretionary permit, review under the California Environmental Quality Act (CEQA) is triggered. This forces local jurisdictions to perform an environmental review, determine whether significant environmental impacts will occur because of granting the land use permit, and if so, take steps to mitigate them. Preparation of an Environmental Impact Report (EIR) may be required.

B. Benefits and Impacts to Disadvantaged Communities, Native American or Tribal Lands and Rural and Agricultural Regions

CARB has recognized the need to consider and address social justice and environmental concerns resulting from implementation of programs and protocols as currently defined under AB 32, and subsequently extended under AB 398. Substantial and justified misgivings exist over accessibility and equitable participation by disadvantaged communities, Native Americans, other indigenous peoples, and rural and agricultural communities in the California Cap-and-Trade Program. In addition, concern exists over the direct impact of regulated entities' operations on adjacent communities, including the effects of GHG emissions and toxic pollutants. Furthermore, impacts from ongoing regulated entity emissions to economically disadvantaged communities in rural and agricultural areas, including migrant farm workers, may be exacerbated by the lack of sufficient financial resources, education, and adequate social support systems to respond to these unintended impacts resulting from implementation of the program.

The Subgroup recognizes that solutions to these issues are complex and challenging and will require additional dialogue with impacted stakeholder groups. We offer these recommendations and considerations on the AB 32 Program in general, and for CARB to consider as additional agricultural and grassland carbon offset methodologies are evaluated and adopted. In addition to engagement of rural communities through livestock, agriculture, and rangeland offset protocols, increased engagement and participation of Native American and indigenous peoples in the program may be one way to assist and promote the self-determination and cultural conservation goals of these communities. Future CARB adopted policies, protocols and methodologies should recognize the potential community, ecological, and environmental benefits that will result from diverse program participation, as well as the unique constraints and obstacles facing these communities, and incorporate strategies and policies to reduce the logistic, legal, and economic obstacles of project development and implementation.

i. Land Base, Legal, and Jurisdictional Challenges

The California carbon market includes regions across multiple states and regions, and includes a multitude of disadvantaged communities, Native American tribes, and economically sensitive rural and agricultural regions that could participate in, or benefit from the Cap-and-Trade program. These regions support diverse agricultural and rural communities, migrant farm workers, as well as lands within the historic ancestral territory of federally recognized Native American tribes. These communities often do not have legal ownership, jurisdictional rights, or the economic resources to develop viable carbon sequestration projects. Many of these communities do not own or manage lands

of sufficient acreage, or a consolidated land base to make project development cost-efficient. In addition, in many cases these communities, and often Native American tribes and other indigenous peoples, do not possess the legal jurisdiction to develop and manage carbon sequestration on lands within their historical ancestral territories. Land ownership fragmentation limits the ability to develop financially feasible projects and creates a legal and jurisdictional checkerboard constraining effective project development.

Substantial interest exists by many federally recognized Native American tribes to develop carbon sequestration and emission reduction projects on tribal owned fee lands and trust lands. In addition, revenues from carbon offsets sales have been used as a means to repatriate non-Indian owned lands within tribal reservations, and adjacent lands within ancestral territories.[108] As agricultural carbon offset methodologies are considered and adopted, CARB should include provisions and mechanisms to allow Native American tribes to develop projects on both tribal-owned fee simple lands and tribal trust lands. Tribal trust lands are communal lands held in trust by the federal government for the benefit of a federally recognized Native American tribe. Although tribal, these tax-exempt lands have restricted rights and usage, and must be co-managed with the Bureau of Indian Affairs (BIA). In addition, tribal allotments are similarly held in trust by the federal government, but have been “allotted” to individual tribal members. Often, communal tribal trust and tribal member allotment lands make up a substantial, or majority, of the tribal reservation lands. Furthermore, substantial agricultural and ranch lands exist on many Indian Reservations throughout California and could provide opportunities for project development if federal jurisdictional authority and use issues can be reconciled. The jurisdictional challenge of carbon offset and emission reduction project development on tribal trust lands and allotments remains a substantial obstacle to program participation.

Despite these obstacles, these unique rural and indigenous communities possess Traditional Ecological Knowledge (TEK), skills, and experience living, managing, and working within these natural ecosystems, which may provide additionality to ‘western’ land management strategies. Integration of TEK and non-western land management strategies may provide increased project-level DEBS, and support multiple-use benefits, including: increased economic opportunities, job development, ecological diversity, promotion of native flora and fauna, and conservation and restoration of culturally important places, foods, and medicines.

[108] Manning, B., Reed, K. Returning the Yurok forest to the Yurok Tribe: California's first tribal carbon credit project. Stanford Environmental Law Journal, 39(1), 71-124 (2019).

ii. Economic and Technical Challenges and Recommendations

Project development costs for agricultural carbon and other emission reduction projects are high and technically complex, requiring substantial economical investment. The following list of recommendations and strategies should be considered by CARB if and when agricultural-based, compliance-grade offset methodologies are further developed and adopted by CARB.

a. Project development loans and subsidies:
Recommend CARB consider mechanisms within the Cap-and-Trade Program, and associated California Climate Investments (CCI) funded grant programs to provide low and zero-interest loans to Native American tribes and other disadvantaged communities to finance agricultural carbon and emission-reduction project development and initial project management costs. This program could be modeled on the State Water Resources Control Board's State Revolving Fund (SRF) Loan Program for water infrastructure and water quality improvement projects.

b. Project consolidation across fragmented tribal land ownership:
Recommend CARB consider and develop mechanisms and protocols to allow consolidation of carbon projects on fragmented tribal trust and fee lands, and tribal member allotments utilized for agriculture and ranching purposes. Recommend CARB evaluate and resolve legal and economic constraints of multiple-owner projects, and/or the establishment of "cooperatives" of agriculture project developers as a means to reduce and share costs, share technical resources, and increase capacity.

c. Pricing Agreements:
Recommend CARB implement incentives for associated carbon registries to offer reduced project registration and listing costs, and associated fees for tribal, indigenous, and disadvantaged rural/agricultural communities. Also, recommend CARB waive all annual project costs and fees for economically qualified rural and disadvantaged communities, and federally-recognized Native American tribes.

d. Project Inventory and Verification Streamlining:
Recommend CARB evaluate mechanisms to simplify and streamline carbon inventory and verification requirements, while preserving quantitative confidence, for tribal-owned and disadvantaged community-owned agricultural carbon projects once the project has successfully completed half of the verifications during the current crediting period.

e. Investments and Partnerships Incentives:
Recommend CARB evaluate and implement procedures and mechanisms to promote private investment in agricultural carbon project development in tribal and indigenous communities. Possible development and implementation of a

"community project development buffer," where a portion of issued carbon offsets across the Program are preserved to generate revenues to support project development and technical support services for disadvantaged communities, Native American tribes, etc.

f. Agency Technical Support:

Sufficient technical resources and expertise may not be available to these communities to meet the high standards for compliance (or voluntary) status project development, implementation, and management. In addition, costly consultation and contracting services reduce much needed economic resources needed to support internal capacity-building and develop critical technical skills of tribal members and staff. As self-governed, federally recognized tribes, the ability to effectively and efficiently manage Tribal natural resources is of critical importance, both for cultural preservation and to promote and advance their self-determination goals. Recommend CARB develop technical training and support services to interested Native American tribes and other disadvantaged communities to promote project development, technical and analytical capacity, and project administration capabilities.

C. Environmental Impacts and California Environmental Quality Act Considerations

The California Environmental Quality Act (CEQA) and CARB policy require an analysis to determine any potentially adverse environmental impacts of any potential projects under the compliance offset program. This is typically called an Initial Statement of Reasons (ISOR). The Resource Area Impacts section of the ISOR contains 17 different categories: aesthetics; agriculture and forest resources; air quality; biological resources; cultural resources; energy demand; geology, soils and minerals; GHG emissions; hazards and hazardous materials; hydrology and water quality; land use and planning; noise; population and housing; public services; recreation; transportation and traffic; and utilities and service systems. As a voluntary body, the Livestock, Agriculture, and Rangeland Compliance Offsets Protocol Task Force Subgroup is not able to provide a detailed analysis of the 17 criteria for each of the practices identified in this report. Instead, we are providing a high-level, general analysis of the resource area impacts.

All the practices identified by the Subgroup are not expected to have significant negative impacts on the recommended practices and most of the environmental impacts are already considered by existing regulations. Therefore, mitigation measures are unlikely to be necessary. The practices identified and the protocols that support them are not expected to increase the acres of agricultural land and therefore will not impact aesthetics, cultural resources, land use and

planning, population and housing, public services, or recreation. These impacts are expected to be the same as they are currently.

For one of the practices, the application of compost to grazed grasslands, there could be short-term impacts on transportation, traffic, and noise resulting from the transportation of compost to grasslands. For the other practices, the Subgroup was not able to identify any changes in the impacts on transportation, traffic, and noise resulting from the practices.

The implementation of most of the practices will have a positive impact on air quality; biological resources; energy demand; geology, soils and minerals; GHG emissions; hydrology and water quality; and utilities and service systems. For example, avoiding the conversion of grasslands to croplands will reduce the emissions associated with plowing fields and may preserve habitat for threatened or endangered species.

The Task Force was directed by the Legislature "to provide guidance to the state board in approving new offset protocols for a market-based compliance mechanism for the purposes of increasing offset projects with direct environmental benefits in the state while prioritizing disadvantaged communities, Native American or tribal lands, and rural and agricultural regions."[109] The Task Force was not asked to consider broader environmental impacts of adopting new offset protocols. The Subgroup recognizes there may be environmental impacts of the practices identified that the Subgroup members are not aware of. Therefore, the Subgroup recommends that CARB staff consider those potential environmental impacts in the development and adoption of new offset protocols.

D. Leakage

According to the Cap-and-Trade Regulations,[110] two types of leakage are defined, Activity-Shifting Leakage and Market-Shifting Leakage, which are defined as:

- **Activity-Shifting Leakage** means increased GHG emissions or decreased GHG removals that result from the displacement of activities or resources from inside the offset project's boundary to locations outside the offset project's boundary as a result of the offset project activity.

[109] AB-398 California Global Warming Solutions Act of 2006: market-based compliance mechanisms: fire prevention fees: sales and use tax manufacturing exemption. 38591.1. (a)
[110] California Code of Regulations, Title 17 Public Health, Chapter 1. Air Resources Board, Subchapter 10. Climate Change, Article 5. California Cap on Greenhouse Emissions and Market Based Compliance Mechanisms to Allow for the Use of Compliance Instruments Issued by Linked Jurisdictions § 95802, Definitions (2014).

- **Market-Shifting Leakage**, in the context of an offset project, means increased GHG emissions or decreased GHG removals outside an offset project's boundary due to the effects of an offset project on an established market for goods or services.

Based on the Subgroup's review of the scientific literature and existing protocols, there is a very limited risk of activity-shifting or market-shifting leakage for any of the agricultural practices investigated. In cases where there is a leakage risk, it can be controlled by monitoring and reporting. Some examples of research related to the potential leakage of practices:

- **Compost application to grazed grasslands**: The application of compost to grasslands increases the net primary production.[111] This additional forage could lead to a management decision to increase the stocking rate on the land. Increasing the stocking rate would be a reduction in activity-shifting leakage.
- **Avoided grassland conversion:** Avoiding the conversion of grasslands removes potential cropland that would otherwise enter into production. Both protocols consider the complex and uncertain probability of removing land in one location leads to conversion in other regions. To address this concern, both the ACR and Reserve protocols include a leakage discount factor of 20% based on a review of the latest literature at the time of the development of the protocol. To reach this conclusion the Reserve[112] and ACR[113] analyzed several peer reviewed papers in their consideration of leakage.
- **Cattle feed additives:** It is highly unlikely that operators of dairies or other cattle facilities would feed their cattle anything which would decrease milk yield or growth rates, resulting in activity-shifting leakage.

[111] Ryals, R., Silver, W.L. Effects of organic matter amendments on net primary productivity and greenhouse gas emissions in annual grasslands. *Ecol. Appl.* 23(1), 46–59. (2013) https://doi.org/10.1890/12-0620.1.

[112] Reserve papers included: Wu, J. Slippage effects of the Conservation Reserve Program. *American Journal of Agricultural Economics*, 82, 979-992 (2000) and Roberts, M. J. and Bucholtz, S. Slippage in the Conservation Reserve Program or Spurious Correlation? A Comment. *American Journal of Agricultural Economics*, 87, 244-250 (2005)

[113] ACR papers included: Taheripour, F. Economic impacts of the Conservation Reserve Program: A general equilibrium framework. American Agricultural Economics Association Annual Meeting, Long Beach, California. 33 (2006), Wu, J. Slippage effects of the Conservation Reserve Program. *American Journal of Agricultural Economics*, 82, 979-992 (2000), Barr, K. J., Babcock, B. A., Carriquiry, M. A., Nassar, A. M., & Harfuch, L. Agricultural land elasticities in the United States and Brazil. *Applied Economic Perspectives and Policy*, 33(3), 449-462 (2011), and Murray, B. C., McCarl, B. A., Lee, H. C. Estimating leakage from forest carbon sequestration programs. *Land Economics*, 80(1), 109-124 (2004).

E. Perverse Incentives

The Subgroup does not believe that any of the practices or protocols reviewed include perverse incentives. Perverse incentives have occurred with biodiversity offset programs where landowners intentionally destroyed endangered species habitat to avoid future land-use constraints on their property.[114] Perverse incentives have also occurred with regard to gases with high global warming potentials where some countries increased the production of these gases to then destroy them in order to generate credits.[115] There is a perspective that landowners may put marginal agricultural land into production depending on economic incentives.[116] These concerns can be addressed through the design of the program, such as requiring a sufficient historical baseline to avoid potential switching effects, such as one-time tilling and then converting to no till.

VII. PRIORITIZED RECOMMENDATIONS SUBJECT TO COMMITTEE DISCUSSION

The Subgroup ranked the practices reviewed into three categories: 1) practices where protocols could be developed with existing scientific research; 2) practices where protocols could be developed, but there are either scientific or economic barriers; and 3) practices where significant additional research is necessary to support the practice and its quantification.

One area that could not be adequately evaluated, but should be considered by CARB staff, is the development of offset protocols that include lands associated with agricultural production, such as the creeks running in between fields, the edges of fields, and non-productive lands in the same parcels that are also managed by the producer. These areas of agricultural lands provide significant environmental benefit and have not been included in a significant way in any of the offset protocols. The Subgroup encourages CARB staff to investigate the development of additional protocols that support practices on lands associated with agricultural production.

A. Protocols That Can Be Developed With Existing Scientific Research

The Subgroups recommends that CARB investigate the development of offset protocols for three practices: 1) the avoided conversion of grasslands to

[114] Schneider, L., Kollmus, A., Perverse effects of carbon markets on HFC-23 and SF6 abatement projects in Russia, *Nature Climate Change*, 5, 1061–1063 (2015) https://doi.org/10.1038/nclimate2772.
[115] Zeuli, K.A., Skees, J.R., Will Southern Agriculture Play a Role in a Carbon Market?, *Journal of Agricultural and Applied Economics*, 32(2), 235-248. (2000) https://doi.org/10.22004/ag.econ.15492.
[116] California Air Resources Board, Webinar on CARB's Analysis of Progress Toward Achieving Methane Emissions Target from Dairy and Livestock Sector, May 21, 2020. [accessed 2020 September 18] https://ww2.arb.ca.gov/sites/default/files/2020-06/webinar_Dairy_and%20Livestock_Sector_05212020.pdf

croplands; 2) the use of cattle feeds to reduce enteric fermentation; and 3) the modification of the CARB Livestock Protocol to include alternative manure management practices.

i. Avoided Grassland Conversion

California has 11.6 million acres of grasslands.[117] According to modeling developed by the Reserve, California grasslands which have been maintained grasslands for 30 or more years have sequestered 0.529 tons per acre on average. If just 25% of the grasslands in California are preserved, the state could avoid the release of 1.5 $MtCO_2e$ per year. The protocols developed by the Reserve and ACR have generated 194,046 tCO_2e through ten projects. These protocols could be modified for use by California's Cap-and-Trade program. This practice is supported by peer-reviewed science, has demonstrated that it can be cost effectively developed, meets all the AB 32 criteria, and has the potential to generate DEBS.

ii. Cattle Feed Additives to Reduce Enteric Fermentation

Livestock are responsible for 55% of all methane emissions in California. Enteric fermentation is responsible for more than half of all livestock methane emissions – approximately 12 $MtCO_2e$ per year.[118] A recent UC Davis report has identified several feed additives that have significant impact on enteric emissions, and though additional research and product safety testing is needed, some of these additives could be available for use within the next two to three years. To achieve widespread use by cattle producers, there needs to be an economic signal. An offset protocol could provide that economic incentive. Two voluntary protocols have been developed which could be modified for use by California's Cap-and-Trade program. There are no technical barriers for the use of feed additives in confined cattle operations; a compound would only need to be added to feed rations. Of all the practices reviewed by the Subgroup, the reduction of enteric fermentation produces the largest potential to provide DEBs.

iii. Diversion/Conversion of Cattle Manure Storage from Anaerobic Systems to Aerobic Systems

Manure management is responsible for 26% of the methane generated in the state. The California Department of Food and Agriculture (CDFA) has identified four different practices (and variations thereof) which can reduce methane from manure storage. These practices have been supported by the Alternative Manure Management Program (AMMP) since 2017. CDFA has funded 105 projects and the program has been oversubscribed during each grant application

[117] USDA (2017) Op. Cit. Volume 1, Part 5, Table 8 (2017).
[118] California Air Resources Board. Short-Lived Climate Pollutant Reduction Strategy (March 2017). [accessed 2020 September 18] https://ww2.arb.ca.gov/sites/default/files/2020-07/final_SLCP_strategy.pdf

period. The state has the potential to scale up these practices through the modification of the existing Compliance Offset Protocol for Livestock Projects to include alternative manure management practices. The current protocol has proved successful – generating more than 7 $MtCO_2e$ through September 9, 2020. The diversion of cattle manure storage from anaerobic to aerobic systems is supported by peer-reviewed science, meets all the AB 32 criteria, and has the potential benefits to generate DEBS.

B. Practices Where Protocols Could Be Developed, but there are either Scientific or Economic Barriers

The Subgroup identified two practices which, with additional scientific research or reduction of economic barriers, are worthy of consideration as offset protocols. These practices are 1) compost application to grazed grasslands and 2) subsurface drip fertigation.

i. Compost Application to Grazed Grasslands

California is estimated to divert 20 million tons of additional organic waste from landfills annually by 2025. A significant percentage of this organic waste will be composted and a use of this compost needs to be identified. At an estimated cost of $\$11/yd^3$ to purchase the compost, \$13/ton to haul it 5 km, and \$9/ton to spread it on the grassland, the cost to generate offsets from this practice is more than \$200 per tCO_2e. If the economic barriers to this practice can be reduced, there is an existing voluntary protocol which could be adopted by CARB for use in the Cap-and-Trade program. Economic barriers notwithstanding, this practice is supported by peer-reviewed science, meets all the AB 32 criteria, and has the potential benefits to generate DEBS.

ii. Subsurface Drip Fertigation with Manure or Synthetic Fertilizer

The application of nitrogen fertilizer and water to soil surfaces, whether the fertilizer is organic or synthetic, generates emissions of N_2O. Fertilizer use accounts for approximately 42% of all N_2O emissions in California.[119] Modifying the application of fertilizer to apply it below the top surface of the soil, a practice called subsurface drip irrigation (SDI), has been shown to significantly reduce emissions of N_2O. A few dairies have already implemented this practice in partnership with USDA NRCS advisors. Unfortunately, there is limited peer-reviewed research quantifying N_2O emission reductions for any of the more than 400 crops grown in California. If additional research is conducted to quantify the reduction of N_2O from the application of fertilizer through SDI, it would be worth

[119] Li, C., Frolking, S., Butterbach-Bahl, K. Carbon Sequestration in Arable Soils is Likely to Increase Nitrous Oxide Emissions, Offsetting Reductions in Climate Radiative Forcing. *Climatic Change* 72**,** 321–338 (2005). [accessed 2020 September 18] https://doi.org/10.1007/s10584-005-6791-5

CARB investigating the development of a protocol. Unfortunately, there are no voluntary protocols that currently credit the reduction in N_2O emissions from SDI. A protocol would be beneficial in providing capital to support the implementation of this practice. With almost 10 million acres of irrigated croplands in California, there are significant opportunities for the uptake of this practice.

C. Practices Where Significant Additional Research Is Necessary

The Subgroup reviewed and considered two additional practices, limited/no-till agriculture and cover crops, as potential pathways to increase carbon sequestration and possible candidates for a regulatory offset protocol. Unfortunately, there are significant challenges, and additional research must be conducted before either of these practices could be candidates for the development of an offset protocol.

i. Limited or No-Till Agriculture

Retaining organic matter on a field after harvest has the potential to sequester additional carbon in the soil as well as enhance soil health, improve water retention, and reduce erosion. Unfortunately, studies have shown that no-till agriculture has the potential to increase N_2O emissions, especially during the first decade.[120] A long-term commitment to no-till both for increasing carbon sequestration and for ensuring permanence is critical for the success of this protocol. A robust sampling program would also be beneficial for demonstrating that soil carbon stocks increase over time. Protocols are under development by the Reserve and Verra to quantify the benefits of soil carbon sequestration practices and these protocols would be worth monitoring and reviewing for the potential applicability to California's Cap-and-Trade program.

ii. Cover Crops

There is limited scientific evidence that demonstrates and quantifies a permanent increase in carbon stocks as a result of using cover crops in California crops, climate, and soils. Additional research is necessary to identify which crops sequester carbon and how that carbon can be retained in the soil. As with no-till, a robust sampling program would also be necessary to demonstrate that soil carbon stocks increase over time as a result of cover crops in California soils, climate, and cropping systems. Protocols are under development by the Reserve and Verra to quantify the benefits of soil carbon sequestration practices and these protocols would be worth monitoring and reviewing for the potential applicability to California's Cap-and-Trade program.

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Chapter 5: Analysis and Recommendations on Urban Forestry, High GWP (ODS), and Mine Methane Capture

I. INTRODUCTION AND BACKGROUND ON TASK FORCE SUBGROUP

The Urban Forestry, High GWP (ODS), and Mine Methane Capture Subgroup met once a week on Wednesdays and had guest speakers including CARB staff who worked on the applicable protocols as well as representatives of offset registries and project developers who have expertise in the subject matter related to urban forestry, ODS destruction and mine methane capture. In addition to guest speakers, the Subgroup also received valuable written input from these groups, including American Carbon Registry.

The purpose of the Subgroup is to examine and make recommendations to CARB regarding possible modifications to existing offset protocols in the areas of urban forestry, destruction of high global warming potential gases, and mine methane capture, as well as to consider new protocols in these areas. The Subgroup's analyses to date focused on how to improve upon compliance protocols to increase efficacy and induce more projects, as well as how to modify voluntary protocols so that they can be converted into compliance protocols. As directed by the Task Force's Charter, the subgroup focused on how existing or new protocols can provide direct environmental benefits to California and to prioritize disadvantaged communities, Native American or tribal lands, and rural and agricultural regions. Each of the three subject matter areas is discussed separately below, using the template that the full Task Force established at the initial meeting on March 2, 2020.

The Subgroup concurred on recommendations for the three topics, which are summarized in the table below and explained in more detail in the subsections that follow:

Item	Recommendations
	Urban Forestry
1	Consider adopting the Climate Action Reserve (CAR) Urban Forest Management Protocol v.1.1 after making modifications to address ongoing issues such as cost and scale
	Modification(s) to Ozone Depleting Substances (ODS) protocol
2	Add R-22, R-134a, R-125, R-32, and R-143a as eligible
3	Reduce scope of regulatory conformance to activities directly affecting ODS processing and destruction
4	Modify ODS foam baseline to better align with current recovery and reuse
5	Update GWP factors for refrigerants, refrigerant substitutes, and 10-year emission rates
6	Allow ODS sourced from the federal government as eligible
7	Review the current American Carbon Registry (ACR) ODS protocol

Item	Recommendations
	Modification(s) to Mine Methane Capture (MMC) protocol
8	Update MMC protocol to facilitate more projects that will reduce venting methane. Possible updates include: a) simplify quantification methodology by revising the equations to focus on eligible methane destruction activity; b) remove the decline curve concept from quantification of abandoned mine methane projects; c) remove or modify the prohibition on natural gas pipeline projects at active mines; and d) consider ways to remove economic barriers to participation due to upfront costs and threat that payback period may be cut off if legal requirements are later adopted and projects are no longer considered additional

II. NEW PROJECT TYPE: URBAN FOREST MANAGEMENT

Summary Recommendation:

The Subgroup recommends that CARB consider adopting the Climate Action Reserve (CAR) Urban Forest Management Protocol v.1.1 after making modifications to address ongoing issues such as cost and scale. The existing Compliance Offset Protocol for Urban Forests is primarily a tree planting protocol and has fundamentally difficult economics, which make it unlikely to be a viable option even with substantial modifications. Therefore, it is the recommendation of this subgroup that CARB prioritize its efforts on revising and adopting the Urban Forest Management (UFM) Protocol rather than in modifying the existing compliance tree planting protocol.

A. Role of Project Type in Climate Change Mitigation

Cities and towns make up about 3.6% of the land area of the lower 48 states, but they contain 80% of the population (Merrill and Leatherby, 2018). Urban land in the conterminous United States is projected to increase in the future, to 8.6% in 2060. This projected change would be an increase of 95.5 million acres over 50 years, which is an increase in urban area larger than the state of Montana (Nowak and Greenfield, 2018a). As a result of these demographics, millions of people depend on the ecosystem services provided by urban trees.

Total carbon storage in U.S. urban trees is estimated at 643 million tonnes with estimated annual sequestration of approximately 25.6 million tonnes per year (Nowak et al. 2013). Urban trees also contribute indirectly to greenhouse gas reductions through shading and reduced energy consumption in homes and commercial buildings.

Urban trees remove pollutants such as ozone, nitrogen dioxide, sulfur dioxide, and particulate matter from the air through surface deposition or leaf uptake (Nowak and

Greenfield, 2018b). They contribute to stormwater management and reduced runoff, natural water filtration and groundwater recharge. Additionally, they have been shown to significantly increase property values. Research also suggests that urban forests promote overall human health and wellbeing in a variety of ways, including contributing to reductions in obesity, stress and depression, improved productivity and educational outcomes, and reduced incidences of asthma and heart disease among residents (McDonald et al., 2017).

A recent study showed a loss of urban and community tree cover in the U.S. of approximately 175,000 acres per year during the period 2009-2014. All but six out of the 50 states plus the District of Columbia saw a loss of canopy cover and only three saw an increase over this period (Nowak and Greenfield, 2018a). Over the 5-year study period, this equates to a loss of land area the size of the 12 cities of New York, Atlanta, Philadelphia, Miami, Boston, Cleveland, Pittsburgh, St. Louis, Portland, San Francisco, Seattle, and Boise combined (McMichael et al. 2019).

Despite the myriad benefits of urban forests and strong stakeholder interest in opportunities for generating carbon credits from urban forest projects, there have been no urban forest carbon projects to date that follow either CARB's Compliance Offset Protocol or CAR's voluntary urban forest methodologies. CAR's first voluntary urban tree planting protocol was adopted in 2008, over 12 years ago, and despite much interest over the years, no urban forestry projects have been developed. There have been a small number of projects developed under the voluntary City Forest Credits program, which has its own protocols for urban tree planting and preservation projects, as well as its own registry for issuing and tracking carbon credits. Some of the barriers to broader participation in urban forest carbon projects include cost, scale, timing of revenues from carbon credits, and issues of ownership and liability.

B. Development of Project Type

To develop this recommendation, the subgroup relied on white papers, peer reviewed research, a review of voluntary urban forest protocols – primarily the CAR Protocol and City Forest Credits Protocols – and discussion with the Climate Action Reserve. The subgroup looks forward to receiving public comment and engaging with additional stakeholders on this topic.

C. Description of Project Type

The project type under the existing Compliance Offset Protocol for Urban Forest Projects, which was adopted in 2011, is a "planned set of tree planting and maintenance activities to permanently increase carbon storage in trees. This protocol is based on The Climate Action Reserve's Urban Forest Project Protocol Version 1.11 (CAR 2010)." This Protocol is limited to tree planting and maintenance activities and has the following challenges:

- Cost
    - Protocol relies on annual field-based inventory of tree planting locations, which is time consuming and expensive
    - Remote sampling of project trees is not allowed
- Baseline is difficult to exceed
    - Number of new tree planting sites must increase (not just number of trees or amount of carbon stored in the trees)
- Difficult to aggregate and scale
- Does not have a buffer pool contribution for unintentional reversals, which might make some potential project developers wary of participating.

Since 2011, CAR has developed a new type of Urban Forest Protocol that focuses on Urban Forest Management (UFM) activities that consists of:

"A planned set of activities designed to increase removals of CO_2 from the atmosphere, or reduce or prevent emissions of CO_2 to the atmosphere, through increasing and/or conserving urban forest Carbon Stocks…Eligible management activities may include, but are not limited to:

- Increasing the urban forest productivity by removing diseased and suppressed trees
- Reducing emissions by avoiding tree removals
- Planting additional trees on available and appropriate sites
- Monitoring, protecting, and treating trees to avoid premature mortality from stressors such as drought, pests, storm damage, and abiotic agents
- Reducing the vulnerability of trees to impacts of climate change by increasing resilience" (CAR, 2019).

Some of the advantages of this new project type are:

- Allowing a range of management activities to maintain and increase canopy cover, not just new tree planting
- Reliance on remote sensing technology to bring costs down
    - Measuring urban forest canopy cover can be done via remote sensing, satellite imagery, and tools like iTree Canopy
- Reliance on standardized modeling and quantification tools to bring costs down
    - Carbon storage is quantified based on a relationship between canopy cover and carbon storage. The amount of carbon per acre of canopy cover is referred to as a ratio estimator. Projects may use default ratio estimators published by the Reserve which are based on research by Nowak et al. 2013 and vary by project location (city and/or region). Default estimators offer an alternative means for forest owners to develop an urban forest carbon inventory in lieu of field sampling.
- Greater potential for scale

    - The scope of a project can be one or more counties, municipalities, educational institutions, utilities/special districts, or Urban Forest Owners that own a minimum of 50 acres (referred to as Large Urban Forest Owners). Aggregation is also explicitly allowed and Urban Forest Owners can combine projects with other Urban Forest Owners.
- Buffer pool
    - UFM Projects contribute 6% of their credits to a Buffer Pool any time they are issued credits for verified GHG reductions and removals. Buffer Pool credits are used to compensate for Unavoidable Reversals that are not due to the Project Operator's negligence, gross negligence or willful intent. Examples include reduced vigor or mortality due to pollution or insects and disease.

Areas for further work to improve usability of the UFM Protocol include:

- Baseline
    - The current UFM Protocol requires developing a project-specific historical trend line between two previous estimates of carbon stocks that are at least 10 years apart. Historical carbon stocks are based on using tree canopy estimates from remotely sensed data and applying the default ratio estimators. The resulting trend line is extended 25 years into the future beginning from the Project Start Date and then held steady for the remainder of the 100-year projection.
    - Taking two points in time and trying to infer a trend that is applicable to the future is a difficult undertaking. It could also be subject to differing results, depending on which two dates are selected. Finally, it could disincentivize jurisdictions that have made progress on increasing urban forest canopy in the past but may not have the resources to maintain it going forward and thus face an uncertain future.
    - Instead of using project-specific historical trends, consider using pre-determined regional trends based on recent research (e.g., Nowak and Greenfield, 2018a). This approach would be similar to the regional common practice values for rural forest projects under the Compliance Offset Protocol for U.S. Forests.
- Ownership and liability issues
    - The current UFM Protocol requires that in all cases where multiple Urban Forest Owners participate in a project, an agreement must be secured from all Urban Forest Owners and this agreement must give any of the Urban Forest Owners the opportunity to opt out of the project. This provision has some clear benefits and supports the goal of public participation, but also poses practical challenges and may limit the inclusion of large numbers of urban trees on private property, such as in yards. It could also pose barriers to projects that might be developed as a result of municipal, county or even state-level policy initiatives.

D. AB 32 Criteria

a. **Real:** UFM GHG reductions or removals are achieved when measurable urban forest carbon stocks exceed the baseline.
b. **Additional:** The high cost of urban forest activities and declining trends in urban forest canopy cover nationwide support the fact this project type is additional to business-as-usual. In addition, individual projects must demonstrate that they meet two tests of additionality:
    i. Legal requirement test: UFM Projects must achieve GHG reductions or removals above and beyond compliance with any federal, state, or local law, statute, rule, regulation, or ordinance, as well as any court order or other legally binding mandates.
    ii. Performance standard test: UFM projects must maintain carbon stocks above the business-as-usual baseline.
c. **Quantifiable:** The Protocol contains specific guidance on how to measure, quantify, and track carbon stocks in urban forests.
d. **Permanent:** Projects must monitor, report, and undergo verification activities for 100 years following the last credit issued to the project. There are also provisions in place that address reversals to urban forest carbon stocks and require compensation for reversals.
e. **Verifiable**: The Protocol requires regular third-party verification to independently confirm carbon estimates and general conformance with Protocol requirements.
f. **Enforceable**: The Protocol requires regular monitoring, reporting, and verification for life of the project. It also requires a Project Implementation Agreement executed with CAR to give CAR enforcement authority over the project (which would not be required under the compliance program with enforcement authority exercised by CARB).

For more detailed information, please refer to the CAR Protocol (2019).

E. Direct Environmental Benefits in the State (DEBS)

The following excerpt is from CARB's determination that projects following the existing Compliance Offset Protocol for Urban Forest Projects automatically meet the definition of providing Direct Environmental Benefits in the State (DEBS) if the projects are located within the state. These same benefits would also apply to projects following the Urban Forest Management Protocol.

> "Urban and U.S. forest projects deliver air quality benefits by the cooling effect of tree shade (for urban projects) and by removing certain pollutants (leaves and needles have surface area that can allow for removal (deposition) of ozone, nitrogen dioxide, and to a lesser extent particulate matter). (CARB 2012) Healthy forests, with reduced fuel loads, help reduce the risk of wildfire and local air quality risks. (Forest Climate Action Team 2018) In addition, healthy forests, with improved management and/or avoided conversion projects, reduce the risk of runoff into

waters of the state. (CARB 2017a) Moreover, reduced harvesting will reduce fossil fuel usage by equipment and vehicles which will result in reduced energy consumption (CEC 2005) and reduced criteria, toxic, and GHG emissions that are not accounted for in the protocol. All of these benefits are in addition to the GHG reductions for which urban and U.S. forest projects would receive credits for and these project types located within the state therefore provide DEBS." Available online at https://ww2.arb.ca.gov/our-work/programs/compliance-offset-program/direct-environmental-benefits

F. Disadvantaged Communities, Native American or Tribal Lands, and Rural and Agricultural Regions

Low-income communities tend to receive less than an equal share of urban forestry and other "green infrastructure" investments, and as a result live in areas with fewer trees and parks, more paved surfaces, and lower air and water quality (Enelow et al., 2017). By stemming declines in urban tree canopy and increasing the prevalence of trees within urban areas, this protocol type would benefit disadvantaged communities that typically do not benefit equitably from the ecosystem services that urban forests provide.

UFM Projects under the CAR Protocol must consider the potential for negative social externalities in their project design to minimize the potential for uneven distribution of project benefits (e.g., project sites favored in affluent communities). Elements that must be addressed in project design include 1) an equitable distribution of forest resources between communities and 2) adequate notification and opportunities for public participation related to urban forest management activities.

G. Cost Barriers

Cost is the single largest deterrent to undertaking an urban forest project. Urban forests are already considered a significant cost area for most jurisdictions, which require annual budget allocations and other sources of public and private funding. Carbon credits alone are unlikely to be enough to cover the costs of urban forest management activities, so there will be continued need for additional funding. For urban forest offset projects to be viable, it is imperative that the costs of offset project development, verification and long-term monitoring and maintenance be manageable yet sufficient to ensure the integrity of the offset project.

Before being adopted by CARB, additional modifications to the CAR Urban Forest Management Protocol should be considered in consultation with stakeholders. See Section C for recommendations regarding areas for modification.

H. Market/Demand Implications

A white paper published by City Forest Credits in 2019 estimates that if 250 trees were planted in 20 neighborhoods in 50 cities, the projected carbon storage after 25 years of those 250,000 trees would equal almost 500,000 metric tons of CO_2e after accounting for mortality and a buffer pool contribution. The same paper estimates that if 50 acres of existing urban forest were preserved in 50 cities across the country, the avoided emissions from those 2,500 acres would equate to approximately 375,000 metric tons of CO_2e (McMichael et al. 2019).

With the vast majority of states experiencing urban forest cover decline, there appears to be substantial potential to stabilize if not increase urban tree cover in the U.S. through urban forest management activities such as conservation, better maintenance and increased tree planting. There is a broad range of stakeholder interest as well as public support for urban forest projects, both within California and across the country. There also appears to be interest from compliance buyers in purchasing offset credits from urban forest projects, especially those that provide DEBS.

Before being adopted by CARB, additional modifications to the CAR Urban Forest Management Protocol should be considered in consultation with stakeholders. See Section C for recommendations regarding areas for modification.

I. Joint Development of Projects

The CAR Protocol explicitly allows aggregation of smaller projects into a single combined project. This approach lowers transaction costs and promotes greater participation. However, issues of ownership and liability should be revisited prior to adopting the UFM Protocol so that additional barriers to aggregation can be addressed.

J. Leakage

The CAR Protocol states that biological emissions due to leakage are unlikely to be significantly different from baseline levels and are thus considered to be de minimis. If a project boundary contains most of the urban forest canopy in a jurisdiction (which is related to issues of project scale and ownership), then the risk that an increase in carbon stocks in one part of the urban forest will result in a decline in another part is low and would be accounted for in project quantification. There could theoretically be a risk that by maintaining and increasing urban forest cover in one jurisdiction, development could move to another jurisdiction without a carbon project and thus lead to greater loss of urban forest there. However, that risk is mitigated by the fact that urban forest cover is associated with higher property values and higher quality of life, which would suggest that strategic urban densification and infill development would be more beneficial in urban areas with greater canopy cover.

K. Perverse Incentives

One potential perverse incentive of the current CAR UFM Protocol is that because the baseline is calculated from project-specific trends in urban forest canopy cover, there could be a perverse incentive for jurisdictions to lower funding and investment in urban forestry prior to starting a carbon offset project so as to create a lower baseline for the carbon project. The likelihood of this happening is low but could be addressed by establishing regional trends rather than relying on project-specific trends (see Section C).

L. Jobs

Urban forest management projects, including tree planting and maintenance, require employment, skills development, and training. A study conducted by Ecotrust in partnership with PolicyLink and Verde discovered that in a case study of one Portland, Oregon-based urban forestry and "green infrastructure" contractor, each $1 million of direct economic activity generated by the company resulted in 16 direct jobs and 23 total jobs being created in the Greater Portland Metropolitan Region (Enelow et al., 2017).

M. Environmental Impacts

As discussed in Section A, urban forests provide myriad positive environmental, economic and social benefits. The primary negative impact is cost, but this can at least be partially addressed through carbon financing via offset project development. Some of the other potential negative impacts that could arise from urban forest projects include introduction of non-native or invasive species, damage to urban infrastructure, and inefficient water usage. These negative impacts can largely be mitigated through appropriate tree species selection and/or adequate ongoing maintenance, such as pruning. The CAR UFM Protocol currently requires projects to describe how these types of potential impacts will be addressed.

III. PROJECT TYPE: ODS/HIGH GWP SUBSTANCE DESTRUCTION

A. Role of Project Type in Climate Change Mitigation

The subgroup considered modifications to CARB's existing ODS GHG offset protocol.

B. Development of Project Type

Communication with Stephen Shelby (California Air Resources Board, ODS project lead), Derek Six (ClimeCo Corp.), Erik Ripley (American Carbon Registry), Holly Davidson (Climate Action Reserve), Halon Recycling Corporation, and Jay Wintergreen (First Environmental).

C. Description of Project Type

Add R-22 (and other common HCFCs possibly including R-134a, R-125, R-32, and R-143a) to the list of eligible refrigerant ODS's.

Further evaluation is required to determine if halons should be added to the list of eligible refrigerant ODS's. Some commenters argue that halons should not be added as they are critically needed (provide a unique function for numerous applications), are in short supply, and there are no feasible or practicable replacements. Others think they should be added as they are already part of an OPR ODS voluntary protocol, they are already being phase out of production and it is better to destroy them as soon as possible, and there are alternatives with lower GWP that can provide the same function. Both positions appear credible.

Restrict the liability to have offset credits disqualified or discounted if the ODS destruction facility is not meeting regulatory compliance only for non-compliance events directly impacting ODS handling and destruction and emissions from ODS processing (such as system residence time, temperature, emissions source testing), and not to non-compliance events that have no impact on ODS processing.

Review, document, and update as appropriate the ODS "10-year Cumulative Emission Rate" (10-year lifecycle loss factors) of Appendix B, Table B-1.

For ODS foam, change the baseline from the existing protocol which assumes long term disposal in landfill (with very little loss to the atmosphere) to what is the current practice of recovery and reuse (with much higher rate of loss to the atmosphere).

Review and update as appropriate GWP factors for refrigerants and refrigerant substitutes.

Allow ODS sourced from the federal government as eligible.

Review the current ACR ODS protocol which includes numerous corrections and additions to the existing CARB protocol, including a significantly revised foam handling procedure, but not adding halons.

D. AB 32 Criteria

Real: Offsets under the suggested modifications would be real, for identical reasons consistent with the existing protocol.

Additional: There is no regulatory requirement for any of the suggested modifications. Nor, absent the financial incentive provided by an offset credit, would projects under the suggested modifications be expected to occur in a conservative business-as-usual scenario.

Quantifiable: Offsets under the suggested modifications would be quantifiable, for identical reasons consistent with the existing protocol.

Permanent: Offsets under the suggested modifications would be permanent, for identical reasons consistent with the existing protocol, i.e., thermal destruction.

Verifiable: Offsets under the suggested modifications would be verifiable, for identical reasons consistent with existing protocol.

Enforceable: Offsets under the suggested modifications would be enforceable, for identical reasons consistent with existing protocol.

E. Direct Environmental Benefits in the State (DEBS)

DEBS will be roughly the same as with the existing protocol; most destruction occurs outside of California but the amount of ODS from California sources could increase.

F. Disadvantaged Communities, Native American or Tribal Lands, and Rural and Agricultural Regions

No anticipated adverse impacts.

G. Cost Barriers

Same as existing protocol.

H. Market/Demand Implications

Will increase use of the existing protocol.

I. Joint Development of Projects

Will increase use of the existing protocol.

J. Leakage

No anticipated leakage issues, same as existing protocol.

K. Perverse Incentives

No anticipated perverse incentives, same as existing protocol.

L. Jobs

Will increase use of existing protocol and associated jobs.

M. Environmental Impacts

No anticipated adverse impacts, same as existing protocol.

IV. PROJECT TYPE: MINE METHANE CAPTURE

Summary Recommendation:

The subgroup recommends that CARB consider ways to expand the Mine Methane Capture (MMC) protocol to increase use. As described in CARB's ISOR for the MMC protocol, mining activities in the United States release tens of millions of metric tons of carbon dioxide equivalent ($MMtCO_2e$) per year but only a fraction of that methane is captured and destroyed. Mining-related emissions accounted for nearly 12% of U.S. anthropogenic methane emissions and 1% of total U.S. GHG emissions in 2011 (U.S. EPA 2013). While there are mine safety regulations that address methane levels and concentrations to protect mine workers, no regulations currently exist prohibiting the venting of mine gas from drainage systems or ventilation air methane from ventilation systems or requiring the destruction of this methane. Further, as CARB notes, as active

mines continue to close and are abandoned, methane venting will initially decrease but does not stop and, after the initial decline, can continue at a near-steady rate for decades. Thus, the MMC protocol has the potential to fill an important gap in the regulatory structure. However, to date only a small number of MMC projects have been credited, reflecting destruction of approximately 7 $MMtCO_2e$ (CARB Offset Credit Issuance Table, updated as of 9/23/20). Accordingly, CARB should consider adjustments to the Protocol to facilitate more projects that will reduce the venting of methane.

A. Role of Project Type in Climate Change Mitigation

Per template, N/A for modification of existing protocol.

B. Development of Project Type

To develop this recommendation, the subgroup reviewed the CARB and CAR MMC protocols and had discussions with CARB staff member Jeff Coronado and Holly Davison of CAR. The subgroup also received written suggestions from the American Carbon Registry. We also reviewed public comments on CARB and CAR's protocols and communicated with a project developer. The subgroup looks forward to receiving public comment and engaging with additional stakeholders on this topic.

C. Description of Project Type

The project type is fully set forth in CARB's MMC Projects Protocol and ISOR. As CARB notes in the ISOR, the MMC Protocol is the first "umbrella style" protocol for mine methane, covering emissions from active underground mines, active surface mines, and abandoned underground mines. In Subsections G and H below, the subgroup presents possible modifications for CARB to consider to address barriers to use of the existing Protocol.

D. AB 32 Criteria

- **Real:** CARB's existing MMC Protocol demonstrates that the reductions are real – MMC GHG reductions are achieved when measurable quantities of methane above the baseline are destroyed.
- **Additional:** CARB's existing MMC protocol demonstrates the additionality of these projects. As discussed above, there is no legal requirement for capture and destruction of vented mine methane. Nor are the projects occurring, absent the offset incentive, in a conservative, business-as-usual scenario. On the contrary, the incentive provided by the protocol does not appear to be sufficient to encourage MMC, given the small number of projects.
- **Quantifiable:** The MMC Protocol contains specific guidance on how to measure and quantify baseline and project scenarios. As discussed below in Subsection

H, one area for CARB's consideration is to alter a couple of aspects of quantification that could expand use of the MMC protocol and increase destruction of vented mine methane.

- **Permanent:** As set forth in the MMC Protocol, destruction of methane is permanent.
- **Verifiable:** The MMC Protocol requires regular third-party verification to independently confirm conformance with Protocol requirements, including efficacy of the destruction device and gas flow meters to confirm accuracy of measurement of the amount of methane destroyed.
- **Enforceable:** The MMC Protocol requires regular monitoring, reporting, and verification for life of the project.

E. Direct Environmental Benefits in the State (DEBS)

Direct Environmental Benefits in California are minimal. There are no coal mines in California and one trona mine in San Bernardino County. However, trona mines account for only two percent overall of methane vented from sources covered by the protocol. The main environmental impact of the trona mine in California is production of brine ponds that are harmful to avian species. Capture and destruction of vented methane would not address that harm. CARB's 2013 MMC Protocol ISOR evaluated general environmental impacts from MMC projects and concluded there is not significant adverse impact.

F. Disadvantaged Communities, Native American or Tribal Lands, and Rural and Agricultural Regions

MMC projects are located in rural areas but Surface Mining Control and Reclamation Act of 1977 (SMCRA) regulations include specific performance standards and siting criteria that establish buffering requirements for adjacent land uses. Thus, MMC projects would not impair disadvantaged rural communities and may provide some benefits to those communities insofar as they would reduce negative impacts of venting methane in those communities.

G. Cost Barriers

Describe the cost barriers for participants, including smaller participants, and recommendations for reducing these barriers.

Mine methane projects are very capital-intensive and require multi-year payback periods in order to be economically viable. Project developers have raised the concern that if legal requirements are later adopted that require methane destruction, then their projects would no longer be considered additional and the investment would be lost because of the loss of additionality. Therefore, some have requested that they be guaranteed a longer payback period even if legal requirements are later adopted. The subcommittee does not have a recommendation on this but acknowledges the dilemma.

H. Market/Demand Implications

Stakeholders have identified barriers to participation, other than cost. CARB could consider modifying the Protocol in the following ways to potentially increase the number of projects.

1. One possible modification is to simplify quantification methodology by revising the equations to focus on eligible methane destruction activity. Currently, the Protocol requires quantification for non-qualifying destruction that potentially occurs in the baseline. In practice, these components of the equations are rarely employed as it is rare that there has been baseline destruction activity.

2. Another possible modification is to remove the decline curve concept from quantification of abandoned mine methane projects (see quantification Section 5.4). This concept is meant to result in a conservative estimate of emissions that would occur from an abandoned mine in the absence of the project (the baseline) and utilizes various assumptions and methane emission data collected while the mine was active. However, some project developers have pointed out that there is often a lack of available emission data to accurately quantify methane emissions at a given interval. Certain mines have very few data points to construct a decline curve but nevertheless have measured methane emission rates high enough to support projects. In some cases measured emission rates may be well under the modeled decline curve but not in all cases. Nonetheless, methane is highly likely to emit from mine workings even if it can't be precisely determined when or the exact emission rate that would have occurred in the absence of the project. CARB should consider if there are ways to adjust its determination of baseline that maintains baseline integrity but does not disincentivize project developers from extracting and destroying methane that will otherwise be vented.

3. Another identified barrier is the prohibition on natural gas pipeline projects at active mines (see Section 3.4.2(b)(2)(B)) and abandoned mines (see section 3.4.2(b)(4)(B)) that injected gas to a pipeline while they were active. This prohibition lasts in perpetuity but project developers report that there are numerous sites across the country that stopped injecting gas to a pipeline due to issues such as encroaching mining (new degas wells were not connected to a pipeline) and very low gas prices. As a result, these methane sources have been venting to the atmosphere for many years. However, the protocol disallows these potential projects because the mine once injected gas to a pipeline, possibly long ago. CARB could consider either removing or modifying the prohibition.

I. Joint Development of Projects

As set forth in CARB's June 8, 2016 Compliance Offset Program Mine Methane Capture Projects Frequently Asked Questions document, the Protocol allows joint projects, e.g., multiple mines may be considered one project or multiple projects if each methane source from each mine is metered independently. Multiple mines with multiple mine operators may report and verify together as a single project per the requirements of Section 95977 of the Regulation and must follow all requirements under the MMC Protocol, specifically Subchapters 2.4 (c)(1-4), and 6.7.

J. Leakage

As set forth in CARB's 2013 MMC Projects ISOR, ARB staff examined the potential for leakage and determined that there is no risk of leakage associated with the MMC Protocol.

K. Perverse Incentives

One potential perverse inventive of MMC projects is that the revenue derived from sales of offset credits could extend the life of active coal mines that would otherwise close. However, given the low rate of adoption of MMC projects, the likelihood of the incentive making a significant enough difference to extend the life of a mine that would otherwise close is low.

L. Jobs

As set forth in CARB's 2013 MMC Protocol ISOR, there are a limited number of new employment opportunities associated with the construction and operation of the MMC projects

M. Environmental Impacts

The existing MMC Protocol's environmental impacts are already well documented in CARB's 2013 ISOR. If modifications were implemented to increase the amount MMC projects, then additional benefits could be achieved if captured mine methane is utilized for productive purposes such as the generation of electricity or thermal power, production of transportation fuel, or injection into a natural gas pipeline.

V. REFERENCES

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CARB Compliance Offset Protocol for Ozone Depleting Substances (ODS) Projects (November 14, 2014)

CARB Compliance Offset Protocol for Mine Methane Capture Projects (April 25, 2014)

Staff Report and Proposed Compliance Offset Protocol for Mine Methane Capture Projects (September 4, 2013).

CARB Compliance Offset Program Mine Methane Capture Projects Frequently Asked Questions (June 8, 2016)

Appendix A. List of Abbreviations and Acronyms

3NOP	3-nitrooxypropanol
AB	Assembly Bill
ACR	American Carbon Registry
AMMP	Alternative Manure Management Program
ARB or CARB	California Air Resources Board
ARBOC	ARB Offset Credit
CAR	Climate Action Reserve; see Reserve
CCI	California Climate Investments
CCO	California Carbon Offset
CCO0	CCO with no invalidation risk
CCO3	CCO with a 3-year invalidation period
CCO8	CCO with a 8-year invalidation period
CDFA	California Department of Food and Agriculture
CEQA	California Environmental Quality Act
CH_4	methane
cm	centimeter
CO_2	carbon dioxide
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
dbh	diameter at breast height
DDRDP	Dairy Digester Research and Development Program
DEBS	direct environmental benefits in the State
EJAC	Environmental Justice Advisory Committee
FDA	United States Food and Drug Administration
FIA	USDA Forest Service Forest Inventory and Analysis
FOP	Compliance Offset Protocol U.S. Forest Projects
GHG	greenhouse gas
GWP	global warming potential
HCFC	hydrochlorofluorocarbon
HSR	high stocking reference
IEMAC	Independent Emissions Market Advisory Committee
IFM	Improved Forest Management
IPCC	Intergovernmental Panel on Climate Change
ISOR	Initial Statement of Reasons
kg	kilogram
km	kilometer
mg	milligram
MMC	mine methane capture
MRV	monitoring, reporting, and verification
N_2O	nitrous oxide

NGO	non-governmental organization
NRCS	Natural Resources Conservation Service
ODS	ozone depleting substances
OPDR	Offset Project Data Report
OPO	Offset Project Operator
OPR	Offset Project Registry
QCE	Qualified Conservation Easement
QM	quantification methodology
Reserve	Climate Action Reserve; see CAR
ROC	Registry Offset Credit
SB	Senate Bill
SDI	subsurface drip irrigation
SLS	solids-liquids separation
SOC	soil organic carbon
SSR	GHG sources, sinks, reservoirs
Task Force	Compliance Offsets Protocol Task Force
tCO_2e	metric ton carbon dioxide equivalent
TEK	Traditional Ecological Knowledge
USDA	United States Department of Agriculture
VCS	Verified Carbon Standard
VS	volatile solids
yd	yard

Appendix B. Compliance Offsets Protocol Task Force Membership

Task Force Members

Stakeholder Group	Name
Scientists	Frank Mitloehner
Air pollution control and air quality management districts	Bruce Springsteen
Carbon market experts	Emily Warms
Tribal representatives	Tim Hayden
Environmental justice advocates	Neil Tangri (resigned on February 8, 2021)
Labor and workforce representatives	Antonio Sanchez
Forestry experts	David Ford
Agriculture experts	Robert Parkhurst
Environmental advocates	Brian Nowicki (resigned on February 8, 2021)
Conservation advocates	Constance Best
Dairy experts	Jean-Pierre "J.P." Cativiela
Public member (non-statutory)	Andrea Tuttle
Public member (non-statutory)	Gavin McCabe
Chair	Gavin McCabe

Affiliation and Statement of Financial Interest in Offsets (Optional)

The legislation establishing the Task Force (AB 398) requires that task force members be drawn from specified stakeholder groups, including, among others, persons with expertise in carbon markets, forestry, agriculture and dairy issues. Some of the stakeholder groups may have, in general, a financial interest in offsets and the offset market. The Legislature's inclusion of members from the cross-section of stakeholder groups reflects a determination that the knowledge, interest and experience of the full range of stakeholder interests is in the public interest for the purposes of the Task Force: to provide guidance to CARB in establishing new offset protocols for the Cap-and-Trade Program with direct environmental benefits in the state while prioritizing disadvantaged communities, Native American or tribal lands, and rural and agricultural regions.

Task Force members, and any disclosed affiliation and financial interests, are listed below. If no information is provided, "None disclosed" is noted.

Name: Frank Mitloehner, PhD
Affiliation: University of California, Davis
Financial Interest: None

Appendix B. Compliance Offsets Protocol Task Force Membership

Name:	Bruce Springsteen
Affiliation:	Placer County Air Pollution Control District
Financial Interest:	None disclosed

Name:	Emily Warms
Affiliation:	New Forests
Financial Interest:	New Forests has a financial interest in certain forest projects developed under the California offsets program. New Forests acts as an investment manager for institutional timberland owners and supports the management of these investments for the dual objectives of sustainable timber harvesting and carbon offset projects. Through its Forest Carbon Partners (FCP) fund specifically, New Forests has helped finance and develop 18 forest offset projects in partnership with a wide range of landowners, including Native American Tribes, Alaska Native Corporations, family forest landowners, land trusts and non-profits. FCP receives a minority percentage of revenue from the sale of offset credits from these projects; the majority of revenue goes directly to forest landowners. The revenue that New Forests derives from managed-fund offset sales comprises a very small portion of New Forests' total company-wide revenue. New Forests shares CARB and the Task Force's interest in improving the offsets program and broadening participation on a more equitable basis for all program participants, including small family forest landowners, Native American or tribal landowners, and other rural Environmental Justice communities.

Name:	Tim Hayden
Affiliation:	Yurok Tribe
Financial Interest:	None disclosed

Name:	Neil Tangri (resigned on February 8, 2021)
Affiliation:	Unaffiliated
Financial Interest:	None disclosed

Name:	Antonio Sanchez
Affiliation:	None disclosed
Financial Interest:	None disclosed

Name:	David Ford
Affiliation:	American Forest Foundation
Financial Interest:	None disclosed

Appendix B. Compliance Offsets Protocol Task Force Membership

Name:	Robert Parkhurst
Affiliation:	Sierra View Consulting
Financial Interest:	None disclosed
Name:	Brian Nowicki (resigned on February 8, 2021)
Affiliation:	Center for Biological Diversity
Financial Interest:	None disclosed
Name:	Connie Best
Affiliation:	Employee of the Pacific Forest Trust
Financial Interest:	Pacific Forest Trust manages the Van Eck Forest in Humboldt County, which is the site of a compliance offset project.
Name:	J.P. Cativiela
Affiliation:	Cogent Consulting and Communications, Inc.
Financial Interest:	None disclosed
Name:	Andrea Tuttle
Affiliation:	Public Member on Task Force
Financial Interest:	Retired consultant in forest and climate policy. No financial conflicts with my participation on this Task Force.
Name:	Gavin McCabe
Affiliation:	Public Member
Financial Interest:	None

Appendix C. Compliance Offsets Protocol Task Force Subgroup Membership

Overarching/Programmatic Considerations Subgroup

Name	Stakeholder Group
Emily Warms (chair)	Carbon market experts
David Ford	Forestry experts
Brian Nowicki (resigned on February 8, 2021)	Environmental advocates
Antonio Sanchez	Labor and workforce representatives
Neil Tangri (resigned on February 8, 2021)	Environmental justice advocates
Andrea Tuttle	Public member (non-statutory)

Blue Carbon and Wetlands Subgroup

Name	Stakeholder Group
Tim Hayden (chair)	Tribal representatives
Gavin McCabe	Public member (non-statutory)
Neil Tangri (resigned on February 8, 2021)	Environmental justice advocates
Andrea Tuttle	Public member (non-statutory)

Forestry Subgroup

Name	Stakeholder Group
David Ford (chair)	Forestry experts
Constance Best	Conservation advocates
Tim Hayden	Tribal representatives
Brian Nowicki (resigned on February 8, 2021)	Environmental advocates
Bruce Springsteen	Air pollution control and air quality management districts
Emily Warms	Carbon market experts

Livestock, Agriculture, and Rangelands Subgroup

Name	Stakeholder Group
J.P. Cativiela (co-chair)	Dairy experts
Robert Parkhurst (co-chair)	Agriculture experts
Tim Hayden	Tribal representatives
Frank Mitloehner	Scientists

Urban Forestry, High GWP (ODS), and Mine Methane Capture Subgroup

Name	Stakeholder Group
Gavin McCabe (chair)	Public member (non-statutory)
Antonio Sanchez	Labor and workforce representatives
Bruce Springsteen	Air pollution control and air quality management districts
Neil Tangri (resigned on February 8, 2021)	Environmental justice advocates
Emily Warms	Carbon market experts

Appendix D. Chapter 3: Analysis and Recommendations on Forestry

Items are included separately on the Compliance Offsets Protocol Task Force webpage.

Item A – Climate Action Reserve PowerPoint presentation dated May 29, 2020
Item B – Letter from American Carbon Registry dated July 31, 2020
Item C – Letter from California Council of Land Trusts dated November 22, 2019
Item D – Letter from California Forest Carbon Coalition dated July 10, 2020
Item E – Email from Parhelion Underwriting Inc dated September 8, 2020