**Agricultural and Ecosystems Subcommittee**

**(14) PATHWAY A - Maintain and expand Vermont’s natural and working lands’ role in the mitigation of climate change through human interventions to reduce the sources and enhance the sinks of greenhouse gases.**

**STRATEGIES AND ACTIONS**

1. **Leverage, expand, and adapt existing State of Vermont programs that support the agricultural sector’s mitigation of climate change through:** 
   * **Prevention—of emissions to the atmosphere by conserving existing carbon pools in soils or vegetation, or by reducing emissions of methane (CH4) and nitrous oxide (N2O);**
   * **Sequestration—by increasing the size of existing carbon pools, and thereby extracting carbon dioxide (CO2) from the atmosphere; and**
   * **Substitution—substituting of biological products for fossil fuels or energy-intensive products, thereby reducing CO2 emissions.**
   1. Implement agronomic practices that reduce tillage and increase vegetative cover, e.g. no-till, cover crop.
   2. Expand Capital Equipment Assistance Program (CEAP) program to extend beyond water quality and incorporate climate change criteria.
   3. Implement grazing practices that increase vegetative cover and forage quality, e.g. rotational grazing.
   4. Implement agroforestry and silvopasture practices that integrate woody vegetation in agricultural production.
   5. Implement edge-of-field practices that increase herbaceous and woody vegetation, e.g. riparian forest buffer (e.g. CREP).
   6. Implement natural resource restoration practices that support climate mitigation and resilience, including river corridor easements, wetland restoration, and afforestation practices with consideration to agricultural land loss.
   7. Implement Nutrient Management and Amendments (e.g. biochar, compost) on cropland and grazing land.
   8. Implement methane capture and energy generation on farms, e.g. anaerobic digesters and covers.
   9. Research into improved manure management and storage.
   10. Research and develop a climate feed management program, including both feed amendments (e.g. seaweed, biochar) and feed quality (e.g. forage quality) to reduce enteric methane emissions; consider downstream impacts, sustainability and equity.

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| *Preliminary Assessment of Strategy against Criteria* |
| *Impact:* Over 300,000 acres of cumulative agricultural conservation practices have been implemented by farmers in Vermont since 2016.[[1]](#footnote-2) The adoption of natural climate solutions (NCS) and technologies to address water quality impacts on farms have co-benefits for GHG mitigation goals in Vermont. USDA reports that mitigation efforts across agricultural cropland management, manure management, and pasture management can provide over 70 Tg of CO2-e emission reduction across the United States.[[2]](#footnote-3) |
| *Equity:* Soil health can be improved across all sectors of Vermont agriculture. Access to state programs is coordinate with federal programs to attempt to provide the most coverage for different sized farms with different planning and management goals. |
| *Cost-effectiveness*: A 2021 study reports that in Canada, agricultural cropland management could provide the most GHG mitigation potential by 2030 at the most cost-effective price point across all NCS sectors, with over 68% of the 44.4 Mt CO2-e mitigation potential for agriculture costing less than $100/t CO-e.[[3]](#footnote-4) Quantifying the benefit of existing agricultural conservation practices and extending their reach is an immediate first step Vermont can take to mitigate agricultural GHG emissions. |
| *Co-Benefits:* Vermont’s air, biodiversity, soil, water, and social considerations are improved through the implementation of existing agricultural conservation programming described in actions (a) – (j) above. Specific examples of co-benefits in addition to GHG mitigation potential include:  • Overall adaptation, resilience, and water quality benefits  • Reduced soil erosion  • Reduced nutrient runoff  • Increase on soil organic matter (soil health, infiltration, water storage)  • Reduced flooding  • Resilience to drought and extreme rain events  • Reduced nitrogen fertilizer if planting legumes  • Reduced ground temperatures due to albedo effect of plant cover |
| *Technical Feasibility*: Yes |

1. **Create system for tracking and accounting metrics and indicators for natural and working lands.** The tracking and accounting for emissions reductions and sequestration are inadequate for natural and working lands and need improvement. Extensive datasets exist for water quality implementation but need specific quantification for climate mitigation (a). Additionally, the current tools used for quantification are inadequate for the complicated management mechanisms and natural processes occurring on natural and working lands that lead to climate mitigation (b). Finally, update the state’s inventory to reflect guidance issues by the IPCC to account for net emissions. Adequately tracking and accounting for emissions gains and losses from natural and working lands is essential to justly credit and further incentivize ongoing climate mitigation work by farmers, foresters, and other land managers.
   1. Develop a methodology and protocol for quantifying climate mitigation, resilience, and adaptation impacts of existing state and federal water quality implementation programs as reported through the annual Clean Water Initiative Performance Report.

The Clean Water Initiative Performance Report “summarizes the State of Vermont’s clean water efforts and demonstrates how investments are making a difference through accountability measures.” As mentioned, most water quality conservation practices and programs also have climate mitigation, resilience, and adaptation benefits. Recommend using existing tracking systems and quantify the climate benefits from this existing implementation and data tracking. The data spans state and federal funding programs and regulatory programs that drive clean water efforts and coordinates across agencies to track these efforts and monitor progress.

* 1. The Vermont Climate Council has recommended developing and issuing a Request for Proposals (RFP) that will review and analyze methodological gaps of emission inventory tools currently used by the State of Vermont to quantify greenhouse gas emissions for evaluating changes in the Agriculture, Forestry and Other Land Use (AFOLU) sector and the tools’ alignment with the Intergovernmental Panel on Climate Change (IPCC), Environmental Protection Agency (EPA), and peer state methodologies and approaches. The specific recommendations for this RFP can be found in the Carbon Budget Report memo found in Appendix XX
  2. Based on the findings of the technical RFP mentioned in action step b of this strategy, the VCC should consider reccomending that the State of Vermont GHG emissions inventory protocol established in 10 V.S.A. § 582 should be amended to include an inventory of GHG emissions that align with the intent and standards of the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories that will include a net GHG emission accounting for the agriculture, forestry and other land use (AFOLU) sector.

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| *Preliminary Assessment of Strategy against Criteria* |
| *Impact:* Currently, agricultural mitigation in the form of management practices that reduce emissions from identified source as well as sequestration on agricultural cropland is not counted in the current GHG Emissions Inventory. With over 300,000 acres of agricultural conservation practice implementation since 2016 that have GHG mitigation potential and associated Emission Reduction Coefficients – these practices are currently tracked but not counted for agricultural mitigation. The scale of mitigation from the agricultural sector has been identified by a Canadian study to be the largest single opportunity amongst all evaluated Natural Climate Solutions (NCS) – the potential scale of impact for mitigation is large in Vermont if mitigation potentials are counted through the VT GHG Emission Inventory. |
| *Equity:* The current GHG Emissions Inventory only quantifies non-CO2 emissions from the agricultural sector. Absent from current Emission accounting are the stocks and fluxes of CO2 from agricultural cropland – management impacts are also not provided for in the current GHG Emissions Inventory for agriculture. Ensuring that the State of Vermont GHG Emissions Inventory comports with IPCC standards is essential for an equitable accounting for the AFOLU sector. |
| *Cost-effectiveness*: Over 300,000 acres of agricultural conservation practices have been tracked on an acre-by-acre basis through state and federal programs since 2016 for water quality improvement metrics. Development and implementation of a protocol to count existing agricultural programming that has co-benefits for agriculture is a cost-effective approach that leverages existing programs. |
| *Co-Benefits:* Co-benefits for water quality are tracked through existing state and federal tracking mechanism which are quantified for phosphorus reduction benefits for water quality. |
| *Technical Feasibility*: Yes |

1. **Implement a Payment for Ecosystem Services (PES) program for natural and working lands.** Managers of natural and working lands, including farmers and foresters, provide important environmental or ecosystem services to the public, such as clean air and water, reduced flooding, or sequestration and storage of carbon. A Payment for Ecosystem Services (PES) program compensates land managers for these services they provide through a quantifiable and verifiable framework. It is important to provide compensation for the benefits of good land management to justly credit and further incentivize implementation. PES programs vary in design and could focus on particular ecosystem services or land uses, i.e. (a) farms or (b) forests, or both, and could offer direct payments or other financial compensation, such as tax credits (c). Regardless of design, PES is an innovative and important mechanism to further climate mitigation occurring on natural and working lands.
   1. **Develop and implement a PES program for healthy soils and soil carbon sequestration on farms.**

Act 83 of 2019 convened the Payment for Ecosystems Services working group whose purpose is to recommend financial incentives designed to encourage farmers in Vermont to implement agricultural practices that improve soil health, enhance crop resilience, increase carbon storage and stormwater storage capacity, and reduce agricultural runoff to waters. Final program recommendations from the PES Working Group are due in January, 2023.

* 1. **Develop and implement a PES program for forestland owners including water filtration/cycling, carbon sequestration, etc.**
  2. **Incentivize management for ecosystem services through a tax credit system that compensates landowners/managers for maintaining or restoring ecosystem services**.

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| *Preliminary Assessment of Strategy against Criteria* |
| *Impact:* A PES program – as conceived for Vermont – seeks to leverage Vermont’s natural and working lands (NWLs) to deliver ecosystem services on a performance basis that provides cost-effective additionality to Vermont’s existing environmental programming. Quantifying whole-farm and whole-parcel management and the entirety of bundled or stacked practices can help provide a fuller picture of ecosystem service benefit Vermont’s NWLs can deliver for Vermont’s climate goals. |
| *Equity:* A core consideration for the development of a PES Program in Vermont is how to ensure a program is implemented equitably – should payments be based on annual, incremental environmental benefit, or threshold based with payments above a set additionality. Goals of a PES Program are to be inclusive of the multiple agricultural sectors in Vermont, not just the largest land users and managers. |
| *Cost-effectiveness*: Literature suggests that natural and working lands and the application of natural climate solutions (NCS) are cost-effective, immediate, and permanent contributions to GHG mitigation efforts that can be deployed across land uses at rates well below the social cost of carbon.[[4]](#footnote-5) |
| *Co-Benefits:* The PES Working Group has identified water quality, climate change mitigation, and watershed resilience as the three focus areas for evaluation and payment in a PES program around soil health. Multiple more co-benefits can be quantified through the enhancement of soil health. |
| *Technical Feasibility*: Yes |

1. **~~Support and empower Vermont’s farmers, foresters, and land workers to reduce greenhouse gas emissions from their operation~~s Utilize existing state programs to address upstream waste and downstream emissions from food waste and other synthetic fossil-fuel based inputs.**
   1. **Develop program for tracking and limiting the use of chemicals, substances, or products that contribute to climate change in Vermont and leverage existing legislative activity on this topic.**

VAAFM currently tracks statewide commercial pesticide use as well as statewide fertilizer use. This data is currently used to establish trends in the use of these inputs as our agricultural systems evolve.

Programs to track these agricultural inputs already exist in the Agency but have never been assessed through the lens of contributions to climate change. The Agency or the new newly established Agricultural Innovation Board (AIB) can prioritize an assessment of the impacts and benefits our agronomic systems have on offsetting climate change.

* 1. **The state should identify simple, low- and no-cost mechanisms to increase organics diversion and provide incentives and business and workforce development to private organics haulers and composters (including farms). ~~Examples: encourage town-wide organics hauling, encourage innovation by broadening rules for food scrap collection sites, and support community composting at small businesses through small grants for materials and training.~~**

Act 41 of 2021 created an Agricultural Residuals Management Program to be administered by VAAFM. The purposes of this new chapter of law is to establish a program for the management of residual wastes generated, imported to, or managed on a farm for farming in Vermont.

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| *Preliminary Assessment of Strategy against Criteria* |
| *Impact:* Based on advice of the Agricultural Innovation Board (AIB) the Secretary of Agriculture may make, adopt, revise and amend reasonable rules he or she deems necessary with the advice of the AIB. |
| *Equity:* The AIB includes 13 members named by the General Assembly which represent multiple stakeholders in the process – farmer input is embedded in the process with required farmer surveys in every county to better help understand farm use of inputs. |
| *Cost-effectiveness*: Leveraging existing state processes ensure no duplication of efforts and that available resources are targeted for maximal impact. |
| *Co-Benefits:* Reduction of external inputs for farming operations can help reduce operating costs and increase farm profitability. Co-benefits for soil health if composting of food residuals and application to cropland is conducted in conformance with state requirements. |
| *Technical Feasibility*: Yes |

1. **Develop and implement programs which incentivize management practices which maintain or increase forest carbon storage** Approximately 80% of Vermont’s 4.5M acres of forestland are in private ownership. Private forestland owners in Vermont have the opportunity to take meaningful action towards mitigating the impacts of climate change and building resiliency in our forests, but are generally excluded from traditional carbon markets (and the associated revenue, which could enable these actions) due to the average parcel size and the high up-front cost associated with developing such complex projects. Models which provide for incentive payments to landowners who adopt specific Improved Forest Management practices which measurably enhance carbon sequestration could provide the economic opportunity which is currently missing.
   1. Create or adopt existing certification standards ~~(similar to what is used by American Tree Farm System)~~ where management activities account for principles of Improved Forest Management towards increased carbon storage, as well as maintaining and creating resiliency (as described in existing state guidance such as *Maintaining and Creating Resilient Forests in Vermont: Adapting Forests to Climate Change*, VTFPR 2015, or as modeled in existing programs such as the American Forest Foundation’s *Family Forest Carbon Program*).
   2. ~~Utilize~~ Apply these certification standards ~~for~~ to the procurement of forest products utilized in ~~any~~ energy or thermal generation facilities subject to PSB oversight (parallel to the existing review ~~by biologist~~ for state mapped deer winter yard, etc.) through potential revisions to the renewable energy standard.
   3. Explore additional market opportunities for certified products, expanding the potential revenue base to support Improvement Forest Management (parallel FSC, SFI, etc)

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| *Preliminary Assessment of Strategy against Criteria* |
| *Impact:* 80% of Vermont’s forests are in private ownership. Vermont's forests store over 1.7 billion metric tons (Mt) of CO2 equivalent (CO2e) and sequester (take in) more than 5 million Mt CO2e each year |
| *Equity:* Expands opportunity to smaller ‘Vermont Scale’ forest landowners who would otherwise be excluded from traditional carbon markets; removes significant upfront capital requirements which would otherwise be a barrier |
| *Cost-effectiveness*: Potentially allows smaller forestland owners to access climate finance (private capital) from existing markets; leverages market-based incentives for adoption of practices |
| *Co-Benefits:* Sustaining all fundamental ecological functions of intact forests |
| *Technical Feasibility*: Yes |

1. **Leverage market-based solutions, such as existing or new regional carbon market opportunities, to incentivize forest management practices which sequester and store greater amounts of carbon in our forests.** Carbon markets provide a largely untapped opportunity for forestland owners in Vermont. The generation of carbon offset credits can provide a significant revenue stream to forestland owners, increasing capacity for improved management, and the ability to hold and maintain intact forestland. Financially viable projects generally require large (5,000+ acre) ownerships, therefore aggregation for parcels (generally 200+ acres in size) is critical for viability, Aggregation is currently allowed for under existing Voluntary Market standards. These opportunities build on existing incentives and/or provide synergy from multiple stewardship mechanisms. Recent spatial analysis by the Vermont Land Trust and UVM Carbon Dynamics Lab has identified close to 330,000 acres in privately held forest parcels > 500 acres in size which could be eligible for such aggregation opportunities. In terms of conservation priority, these parcels present the greatest opportunity for aggregated carbon projects to contribute to the sustainability and ecological functionality of Vermont’s working landscape through the maintenance of these forests and the Improved Forest Management practices employed.

* 1. Work to develop a new Vermont-Based or regional (modeled on RGGI) Carbon Credit marketplace with necessary research and standards which address concerns around the efficacy of baseline establishment, accounting for additionality, the potential for leakage, and address equity for the diversity of wood lot owners across the state
  2. Incentivize the in-state purchase of carbon credits developed by Vermont-based or regional carbon projects through a system which addresses concerns of accounting (i.e. additionality and leakage)

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| *Equity:* Such models could still exclude smaller forest holdings (<200 acres, which could potentially access practice based payments as described in preceding strategy) but would provide an opportunity for mid-sized forestland owners currently excluded from existing markets. |
| *Cost-effectiveness*: Potentially allows smaller forestland owners to access climate finance (private capital) from existing markets; leverages market based incentives for adoption of practices |
| *Co-Benefits:* Sustaining all fundamental ecological functions of intact forests |
| *Technical Feasibility*: Yes |

1. **Increase tree coverage.** Trees remove carbon dioxide from the atmosphere through the process of photosynthesis, and capture that carbon in the form of wood or other organic matter. Trees remain the most efficient and cost-effective form of carbon capture technology at scale presently available.
   1. Expand tree and other planting efforts on private land to promote restoration efforts to reforest riparian areas, wetland buffers, and degraded lands.
   2. Expand funding and support to the Vermont Community Canopy Program.
   3. Provide incentives for restoration and expansion of floodplain forests.
   4. Increase funding to tree planting via Renewable Energy Standard (RES).
   5. Increase support, funding, and education for increased urban tree planting efforts expansion to increase access to natural spaces and improve carbon sequestration/storage in the urban environment.

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| *Preliminary Assessment of Strategy against Criteria* |
| *Impact:* Impact is scaled to the degree of increased tree cover; a typical hardwood tree can absorb as much as 48 pounds of carbon dioxide per year, sequestering approximately 1 ton of carbon dioxide by the time it reaches 40 years old |
| *Equity:* The financial capacity to support planting efforts presents a potential barrier. Afforestation efforts will need to account for land use changes which impact existing use. |
| *Cost-effectiveness*: High |
| *Co-Benefits:* Mitigation of heat island effects in urban areas; associated impacts to water quality and landscape scale restoration; wildlife habitat enhancement; aesthetics |
| *Technical Feasibility*: Yes |

1. 2020 DEC Clean water investment report [↑](#footnote-ref-2)
2. <https://www.usda.gov/sites/default/files/documents/White_Paper_WEB_Final_v3.pdf> [↑](#footnote-ref-3)
3. C Ronnie Drever et al., Natural Climate Solutions for Canada, 7 Science Advances 1 (2021) [↑](#footnote-ref-4)
4. C Ronnie Drever et al., Natural Climate Solutions for Canada, 7 Science Advances 1 (2021) [↑](#footnote-ref-5)