SOIL CONSERVATION PRACTICE AND PAYMENT FOR ECOSYSTEM SERVICES WORKING GROUP REPORT

Prepared for the Vermont General Assembly in Accordance with

Act No. 83, Section 3 (2019)

Submitted to the

Senate Committee on Agriculture

House Committee on Agriculture and Forestry

By the

Vermont Agency of Agriculture, Food and Markets

January 15, 2020

Soil Conservation Practice and Payment for Ecosystem Services Working Group Report

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I. Executive Summary

Due to the initiative of three farmer-led watershed coalitions, the Vermont Legislature enacted Act 83 of 2019 charging the Secretary of Agriculture, Food and Markets to convene a Working Group to discuss Soil Conservation Practices and Payment for Ecosystem Services. This report fulfills the requirements of Act 83 Section 3 (2019) that the Working Group submit a report to the Senate Committee on Agriculture and the House Committee on Agriculture and Forestry. Between September 2019 and January 2020, the Working Group met in person five times and held six webinars with experts and practitioners who provided resources and perspectives to aid in the Working Group's thinking about payment for ecosystem service (PES) tools, metrics, and system design.

The Work Group focused not only on ecological services, but on the natural capital that provides these services, such as healthy soil ("a soil carbon sponge") that soaks up and filters water, functional landscapes, and biologically diverse ecosystems. This natural capital is the infrastructure needed for the provision of numerous goods and services that only healthy living systems can provide, such as flood protection, clean water, food security, and climate resilience and mitigation.

The Working Group developed a collective view of the future:

> *The Working Group envisions a system in which farmers are hired to use their ingenuity and know-how in caring for the land to rebuild Vermont's natural capital.*

The Working Group concluded it should and can catalyze a paradigm shift in how farmers are acknowledged and empowered to perform their essential roles of environmental stewardship, as well as providing food and fiber. However, investment and capital, as well as technological, programmatic, and market developments that do not currently exist are essential to making this transformative change possible.

The Working Group learned that farmers, public, and the private sector across the country are exploring, often with substantial investment in the tens of millions of dollars, how to create payment for ecosystem services systems. It is important to note that Vermont is one of the locations at the forefront of how to conceptualize, create, and implement effective PES programs. Vermont's work is particularly new and innovative because it is (1) shifting thinking around externalized costs and (2) aiming to capture the complexity of ecosystem services and their benefits.

To help achieve its bold vision, the Working Group forwards eight key recommendations to the General Assembly for its consideration.

Recommendation #1: Charge and resource this Working Group over the next two years to explore and advance transformative investment in agriculture's role to rebuild the natural capital of Vermont.

Recommendation #2: Advance our understanding of soil health and the services it provides.

Recommendation #3: Review, evaluate, and integrate existing tools for PES monitoring and modeling and also identify new tools and their potential for use in Vermont.

Recommendation #4: Support the tailoring or advancement of new emerging tools or programs.

Recommendation #5: Advance the design and development of PES approach(es) that regrow or sustain our natural capital so that it provides at least three ecosystem services: water quality, flood resilience, and climate stability.

Recommendation #6: Refine and evolve the Vermont Environmental Stewardship Program (VESP) to allow continued joint learning and engagement with farmers around PES.

Recommendation #7*:* Maximize access and use of existing programs to ensure farmers have capital to continue to implement practices or actions that lead to increased ecosystem services.

Recommendation #8: Seek additional grant opportunities, where feasible, to advance the vision of the Working Group during its chartered lifetime.

The following sections establish a context and terms for these recommendations as well as describe each recommendation and its associated financial needs.

II. Charge of the Working Group and its Process

Act 83 of 2019, Section 3 outlined the legislative charge to the Secretary of Agriculture to convene the Working Group to discuss Soil Conservation Practice and Payment for Ecosystem Services. This charge called upon the Payment for Ecosystem Services Working Group (Working Group) to "recommend financial incentives designed to encourage farmers in Vermont to implement agricultural practices that exceed the requirements of 6 V.S.A. chapter 215 and that improve soil health, enhance crop resilience, increase carbon storage and stormwater storage capacity, and reduce agricultural runoff to waters." This charge asked the Working Group to:

1. identify agricultural standards or practices that farmers can implement that improve soil health, enhance crop resilience, increase carbon storage and stormwater storage capacity, and reduce agricultural runoff to waters;

2. recommend existing financial incentives available to farmers that could be modified or amended to incentivize implementation of the agricultural standards identified under subdivision (1) of this subsection or incentivize the reclamation or preservation of wetlands and floodplains;

3. propose new financial incentives, including a source of revenue, for implementation of the agricultural standards identified under subdivision (1) of this subsection if existing financial incentives are inadequate or if the goal of implementation of the agricultural standards would be better served by a new financial incentive; and

4. recommend legislative changes that may be required to implement any financial incentive recommended or proposed in the report.

This report fulfills the requirements of Act 83, Section 3 (2019) that the Working Group submit a report to the Senate Committee on Agriculture and the House Committee on Agriculture and Forestry, "including the findings and recommendations of the Soil Conservation Practice and Payment for

Ecosystem Services Working Group regarding financial incentives designed to encourage farmers in Vermont to implement agricultural practices that improve soil health, enhance crop resilience, and reduce agricultural runoff to waters."

Between September 2019 and January 2020, the Working Group met in person five times and held six webinars with experts who provided resources and perspectives to aid in the Working Group's thinking about PES tools, metrics, and system design. Summaries of the meetings and webinars are provided in appendices D and C, respectively. Over this short period, the Working Group began to address all of these charges, but the Working Group concludes that it needs additional time to develop and test the concept that has been at the center of the Working Group's discussion: to pay farmers for rebuilding natural capital in the soil and in a functional landscape to provide a host of ecosystem services.

III. Background on Payment for Ecosystem Services (PES)

What are ecosystem services?
Ecosystem services (ES) are "the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfill human life"[1] i.e. "the set of ecosystem functions that are useful to humans."[2] By adding other forms of capital and investment, people may amplify the benefits provided by ecosystems and may glean additional value from the ES. The value may be monetized, but can also be measured in other terms, including satisfaction (e.g. recreational enjoyment), public health costs avoided, or other benefits. In the context of farming in Vermont, key ecosystem services this group has identified to value are provision of clean water, flood mitigation, and carbon sequestration, in addition to the cultivation of food and fiber—the ecosystem services for which farmers are currently paid.

PES Framework and Terms
In this report we use several terms that we developed a working knowledge of in our dialogue. Graphic #1 below highlights these key terms.

Nature provides (and humans can degrade) *natural capital* – like healthy soils, functional landscapes such as wetlands, and perennial native vegetation – that sustain both human production and natural systems over generations. Natural capital results in various *ecosystem services*. A payment for ecosystem services approach, as this group envisions it, would compensate farmers for rebuilding the *natural capital* itself, which would produce measurable benefits like reduced nutrient runoff for improved water quality, improved flood resilience, improved public health, climate resilience, and economic stabilization and revitalization from reduced spending on externalities. This could be a more systems-based approach that can yield more interconnected ecosystem services than focusing solely on one or another ecosystem service.

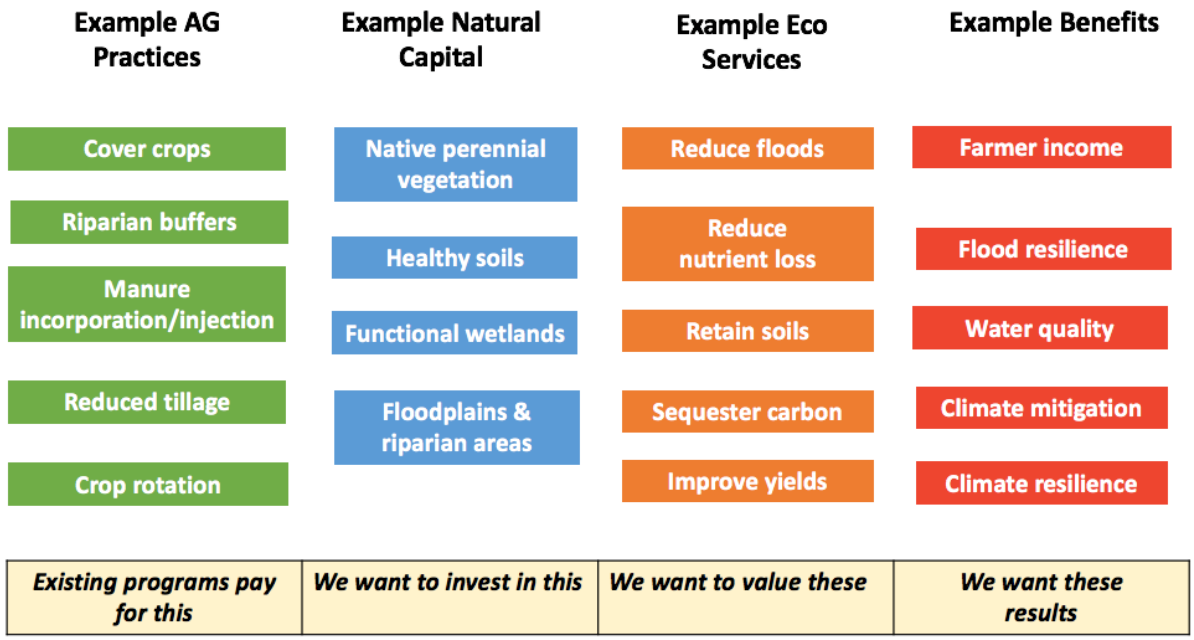
A payment for natural capital and ecosystem services approach as this group envisions it would compensate farmers for producing measurable benefits like reduced nutrient runoff, improved water quality, reduced floods, or climate stability through the sequestration of carbon. This approach could allow farmers to innovate, adapt and combine practices and activities to produce the best outcomes according to the best means available on their land with their capacities. If a PES system can help farmers, agencies, programs, and markets focus on measurable outcomes and natural capital rather than

[1] Daily, G.C. (1997) Introduction What Are Ecosystem Services in Daily, G.C., Ed., Nature's Services Societal Dependence on Natural Ecosystems, Island Press, Washington DC, 1-10. - References - Scientific Research Publishing
[2] Kremen C (2005). 'Managing ecosystem services: what do we need to know about their ecology?'. Ecological Letters, 8, 468-479.

practices, we should be able to achieve greater benefits more efficiently, creatively, and with higher certainty.

Lastly, it should be noted that ecosystem services provide real, tangible *benefits* for people, including farmers and members of the communities in which farms are located. Some benefits accrue to society at large (climate mitigation), some to Vermonters (water quality), some to those downstream and nearby (flood resilience) and some to individuals (farmer income). Current agricultural best management practices also provide many of these benefits, however, the workgroup is recommending additional and more outcome-related opportunities.

Illustration 1: Description of Practices, Natural Capital, Eco Services and Benefits



How does a payment for ecosystem services system work?
ES often provide public goods, but they are influenced by private decisions. Those who supply the ES (or those whose land provides the service) are not always those who benefit. For example, water quality benefits from nutrient retention measures on farms help the entire watershed. Flood mitigation benefits from improved infiltration of soils benefit downstream and downgradient land users. Carbon sequestration has global benefits in the collective effort to mitigate climate change. The market often does not account for such benefits and so does not provide for nor reward many ecosystem services. Internalizing the benefits of ES through payment for ecosystem services (PES) is one strategy to ensure that public goods are stewarded by those whose land can provide them to address this problem of imperfect markets.

A formal definition of PES is a ***voluntary*** transaction where a ***well-defined*** ES (or a land use likely to secure that service) is 'bought' by at least one ES ***buyer*** from at least one ES ***provider,*** if and only if the ES provider secures ES provision.[3] For instance, a public agency might pay a farmer for the reduction in

[3] Wunder S. (2005). Payments for Environmental Services: Some Nuts and Bolts. Occasional Paper No. 42. CIFOR, Bogor.

soil erosion from their farm following a change in agricultural practices that the farmer considered, chose, and made.

PES systems have been created and operated in a range of contexts. Buyers range from municipal to national governments, international organizations, single corporate buyers, and others. Services bought include water quality, biodiversity, flood control, carbon sequestration, and others.

PES is an evolving policy and market tool. Some data are available on what types of PES frameworks have been created and what features have contributed to success in PES systems[4], though their potential applications and limitations are still being explored in a range of contexts. It is important to note that Vermont is on the forefront, along with others, of how to conceptualize, create, and implement effective PES programs. Farmers and agencies across the country are exploring, often with substantial investment in the tens of millions of dollars, how to create PES approaches that work.[5] This work is new and innovative.

IV. The Working Group's Vision

The Working Group envisions a system in which farmers are hired to use their ingenuity and know-how in caring for the land to rebuild Vermont's natural capital.

The group aims to catalyze a paradigm shift in how farmers are acknowledged and empowered to perform their essential roles of environmental stewardship as well as providing food and fiber. We envision a future where farmers are recognized as land stewards, where they are compensated from numerous and diverse income streams for their provision of a range of ecosystem services, and where the public invests in the rebuilding and restoration of our state's natural capital.

This paradigm shift involves transforming or expanding from:

- Farming land to stewarding it;
- Compensation for only crops and commodities to compensation for additional ecosystem services too;
- A focus on fields to one on landscapes;
- Compensation for practices (e.g., cover crops) to payment for performance (e.g., tons of soil retained) and investment in natural capital
- Modeling to monitoring; and,
- Assistance programs to realigned and internalized incentives, including through markets.

While each of these changes will occur at different times, some will be more complex than others, and some may never fully be achieved, together, these changes could transform how and what we in Vermont farm.

[4] Salzman, James, Genevieve Bennett, Nathaniel Carroll, Allie Goldstein, and Michael Jenkins. "The Global Status and Trends of Payments for Ecosystem Services." Nature Sustainability 1, no. 3 (March 2018): 136–44. https://doi.org/10.1038/s41893-018-0033-0.

[5] See the newly launched Ecosystem Services Market Consortium at https://ecosystemservicesmarket.org/

V. The Working Group's Key Findings

Context

Vermont agriculture is at a critical and urgent junction. Vermont farming confronts issues of low incomes, limited profitability, inadequate health and childcare, labor shortages, declining community support, and decreased acceptance and understanding of agriculture. The state risks losing its iconic and bucolic agricultural working landscape and the many cultural, economic and community attributes this landscape provides for Vermont. Addressing the financial viability of farming is urgent. Vermont has experienced a 32% loss in agricultural cropland over the past 30 years between 1987 and 2017.[6] In 2009, there were 1,091 dairies. In 2018, there were only 696.[7] In 2018 alone, 75 farms ceased operations.[8] Vermont has lost 20% of its shipping dairies in the last two years alone.[9] The loss of dairy farms is critical as they steward over 80% of the open land in Vermont and generate close to 70% of the farm gate receipts that undergird the foundation of all farming and agriculturally related businesses and activities.[10]

At the same time, environmental concerns around the quality of Vermont's waters also are front of mind. The Lake Champlain Basin has been assessed a phosphorus Total Maximum Daily Load (TMDL), there are nitrogen loading issues in the Connecticut River Valley and other lakes and water bodies across the state are under threat for a host of reasons. With the increased prevalence of cyanobacteria, or harmful algal blooms, Vermont residents and tourists have experienced the cumulative effects of pollution from the different land use sectors on Lake Champlain and other waterways in Vermont. These blooms affect the recreational value of Vermont's waters and result in loss of jobs and loss of tax revenue to the State. Research has demonstrated the potential loss in lakeshore property values and tourism revenue for Lake Champlain.[11]

With federal and state conservation programs, farmers have made meaningful strides in addressing nutrient contamination from farms into our lakes and rivers. In the Lake Champlain basin, agriculture has been the source of 41% of phosphorus loading.[12] While the Lake Champlain phosphorus TMDL called for agriculture to produce 67% of the required reductions in the basin, farmers have actually been responsible for 97-99% of reported phosphorus reductions between 2016 and 2019.[13] These reported reductions, which do not include many agricultural and other sector practices yet to be assigned a phosphorus reduction efficiency, reflect the cost-effectiveness of farming practices for nutrient reductions, the maturity of partner networks in promoting practice implementation and the willingness of farmers to take on their part of the TMDL. Even so, there is still much work to do and there is concern, despite all the hard work, that the goal of fishable and swimmable waters in Lake Champlain will not be met for some time.

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[6] USDA NASS Ag Census (2017). Table 1. Historical Highlights: 2017 and Earlier Census Years. https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_1_State_Level/Vermont/st50_1_0001_0001.pdf

[7] Vermont Agency of Agriculture, Food & Markets (2019). Vermont Dairy Data – December 2, 2019. Agency report.

[8] ibid

[9] ibid

[10] Vermont Agency of Agriculture, Food & Markets, Vermont Agency of Commerce & Community Development (2015). Milk Matters. https://vermontdairy.com/wp-content/uploads/2015/12/VTD_MilkMatters-Brochure_OUT-pages.pdf

[11] Voight B, Lees J and Erikson J (2015). An Assessment of the Economic Value of Clean Water in Lake Champlain. (Report No. 81). Grand Isle, VT: Lake Champlain Basin Program.

[12] Environmental Protection Agency (2016). Phosphorus TMDLs for Vermont Segments of Lake Champlain. https://ofmpub.epa.gov/waters10/attains_impaired_waters.show_tmdl_document?p_tmdl_doc_blobs_id=79000 at page 48.

[13] Vermont Agency of Administration, Vermont Agency of Natural Resources (2019). Vermont Clean Water Initiative 2019 Performance Report. https://legislature.vermont.gov/assets/Legislative-Reports/2020-01-14_CleanWaterPerformanceReport_SFY2019-FINAL.pdf

Current state and federal agricultural programs, including those focused on water quality, tend to pay for discrete practices, although they do not exclusively take this approach. A PES approach could take advantage of farmers' ingenuity and know-how to regenerate natural capital and to achieve outcomes across a functional landscape in a host of more tailored, innovative, and effective ways. Vermont can be a leader in rethinking both conservation and water quality programs, re-evaluating what farmers produce (not just crops, which are only one of many ecosystem services), and in creating additional income streams for farmers to invest in. For instance, would insurers be willing to invest in a landscape that is far less likely to have flood losses? Could town, state or federal funding for flood damage to roads be redirected towards creating a working landscape that soaks up rain? What entities might pay for approaches that sequester carbon?

However, this opportunity will take investment and capital as well as technological, programmatic and market developments that do not currently exist to make transformative change possible. The Working Group aims for these efforts to expand and enhance existing tools to measure, pay for, and strengthen ecosystem services to lay the groundwork for the transformational change that the group acknowledges is needed and ultimately seeks.

PES Principles

In exploring various PES approaches, the group also identified several guiding questions and criteria to be addressed. Some of these are assertions and some are questions that may require further investigation and research. These include:

- Paying farmers for producing services that go above and beyond Required Agricultural Practices (RAPs). Eligible participants should meet Required Agricultural Practices (RAPs).
- Investing in agriculture to evolve and transform behavior is a cost-effective place for society to invest in a range of environmental benefits.
- Identifying a baseline from which to measure performance, that includes recognizing good work already done by some farmers and including those who may not have had the opportunity to join past programs to participate, is important.
- Ensuring all farms, regardless of size, geography or product, have the opportunity to participate, while recognizing that small farms may not have the staff, technical resources, or financial capital to be as robust in their response.
- Utilizing Vermont- and farm-specific data to the greatest extent possible while ensuring data gathering does not overwhelm in both cost and time the payments to farmers for action.
- Determining if the intent is for a series of payments over time that diminish as performance advances, upfront capital assistance to achieve long-term sizable gains, or on-going annual payments in perpetuity to obtain the desired services, or some combination thereof.
- Setting prices and payments needed to both effect measurable and desirable change at the watershed or state-wide scale and provide meaningful additional income streams to or investments in farms.
- Seeking out new markets and additional dollars while drawing on and utilizing as effectively as possible current state and federal agricultural conservation programs as well as other public investments.
- Ensuring the administrator of the program is highly knowledgeable, trusted, flexible, innovative, and can deliver outcomes at reasonable costs.

Soil Health

The Work Group chose to focus primarily but not solely on healthy soil as an essential part of the state's natural capital to invest in and rebuild. A focus on soil health provides a focal point for action and plausibly addresses a number of desired ecosystem services, including improved farm productivity.

Healthy soil – spongy, organically rich, biologically diverse, and chemically balanced -- is central to the fertile and sustainable production of agricultural crops and provides a host of other benefits. A PES system that rewards farmers for rebuilding healthy soils could potentially improve many ecosystem services that the working group is interested in supporting in Vermont agriculture. Healthy soil could provide ecosystem services by:

- protecting and improving Vermont's water quality by retaining nutrients and minimizing soil erosion;
- improving infiltration of water, thus providing a valuable natural means to mitigate flooding;
- sequestering carbon, a much-needed action to mitigate climate change; and
- growing food and fiber more environmentally and economically sustainably.

We, as well as many others across the U.S., have more to learn about the nuanced, measurable, and multiple benefits that healthy soils can provide. More research is needed to establish the full host of soil health ecosystem services and to decide on metrics that more clearly define the correlation between soil health and some of these services. However, initial investigation demonstrates important connections.

Priority Research Questions
Through this preliminary work, the Working Group has identified a series of research questions that need to be addressed before the group makes final recommendations regarding the design and implementation of a PES approach. Among these are:

1. What ecosystem services or types of natural capital will be paid for? Does soil health or the building of natural capital provide these services in measurable ways?

2. How will these services and natural capital be measured? How will the efficiencies of modeling (based on robust models with locally relevant and accurate data sets) be balanced with the precision of farm-specific monitoring to measure actual performance? What existing, modified, or emerging new technologies can be utilized to truly measure performance and outcomes?

3. What are the cost-savings that can be expected and realized by improving ecosystem services? What are the existing externalized costs that Vermonters are already funding and how can these funds be redirected from effects to causes?

4. What private and/or public funding sources will be tapped to make these payments?

5. Who will be eligible to be compensated for providing these services? What payment scheme will best balance fairness (i.e. compensating for gains already made for farmers ahead of the curve as well as to those making improvements now) with efficiency (i.e. compensating for the largest improvements and greatest gains)?

6. How can this PES approach developed by this effort initiate a pathway towards broader market-based systems for compensating farmers for providing ecosystem services beyond state and federal programs only? What early steps does this approach need to take to work toward that goal? Who can best administer this or these PES approaches?

VI. Key Recommendations

The Vermont PES and Soil Health Working Group offers these recommendations to the Legislature:

Recommendation #1:
What*: Charge and resource this Working Group over the next two years to explore and advance transformative investment in agriculture's role to rebuild the natural capital of Vermont.*
To Whom*: The Vermont Legislature*
This Recommendation's Funding Request*: $90,000*

The Vermont Legislature formed the Soil Conservation Practice and Payment for Ecosystem Service Working Group, catalyzed by three farmer-led watershed groups proposing to work together to advance a PES approach. The WG has been powerful in bringing together related conversations and diverse actors around the state regarding soil health, ecosystem services, and the role of farmers in conservation. Our group, comprised of farmers, state agencies, federal agencies, academics, and advocates, has worked constructively to explore these issues and to quickly educate its members and one another about a range of issues related to soil health and ecosystem services. Our group has arrived at an ambitious, bold vision for the future of farming in Vermont. But our work has only just begun. In the time allotted, with five intensive meetings in a few short months, plus numerous webinars[14] and presentations, we were able to develop a general framework. This framework needs time, discussion, data, technical development, further research, and continued collaboration to build a clear, effective, empirically driven approach. This framework should also take advantage of programs being researched and developed nationally so as to benefit from current processes. We ask the Legislature to charge the Working Group to continue work over the next two years to help realize its bold vision.

While the Working Group's financial request noted below is significant, it should be noted that similar national efforts are receiving funds in the tens of millions of dollars to pursue PES in other states and regions. Furthermore, many of the costs of not paying for ecosystem services are already embedded elsewhere in the state's overall fiscal heath – post-flooding recovery costs downstream, declining farm income due to poor soil health, the future costs of mitigating climate change, losses in tourism dollars and public health costs of algal blooms in our lakes, and losses on farm due to drought and flooding.

These two years will allow us to undertake, support, and track several parallel work streams described below in further recommendations. These work streams can result in a focused, funded, technically justified, implementable PES approach of which the state can be proud. This approach would articulate the ecosystem services or natural capital to prioritize, a measurement system for soil health and other factors, a justifiable price for a unit of soil health or other capital or services sought, details on farmer/farm eligibility, and a forecast of impact, length of effort, sources of funds, and costs.

Specific Actions

1. The Vermont Legislature charges and funds the Working Group to continue for two years until December 31, 2021.

2. The Vermont Legislature adds membership categories to the Working Group in addition to the current membership as well as encourages alternates from the same or similar member organizations to provide consistent participation
    a. A representative(s) from agricultural use not currently represented on the group
    b. An environmental Non-Governmental Organization (NGO) with a state and national presence that can provide technical assistance and potential fundraising assistance
    c. An agricultural economist, preferably from an in-state institution or organization (to directly help shape valuation and financial questions)

[14] *see Appendix C that summarizes these webinars*

d. One or more ecosystem services and UVM Extension specialists from Vermont able to translate programs and research to on-the-ground work, preferably from a state or federal agency or service provider
e. A soil scientist to support the group in understanding and advancing soil health as a key area of focus

3. The Vermont Legislature provides up to $500,000 to support the group in advancing its work to create an effective, Vermont-tailored, implementable approach (*see Appendix A for more detailed budget*).

4. The Vermont Legislature provides, as part of that $500,000 request, monies for travel and participation stipends for non-paid WG members ($15,000) and the facilitation and outreach support needed to help the diverse WG be successful ($75,000)

5. Rename the Working Group from *Soil Conservation Practice and Payment for Ecosystem Services* to *Payment for Ecosystem Services and Soil Health* in order to emphasize the importance of soil health as natural capital and to move our focus from conservation practices to conservation performance.

Recommendation #2:
What*: Advance our understanding of soil health and the services it provides.*
To Whom*: State and Federal agencies and their grantees and technical providers*
This Recommendation's Funding Request*: $30,000*

The Working Group concluded that healthy soils are an essential natural capital that must be invested in for Vermont's future. Soil health has chemical, physical, and biological properties. Through complex interactions among these elements, healthy soil can be like a sponge, soaking up water in times of inundation and retaining more moisture in times of drought all the while producing crops and forage. We do need to learn more about the correlation between soil health and many of its possible ecosystem services. There are a number of existing research efforts that the Working Group can learn from, engage with, and potentially influence to advance the work of understanding soil health as a key component of natural capital. We need to learn more about soil capital, how it should be measured, by what metrics or tools, and the more precise stream of ecosystem services that arise from it. There are a limited number of specific research efforts the WG would want to support and initiate to better inform and ground their work, its conclusions and the actions necessary to make progress. These research efforts will be explored and refined in the coming months.

The Working Group can provide a forum where research teams can report their finding and learnings, where the group can influence and shape research design, to the extent possible, to advance shared goals. The Working Group might also engage with and consider appropriate roles on this topic with the Vermont Agricultural Water Quality Partnership (VAWQP). Questions range from the extent and quantity of ecosystem services that healthy soils can measurably provide, to which regenerative strategies lead to the best outcomes in water quality, soil health, carbon sequestration, and other factors, to what various types of monitoring can tell us about intended versus actual outcomes.

Specific Actions

1. The WG review, discuss, and agree to a specific definition of healthy soils.

2. The WG connect with other public and private innovative efforts around the country regarding defining, measuring, and rebuilding soil health in order to better understand the state of evidence linking soil health and the many ecosystem services we desire.

3. The WG support a technical synthesis of what is known and not known about soil health and various ecosystem services from nutrient retention to flood prevention, including the appropriate and best tools for modeling and monitoring soil health

4. For existing AAFM, NRCS, DEC, and UVM Extension research efforts like CEAP, incorporate into existing edge-of-field and other on-going studies as possible:
   a. measurements of soil health, most likely using the Comprehensive Assessment of Soil Health (CASH) tool, or key components of that tool supplemented with other metrics;
   b. gathering and analysis of data from edge-of-field research to identify more clearly the correlations among elements of soil health as measured by CASH and ecosystem services such as water quality, nutrient retention, flood storage, carbon sequestration;
   c. conservation approaches that involve regenerative agriculture concepts and decision-making strategies.

Recommendation #3:
What*: Review, evaluate, and integrate existing tools for PES monitoring and modeling and identify new tools and their potential for use in Vermont*
To Whom*: State agencies and institutions, Federal agencies, and private evaluators*
This Recommendation's Funding Request*: $30,000*

The Working Group has learned that there are a variety of tools from modeling to monitoring that have been or could be developed to help advance ecosystem service approaches. In no particular order, these include the Farm Phosphorus Reduction Planner (Farm-PREP), the NRCS Resource Stewardship Evaluation Tool (RSET), the Agricultural Policy Environmental Extender (APEX), the Comprehensive Assessment of Soil Health (CASH), and proprietary and emerging approaches developed or in development by private companies. However, we do not yet fully understand which of these tools are best fit for which purpose, which can harness actual or real-time Vermont-specific data, at what cost, and how these might be integrated into an overall approach.

Specific Actions

1. The WG will determine the specific ecosystem services and/or natural capital they want to focus on, which will inform which tools are used.

2. The WG recommends supporting two key reviews of existing and emerging tools and techniques.

   a. Review the strengths and weaknesses of monitoring and modeling tools used by various state and federal agencies regarding ecosystem services, the degree to which they utilized Vermont or field-specific data, their cost, how they might be integrated into a program or approach, and where further tool development or testing is needed. The Vermont Agricultural Water Quality Partnership (VAWQP), an interagency, state-wide partnership, as well as others could have a key role in this effort.

   b. Through an independent contractor or entity identify, describe, and provide an initial evaluation of new and emerging technologies and programs for measuring and monitoring outcomes and ecosystem services, particularly those seeking to gather real-time data, utilization of newer technologies be that satellite data, drone data, LIDAR, or other means,

and that might put real time data quickly and clearly into the hands of farmers. This review should analyze where on the technological development spectrum each technology rests, how much investment would be needed to advance to a workable scale, and which tools might best meet the needs of Vermont. This should also include identifying existing private or private-public PES programs occurring at the regional or national scale and identify their tools and potential applicability to Vermont.

Recommendation #4:
What*: Support the tailoring of or advancement of new emerging tools or programs.*
To Whom*: Eligible and capable providers from the private or public sector*
This Recommendation's Funding Request*: $250,000*

Following what the WG learns in Recommendation #2 and #3, the WG believes that it will then have an opportunity to invest Vermont resources in key, select technologies to advance a powerful PES approach in Vermont that increasingly draws on real-time data and monitoring to pay farmers for producing clear, measurable outputs. Thus, the WG is recommending a significant investment in advancing core tools to make PES in Vermont effective.

Specific Actions

1. Based on the reviews completed in earlier recommendations, further refine and hone an approach to PES in Vermont that can achieve as many of the PES Principles, as outlined in the beginning of this Report, as possible.

2. Based on the reviews completed in earlier recommendations, through an RFP or RFI, the WG would solicit responses from capable and innovative entities (private or public) to advance key tools to allow PES program in Vermont to operate.

Recommendation #5:
What*: Advance the design and development of PES approach(es) that regrow or sustain our natural capital so that it provides at least three ecosystem services: water quality, flood resilience, and climate stability.*
To Whom*: The Working Group with Member Leads*
This Recommendation's Funding Request*: $0 since this development covered under a current NRCS grant*

The Working Group explored a host of desired ecosystem services, from pollination to flood prevention to nutrient retention to climate mitigation and resilience. The Working Group homed in, though not exclusively, on three in particular to start: 1) reducing flooding; 2) reducing nutrient loss to improve water quality; 3) increasing climate stability by sequestering carbon. The WG has initially prioritized these services because it is interested in establishing the relationship between each of them and soil health, and because the WG contends and hopes that they may each engage distinct and complementary stakeholders, approaches, and revenue streams. The WG recommends further research regarding each ecosystem service on these questions of possible sources of payments, the best scale and system design for the approach to be implemented, and the valuation of services that will result in the outcomes desired, in addition to how and whether these services could be combined or stacked. These three ecosystem service streams are closely related and overlapping. They are listed separately for clarity, though a desired outcome is an approach that can integrate these three plus others. This is a tremendous amount of work that is only now getting underway and hence the need for more time and resources for the WG to be successful.

Clean Water: Numerous state and federal programs and regulations, including the Vermont Required Agricultural Practices (RAPs), seek to require and incentivize farmers to reduce nutrient loss from their fields and farms. Most efforts to date have focused on a set of practices such as nutrient management, cover cropping, crop rotation, manure injection, and reduced tillage to achieve these goals. This approach would involve a demonstration project to design a PES program for decreasing or eliminating nutrient loss to accelerate and advance what some farms are already doing. The intent is to combine modeling and monitoring tools, needed incentives, and the appropriate technical assistance to create an additive approach to existing programs, that if successful, might even subsume or replace existing programs.

Flood Resilience: The Otter Creek Floodplain study in Middlebury[15] demonstrated that flood prevention through a variety of means, including the conservation of floodplains and the restoration of wetlands, could lead to significant avoided costs during a major storm like *Irene*. The Working Group wants to explore an approach involving upstream farms to benefit downstream owners and users on a local scale. For instance, by rebuilding spongy, absorbent, healthy soils in crop land and pastureland, creating retention basins, riparian buffers, and restoring wetlands, a farm may be able to provide significant avoided costs for downstream owners and private and public users. This approach would seek to understand how to build a local market for such services, how municipal and other funds might flow to farmers to provide this flood reduction service, how to value the service to result in action by the farmer and benefit to others as compared to repairing and rebuilding after a storm, and what actions might lead to the greatest results.

Climate Stability. Creating healthy soils and other activities on farms can provide an increasingly valuable function in sequestering carbon for the mitigation of climate change while also providing resilience in the face of climate threats, such as increases in flooding. There are emerging private markets that pay for carbon credits, including for sequestration of carbon. Regional, national and international efforts are underway to identify how to store carbon in the soil, what practices best retain carbon, how to measure the change in soil carbon, and how such sequestration activities can be paid for, at what price, and by whom. The Agency of Agriculture, Food & Markets is ready and willing to engage with expertise from elsewhere to help identify how Vermont and its farmers can reap the benefits of this growing market.

Specific Actions

1. Because an existing Conservation Innovation Grant let by USDA is already in place to undertake this work, we recommend the WG engage with the resources of the CIG along with the lead agencies on water quality (DEC and VAAFM), with the technical assistance of NRCS and UVM Extension, to advance this work together. *The WG is not asking for a specific line item budget for this task since is covered under existing NRCS funds.* This effort will:

    a. Focus on improving water quality at the watershed or state-wide scale through a performance-based PES approach rather than payments for practices.
    b. Explore flood resilience at the local scale as an ecosystem service of flood resilience
    c. Explore how to pay for sequestering carbon for climate change mitigation through emerging national or international markets.
    d. Determine if each of these should be approached separately, through a market or payment, or bundled together into a package of services to arrive at one payment for multiple results

[15] Watson, Keri B., Taylor Ricketts, Gillian Galford, Stephen Polasky, and Jarlath O'Niel-Dunne. "Quantifying Flood Mitigation Services: The Economic Value of Otter Creek Wetlands and Floodplains to Middlebury, VT." Ecological Economics 130 (October 1, 2016): 16–24. https://doi.org/10.1016/j.ecolecon.2016.05.015.

Recommendation #6:
What*: Refine and evolve the Vermont Environmental Stewardship Program (VESP) to allow continued joint learning and engagement with farmers*
To Whom*: VAAFM with the Working Group*
This Recommendation's Funding Request*: $50,000*

The Vermont Environmental Stewardship Program (VESP) has already enrolled several farmers in a pilot program, utilized a set of existing tools that use farm data inputs for modeling, and undertaken Vermont-specific monitoring. Thus, while the Working Group explores and details the many questions and areas of opportunity for a future PES approach, VESP should be expanded and oriented to provide an avenue for farmers to engage with the PES design process, providing their first-hand experience and know-how to inform design and value-based decisions about PES in Vermont, while benefitting from access to the evaluation tools VESP has and technical assistance to navigate other tools and assistance from related agencies. Participating farmers should be paid a stipend for their participation.

Specific Actions

1. Expand the Vermont Environmental Stewardship Program (VESP) as a means to educate, engage, and prepare farmers for a future PES approach.

Recommendation #7:
What*. Maximize access and use of existing programs to ensure farmers have capital to continue to implement practices or actions that lead to increase ecosystem services.*
To Whom*: NRCS, VAAFM, VACD, and others*
This Recommendation's Funding Request*: $0 since this would be accomplished through existing programs already funded within federal and state programs*

Agencies, watershed groups, and others should continue to engage farmers and inform them of the existing program opportunities for more PES-like approaches such as the Regional Conservation Partnership Program (RCPP), Environmental Quality Incentives Program's (EQIP) new flexibility, and the Conservation Stewardship Program (CSP), to name a few.

Specific Actions

1. Continue to connect farmers to programs that have PES-type features and that allow them to prepare for and reap benefits from emerging pathways for compensation for ecosystem service provision

Recommendation #8
What*: Seek additional grant opportunities, where feasible, to advance the vision of the Working Group during its chartered lifetime.*
To Whom*: The Working Group*
This Recommendation's Funding Request*: $0 since additional monies would be sought under this recommendation.*

The Working Group also recommends seeking out, where appropriate and possible, federal and private grants to advance key issues or areas. The Working Group does not intend to be a fundraising nor grant writing enterprise. That being said, such grants might help support technology and tool development, program design, and/or on-the-ground demonstration programs. Such grant programs include but are not limited to the USDA Regional Conservation Partnership Program (RCPP) and the Conservation

Innovation Grants (CIG). While none of these grant opportunities are guaranteed, time spent in grant development, if done in an efficient and targeted way, can leverage additional resources beyond the state's to advance the efforts of the Working Group.

Specific Actions

1. To supplement existing WG activities supported by legislative funding and seek out, where appropriate, eligible and useful, additional sources of funding for learning and implementation.

VII. Conclusion

The Legislature, by creating the Working Group in 2019, has meaningfully brought together diverse conversations, stakeholders, and expertise, to scope and frame the work ahead. But the work is in its early stages. The work of creating a viable, powerful, extensive payment for ecosystem services approach for Vermont is just beginning. Thus, the Working Group asks for the Legislature's sanction and support to continue to hone and bring to fruition the work we have started.

VIII. Appendices

A. Estimated Budget
B. Work Group Members
C. Working Group Summary of Webinars
D. Working Group Meeting Summaries

Appendix A: Estimated 18-month Working Group Budget 2020-2021

Rec #	Line Item	Value	Details
1	Travel and Honorarium for non-paid WG members	$ 15,000	10 meetings to up to 10 members for travel reimbursement and meeting stipend
1	Facilitation, Coordination, and Farmer and Public Outreach and Engagement	$ 75,000	
2	Soil Health and Ecosystem Services Evidence Based Review	$ 30,000	
3	Comparison and Review of existing state, federal, & university modeling and monitoring tools	n/a	Completed by WG members as part of their on-going work in other areas
3	Comparison and review of emerging tools, real-time monitoring, and PES programs	$ 30,000	An independent finding and comparison of promising new tools that might be used in, developed in, or tailored to Vermont
4	Research Pool for advancing the needed tools to create an evidence-based, innovative multi-ecosystem services approach for VT	$ 250,000	Based on the WG work, the research reviews noted above, the WG will prepare Request for Proposals for specific tool modification or development
2 to 5	Support for economic valuing of natural capital, various ecosystem services, current externalities, and identifying potential markets	$ 50,000	To provide on-going economic support for multiple tasks around valuing services and capital and exploring markets
6	Expansion of VESP program with farmer participation stipends for benchmarking and educating	$ 50,000	To increase participation and engagement in the VESP program
	TOTAL	$ 500,000	
	**Assumes 18-month budget, starting July 2020 through January 2022*		

Appendix B: Working Group Members

1. Alyson Eastman, Chair, Vermont Agency of Agriculture, Food, and Markets (VAAFM)
2. Nancy Everhart, Vice Chair, Vermont Housing and Conservation Board (VHCB)
3. Jill Arace, Vermont Association of Conservation Districts (VACD)
4. Cat Buxton and Didi Pershouse, Vermont Healthy Soils Coalition (VHSC)
5. Paul Doton, Connecticut River Watershed Farmers Alliance (CRWFA)
6. Vicky Drew, Natural Resources Conservation Service (NRCS)
7. Eric Howe, Lake Champlain Basin Program (LCBP)
8. Brian Kemp, Champlain Valley Farmers Coalition (CVFC)
9. Maddie Kempner, Northeast Organic Farming Association of Vermont (NOFA-VT)
10. Taylor Ricketts, University of Vermont Gund Institute for the Environment
11. Chuck Ross, University of Vermont Extension (UVM Extension)
12. Marli Rupe, Vermont Department of Environmental Conservation (DEC)
13. Tyler Webb, Franklin and Grand Isle Farmers Watershed Alliance (FWA)

Appendix C: Working Group Webinar Summaries[16]

10/11/2019: Soil Health

Cat Buxton and Didi Pershouse, members of the PES Working Group sharing a seat for the Vermont Healthy Soils Coalition, started off the webinar series with a presentation on the importance of healthy soil. In this webinar, Cat emphasized that improving soil health contributes to a wide variety of ecosystem services such as flood mitigation, water purification, greenhouse gas reduction, and local temperature regulation. Didi then outlined the potential for developing a bipartisan narrative focused around farmers creating a "soil sponge." This term refers to the fact that healthy soil has a strong matrix of biologically formed pores that enable the soil to better absorb and retain water and nutrients. Both presenters suggested that a PES system could pay for soil health based on avoided costs. For example, if the reduction in the forecasted costs of flooding damage from better land management could be calculated, farmers could be compensated accordingly.

10/23/2019: PES Program Design

Jon Winsten is an agricultural economist and independent consultant and is working with NRCS through CIG in the first stages of designing a pay-for-performance system in Vermont. He has also worked with the NGO Winrock on PES systems nationally and internationally since 2001, including a pilot study in Missisquoi River Basin ten years ago. His webinar emphasized that PES systems should be simple, cost-efficient and motivating to farmers. Jon advocated for a system that models the effects of various practices, allows farmers to choose which of those practices to implement, and then pays farmers for their "performance" based on the modeled results of those practices. He argued that such a system reduces risk on the farmer and is most motivating and cost-effective. This system was the foundation of the pilot program started in Vermont in the late 2000s. In his presentation, Jon further explored the tradeoff between scale and cost of measuring Ecosystem Services performance and recommended that in-stream measurements at the scale of small watersheds would be a good compromise.

10/28/2019: Comprehensive Assessment of Soil Health

Heather Darby, an agronomy and soil science specialist at UVM Extension, presented this webinar on the merits and limitations of the Comprehensive Assessment of Soil Health (CASH). Heather was involved in the creation of CASH, which she feels is one of the longest-standing, most comprehensive, most user-friendly tests for soil health available. She informed the PES Working Group that although she feels that CASH is an excellent tool for informing management decisions on farms, it would have its limitations as the foundation of a PES program. Heather doesn't believe there is enough evidence to correlate soil health metrics and ecosystem services outcomes. However, she suggested that an in-depth pilot study could build off past VT soil test results and take CASH measurements alongside other measurements, such as runoff and erosion rates, to calibrate models of ecosystem services. Heather further advised that any PES system based on CASH should be built on RAP compliance for payment, since CASH metrics don't inherently capture the implementation of practices required by that rule. Heather also commented that CASH is less expensive than most possible PES measurement systems, which she appreciates since she harbors a concern that the money PES systems spend on measurement and administration would cut too much into the potential payments to the farmer.

11/1/2019: Learning from Global PES Systems

Jim Salzman, professor of Environmental Protection and Law at UCSD, is an expert on global PES systems and a co-author of a peer-reviewed paper titled "The Global Status and Trends of Payment for Ecosystem Services" in the journal Nature. In this webinar he shared some takeaways from his research and this article, which identified over 550 active PES systems around the world. Jim informed the

[16] Webinars will be available for viewing at: https://agriculture.vermont.gov/pes

Working Group that most successful PES systems are publicly funded and those that aren't are privately funded by a single large corporate stakeholder. Almost all pay for practice. These trends are because those types of systems are simpler and simpler systems are much more likely to be successful. Jim also counselled that the Working Group pay attention to the political and social implications of the design of a PES system and advised the group to be intentional in their choices. He advocated that the Working Group "reverse engineer" a PES system and start by defining their goals for such a system, followed by the funding source and the restrictions that would provide, and moving towards defining the actual mechanism at the end of the process.

11/8/2019: Farmer-Led Measurement and Synthesis

Abe Collins is a Vermont-based grazing consultant and the co-founder of LandStream, a measurement technology and consultancy company. He presented this webinar on his vision of a comprehensive landscape-scale sensing system that would provide a platform for farmers to measure the ecosystem services of their farming practices across a variety of metrics in the landscape. He advocated strongly that farmers should lead the development of a PES system since they are the key stakeholders and are uniquely able to grow natural capital. Abe declared that current models and measurement for ES performance are inadequate to inform payment and advocated for a more synthesized, landscape-scale approach. He sees the need for a pilot project that performs in-depth, comprehensive measurements on at least 6 pilot farms, compares these results to remote sensing data and farmer observations, and builds a synthesized model for landscape function that could be used for PES going forward.

12/3/2019: Ecosystem Services Marketplace

Chris Kopman oversees the PES efforts at Newtrient, a company which has made a proposed protocol for PES. In this protocol, on an annual basis program administrators would model the effects and costs of field-specific practice outcomes, farmers bid on the funding they want to implement those practices, the program administrators review applications based on Return on Investment in $/lb, selected farmers implement, and then a third party verifies implementation before payment. Chris explained that modelling performance would enable the most money to be paid to farmers and that 3rd party verification of implementation would allow the program to certify reductions and issue payment. Chris advocates for modeling with the Farm-PREP tool, which is farm/field specific, calibrated to VT, and runs off NRCS-Apex. He also advocates for a pilot program but stipulates that it should focus on an outcome for which there is both demand and modelling capability. He explained that nutrient runoff fits those categories, while soil health and carbon sequestration are as-yet inadequately modelled. Chris further pointed out that although private markets offer long-term promise and some companies have stated interest in private PES, their stated goals tend to be closer to 2030 or 2050, which might be too long.

Appendix D: Working Group Meeting Summaries

Vermont Soil Health and Payment for Ecosystem Services Working Group

Waterbury, Vermont
September 30, 2019 Meeting Summary

Next steps

- The Co-chairs and CBI will schedule future meetings based on member availability
- Members will respond to a survey to help glean feedback on options before next meeting
- The Co-chairs and CBI will schedule webinars as soon as possible and make recordings available for those who cannot watch live.
- CBI will revise the ground rules/charter document per feedback from the Working Group
- AAFM will post meeting materials to https://agriculture.vermont.gov/pes

Introductions and setting goals for the process

Working Group Co-Chair Deputy Secretary Alyson Eastman welcomed the group and reviewed the charge of the Working Group, as articulated in Act 83 of 2019 of the Vermont General Assembly. She explained the intention to develop a program to recognize farmers stewarding Vermont's landscape and helping achieve the goals of improved water and environmental quality in the state. She emphasized that agriculture can and should play a role in reaching these goals, and that the loss of farms and farmland is concerning for the state. Co-Chair Nancy Everhart also welcomed the group and expressed the hope that the Working Group would, over the course of its five-month process, be able to determine a framework for next steps for a payment for ecosystem services (PES) system and recommend one or more pilot programs.

The Co-Chairs introduced the facilitator, Pat Field of the Consensus Building Institute, and explained that his role was to strengthen the process and remain neutral to help the group incorporate multiple stakeholder perspectives to collectively guide the outcomes.

Member introductions

Working Group members introduced themselves and the organizations or constituencies they represent. They shared hopes for outcomes of the process. Key goals Working Group members articulated included:

- Instituting an approach to land stewardship that encompasses the whole state.
- Catalyzing a paradigm shift that incents farmers to steward land rather than forcing them to exploit natural resources. Rewarding farmers for the range of environmental and social public goods they provide in addition to the private goods they produce.
- Increasing the viability and sustainability of farming in the state.
- Including broad problem-solving on the structure and functioning of the landscape in a PES program.
- Investigating innovative ideas with opportunities for increased rewards to address several elements of the land and soil health, not only more narrowly defined chemical/nutrient issues.
- Integrating the efforts of agriculture with that of other sectors working to improve water quality and environmental health.

- Balancing the efficiency and equity of a PES program. Recognizing farmers' efforts to improve while also acknowledging those who have instituted practices to improve ecological health.
- Avoiding a one-size-fits-all approach and respecting farmers' knowledge and ability to innovate to solve problems.

Scope and key questions

Working Group members offered the following key questions to address in the process to develop a PES program:

- What is the definition of soil health?
- Would a market function internally to Vermont, or interact nationally and internationally?
- What is the appropriate scale or unit for the program to work with to measure performance and benefits?
- Where will money come from for payments?
- What metrics will be used to calculate efficacy? Will metrics be based on practices or performance (i.e. services being provided.)
- How would the program interact with existing regulations?
- What has made other PES programs successful or not?
- How to ensure equity among farmers starting at different baselines?
- Can the system be adjusted over time to encompass more goals?
- Can this program be tied to other costs and sources of funding? E.g. highway departments, property insurers, municipal DPWs, etc.
- How to ensure some do not take undue advantage of the system and avoid unintended consequences?

Working Group members suggested that success at the conclusion of the five-month process would include:

- A pilot program and resolution of key questions to educate legislators.
- A process that adequately accounted for the voices of stakeholders not in the room, particularly the diverse range of small farmers.
- At minimum, framing policy questions legislators will need to decide to advance a PES system so they can make good decisions.
- Reaching consensus on technologies to measure and quantify services.
- The outcomes of the Working Group are effectively communicated to a range of audiences, including the legislature.

Working Group operating procedures and work planning

The group reviewed and suggested minor revisions to the operating procedures, which the Co-Chairs and facilitator agreed to make.

Working Group members will review technical and substantive material via several webinar presentations over the course of the process whenever possible, in order to maximize the time during meetings for group deliberation.

Review of Vermont's Agricultural Water Quality Regulatory Framework and Programs

Ryan Patch, AAFM Water Quality Division, provided an overview of existing agricultural and water quality regulations with which a new PES program would interact[1]. He explained that current regulations provide a definition of healthy soil: "Healthy soil" means soil that has a well-developed, porous structure, is chemically balanced, supports diverse microbial communities, and has abundant organic matter [6 V.S.A. § 4802(3)]. The regulations also establish standards for nutrient management on farms, including: recommended practices for improving and maintaining soil quality and healthy soils in order to increase the capacity of soil to retain water, improve flood resiliency, reduce sedimentation, reduce reliance on fertilizers and pesticides, and prevent agricultural stormwater runoff [6 V.S.A. § 4810a(4)(B)]. He also traced the evolution of water quality and agricultural regulations that led to the formation of this Working Group.

2016 amendments to required agricultural practices (RAPs) increased the responsibility of the agricultural sector to reduce nutrient loading to meet the total maximum daily load (TMDL) requirements. For example, agricultural contributions of phosphorous (P) are 41% of the total in the Lake Champlain Basin, but because agriculture can cost-effectively reduce P, the sector is responsible for 67% of reductions in the TMDL reduction requirements equation. The baseline outlined in the RAPs will meet many required standards, but farmers can do more and take some pressure off of other sectors to help meet water quality goals.

The state is aiming to reach TMDL goals as quickly as possible. The revision of the RAPs contributes towards that goal, as do other actions such as the creation of a Small Farm Operation certification program. To meet US Environmental Protection Agency (EPA) water quality requirements, under a regulatory framework, the state is working to implement education and outreach, technical and finance assistance, and inspection and enforcement programs.

To work towards these goals, AAFM collaborates with the Natural Resources Conservation Service (NRCS) and works to leverage federal and state funds through the Capital Equipment Assistance Program (CEAP), the Farm Agronomic Practices Program (FAP), and other programs.

The state is also working to advance processes that recognize and quantify the voluntary efforts of farmers exceeding RAPs and/or implementing best management practices (BMPs). AAFM entered into a grant agreement with Newtrient to develop a preliminary model of an eight-step process to certify practices on a farm that reduce P and could generate credits to be traded or sold.

The Vermont Environmental Stewardship Program (VESP) is a voluntary program that adopts a holistic, comprehensive view of environmental quality standards and provides incentives to farmers through social-based recognition.

Questions and comments from Working Group members *(direct responses from AAFM staff are in italics)*

- Are you suggesting the Working Group make RAPs the baseline for a PES program?
    - *The program will ensure that water quality standards are met throughout the state. Setting enhancements or incentives beyond RAPs may be best. This could be done either*

[1] See slides found at https://agriculture.vermont.gov/pes for additional detail.

through a temporal difference to incent the achievement of water quality standards faster, or by setting standards past RAPs.

- The additionality beyond RAPs could either be implementation of different practices, or implementation of RAPs practices to a higher standard.
    - *There is no standard for soil carbon or organic matter. Different metrics that are discretely regulated in RAPs, or soil erosion rates, could be options. It would be important to set goals past RAPs standards.*
- What portion of farmers are in compliance with RAPs? What happens if they are not compliant?
    - *Of assessments done thus far, there is a 67%[2] compliance rate. Since certified small farms are a new area of regulation, we are two years in to a seven-year process to assess small farms. The goal of enforcement is to fix the problem. Farmers must develop plans to implement practices.*
    - *The Revised Secretary's Decision outlines a compliance schedule whereby farms under the decision would be given one year to fix one problem, and 10 years to address all other issues. If there is not sufficient financial assistance, they may be granted an additional five years, since the costs can be high. The Agency's WQ Enforcement process has a much shorter timeframe for compliance than 10 years.*
- Are RAPs measuring practices or performance?
    - *Both. A lot of discretion is left to farmers—e.g. the no discharge requirement. However, requirements are more prescriptive in some contexts, such as the requirement for cover crops in the floodplain.*
- What other baselines can we draw on besides RAPs, considering that only some metrics are tied to erosion and water quality?
- What about certified small farmers that have not yet been certified? Will they be ineligible for PES?
- RAPs have come about in response to producers using or exploiting natural resources to create a single commodity. However, we are interested in whole other ways of stewarding the land and reaching goals such as climate resilience, clean water, clean air. We should consider a focus on the metrics and desired outcomes, rather than getting bogged down in the details of baselines for the process.
    - *The holistic perspective for lands is important. Using a baseline of what is already required is helpful from an efficiency perspective given finite resources to avoid "paying twice."*
- As we consider services beyond reducing P, the complexity will increase regarding what baselines to use.

[2] The compliance rates for farm production areas specifically, based on Agency of Ag inspections of farms in the Lake Champlain Basin from 7/13/2016 – 7/16/2019, is that the production area compliance rate for SFOs, CSFOs, MFOs and LFOs inspected in the Lake Champlain Basin by AAFM is 67%.

In SFY 2018, the AAFM Water Quality Division completed 652 inspections or investigations of farms throughout Vermont and issued 101 enforcement actions to farms.

Considering a framework for a Vermont PES program

Taylor Ricketts, Gund Institute, UVM, provided a review of ecosystem services (ES) and PES concepts, discussed key design elements, and shared an initial proposed design for a program developed by members of a graduate course he taught.

Defining and conceptualizing ecosystem services

Taylor provided the following definition for ecosystem services: "The conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfill human life" (Daily 1997). ES are generally grouped into four categories: cultural, provisioning, supporting, and regulating. Ecosystems provide bundles of multiple services. Ecosystems and species contain forms of natural capital (e.g. healthy soil, forests, etc.) which allow the ecosystem to function. ES are those functions which benefit people. By adding other forms of capital, people may amplify the benefits provided and may glean value from the ES.

Those who supply the ES (or those whose land provides the service) are not always those who benefit. The benefits may be monetized, but could also be measured in satisfaction, avoided hospitalizations, or other benefits.

Key concepts of payments for ecosystem services

ES often provide public goods, but they are influenced by private decisions. The market often externalizes these benefits and does not provide for ES effectively. Regulation can address this problem by requiring practices to mitigate pollution. Incentives (i.e., PES) can be used to motivate farmers and landowners to act as environmental stewards.

A formal definition of PES contains five components:

1. A ***voluntary*** transaction where
2. a ***well-defined*** ES (or a land-use likely to secure that service)
3. is being 'bought' by at least one ES ***buyer***
4. from at least one ES ***provider***
5. if and only if the ES provider secures ES provision (***conditionality***)

PES proposal for Vermont

There are a number of key questions to answer in designing a PES program. Members of a graduate course Taylor taught developed a proposal for a PES program for the state, addressing key design questions in the following ways

I. *What are the goals of the program?*
    a. Measured contributions to environmental goals
    b. Enhanced farm viability and public trust
    c. Voluntary and equitable participation
    d. Innovative and sustainable agriculture

II. *What ecosystem services will be involved?*

They selected P retention and carbon sequestration as the primary services to target, considering that these outcomes are closely linked to the state's comprehensive energy plan and EPA TMDL requirements.

III. *How will we measure them? Practice or performance?*

They determined they would measure services based on performance rather than practice, for several reasons

a. Focus on outcomes
b. Encourages innovation
c. RAPs already exist
d. Uncertain effectiveness of practice-based.

They acknowledged risks of a performance-based approach: it is more complicated, potentially costly, and practices aiming to achieve performance may not work.

They proposed that measurements could be made on a "farmgate" basis, measuring whole farm nutrient balance by gauging total P imports to and exports from a farm, and/or by using the state's P index (which has the benefit of using existing data and being supported by Extension.)

IV. *Who gets paid and how much?*

The class proposed that payees must be in compliance with RAPs and would receive an average of $10-100/pound P/year. Payments would be differentiated based on farm size and location, acknowledging that P reductions are more valuable/needed in some locations and that larger abatement costs may be faced by smaller farms.

They proposed upfront payments to incentivize enrollment, followed by annual payments based on performance. They proposed an initial baseline would be calculated by average P levels for the three years preceding enrollment. They also discussed the possibility of using RAPs as a baseline.

V. *Who pays?*

The class suggested a publicly funded model.

- Option 1 would reallocate current funding sources. This would require considering the cost effectiveness of PES versus other existing programs in reducing P.
- Option 2 would expand funding sources. This would require assessing the political feasibility of expanding sources (e.g., is a new tax a viable option?)

VI. *Who will administer the program?*

The class determined an intermediary between the public beneficiaries and farmers should be trusted by all stakeholders and experienced in administering conservation incentives. They discussed the possibility of empowering an existing entity, and posed as potential options: Vermont Housing and Conservation Board, Vermont Land Trust, or Natural Resources Conservation Service.

VII. *How do we balance fairness and efficiency?*

The class acknowledged a central tradeoff between rewarding past good behavior (e.g. of early adopters of ecological practices) and maximizing environmental improvements (by targeting those with most

room for improvement.) They suggested the differentiated payments and use of baselines as key levers to balance this tradeoff. They also suggested that seeking equity can improve efficiency by increasing participation and support for the program and enhancing legitimacy.

Questions and comments from Working Group members *(direct responses from Taylor are in italics)*

- Overlapping benefits are complex. How can we assess the value of a broad array of ES, especially if they overlap? Will social and cultural ES be included in what this Working Group considers?
    - *Often each benefit has its own buyers. They are sometimes sold individually and are sometimes bundled together. The specificity or fuzziness of each approach come with tradeoffs.*
- All four models of ES benefits (cultural, provisioning, regulating, and supporting) are relevant and will financially benefit the farmer.
- Who pays matters. Who pays for the costs to land, people's health, and society at multiple levels of producing items like high-fructose corn syrup is different from who pays for organic beef. We're all paying for the damages of products like high-fructose corn syrup through the production and consumption cycle, whereas only a few of us are paying for all the benefits of organic farming.
- How can the metrics discussed account for agronomic practices to improve soil biology to reduce P contributions?
    - *This can be accounted for the in farmgate model where, for example, how much P-laden feed needs to be trucked in. This can provide an incentive to disrupt problematic supply chains.*
- Some of what is called performance seems to be a more refined practice model. There is a balance between practice and performance, but either type of measurement costs money.
    - *Some metrics are an attempt to walk between practice and performance by accurately predicting performance from practices in specific land contexts.*
- We should measure what is actually happening rather than model it based on research. Biology is always adapting and changing. The saying "all models are incorrect; some are useful" is apt. It would be helpful to identify one thing or a small number of things to measure from which all other necessary improvements flow. I would posit the structure and structural integrity of soil could be that metric. Clod tests or infiltration tests could be useful metrics in this regard. It may be more efficient to measure and reward the creation of natural capital.
- Soil health is also a useful metric because it benefits the farmer. Something that benefits the farmer is helpful because it may mean that payments are not required indefinitely if they ultimately are beneficial enough to the landowner/farmer.

Vermont Environmental Stewardship Program (VESP)

Judson Peck, AAFM Water Quality Division, provided an overview of VESP, reviewed the VESP pilot study, and discussed the possibility of VESP administering a PES program.[3]

[3] For more detailed information on VESP, including information about the assessment tools it uses, see slide found here: https://agriculture.vermont.gov/pes.

VESP overview

VESP's goal is to accelerate water quality improvements through additional voluntary efforts and provide recognition for farmers who strive for environmental excellence. It currently provides social recognition to program participants, but could potentially provide financial payments in the future.

The program's development began in 2013, with funding originally coming from an NRCS Vermont Conservation Innovation Grant. AAFM, Department of Environmental Conservation (DEC), USDA Natural Resources Conservation Service (NRCS), Vermont Association of Conservation Districts (VACD), and University of Vermont Cooperative Extension (UVM) partner on the program.

To be eligible to participate in VESP (which is a voluntary program), farms must

- Be actively farming in the state
- Be a farm size as defined in the RAPs
- Submit all land managed by the farm, whether owned or leased, to assessment and certification
- Meet existing regulations, including RAPs

Assessment and tools

Participating farms are assessed according to the following criteria using the NRCS Resource Stewardship Evaluation Tool (RSET) and the Cornell Comprehensive Soil Health Tests.

- Nutrient management
- Sediment and erosion control
- Soil health
- Air quality
- Carbon sequestration
- Pasture health

RSET streamlines the assessment of multiple resource concerns in an integrated tool: soil management, water quality, water quantity, air quality, and wildlife habitat. It evaluates site-specific risks and applies thresholds to meet a unified national target (i.e., higher-risk fields require a higher level of stewardship to meet the national target.) The Cornell tool is a comprehensive test that measures multiple indicators of physical, chemical, and biological soil health.

Process

Farmers who meet baseline RAPs may apply to VESP. VESP contracts with conservation planners who conduct the farm assessment. If the farm does not meet the thresholds established in the RSET and Cornell Soil tools, the farmer works with the conservation planner to develop a conservation plan. If thresholds are met, the farm receives the VESP sign and is certified for five years. Follow-up monitoring is conducted and farmers may reapply for additional certification periods.

Pilot study

VESP is currently conducting a pilot with 10-12 diverse farm types to vet the process and assessment tools. The majority of farms tested so far in the pilot are doing quite well relative to the threshold indicators of both tools.

VESP and PES

VESP is a nearly full functional program, currently in a pilot, that provides a framework to objectively quantify multiple ES.

Act 83 of 2019 of the Vermont General Assembly, which called for the creation of this Working Group, identifies similar goals to those identified in Act 64 of 2019, which called for the creation of the Environmental Stewardship program. Namely, they seek to

- Improve soil health
- Enhance crop resilience
- Increase carbon storage and stormwater storage capacity
- Reduce agricultural runoff to waters

Additionally, there is good alignment on principles between VESP and best practices for a PES program:

1. Voluntary – participation based on additional benefit of PES program; no legal requirement
2. Beneficiary Pays – land managers are stewards (not polluters)
3. Direct Payment – beneficiary (public) to provider (land managers); or through intermediary (VAAFM)
4. Additionality – provision of services not occur without PES program (pay for additional services)
5. Conditionality – payment dependent on delivery of services

In the current VESP program, there is no baseline (e.g. reducing from a three-year average of P loads.)

AAFM submits to the Working Group for consideration the possibility of building on or incorporating VESP into a PES program.

Questions and comments from Working Group members *(direct responses from AAFM staff are in italics)*

- What are you testing in the pilot? Are you actively checking farms?
    - *Part of the effort is to calibrate the standards. If all farms easily pass, maybe the threshold is too low.*
- How significant is the social recognition alone to farmers?
    - *A number of farms reached out to VESP to express interest. Social recognition is important, though financial compensation would obviously be preferred. VESP has the authority to manage payments, though it does not have a means or methodology to do so currently.*
- Should there be financial incentives lasting five years that a producer can obtain from a snapshot assessment done in one day? Perhaps other assessment tools that provide more ongoing accountability should be considered. For example, there are technologies using satellites to measure growth every day.
    - *Annual spot-checking & verification of implementation is a part of maintaining VESP Certification and is built into the framework for the full VESP program.*
- How much could VESP be adapted in response to what this group develops for measurement, methodology, etc.?

    - *This program is flexible and still in pilot. Use of RSET aims to balance accuracy and costs, but other technologies could be considered.*
- Could the program accommodate a lot of farmers who wanted to join?
    - *The pilot is evaluating how much work evaluation requires, particularly for larger farms.*
- Does VESP show additionality, e.g. requirements to go beyond RAPs?
    - *It varies by field and by farm, since requirements are dependent on site-specific risks.*
- An expanded pilot could answer some additional questions and test some other tools.
    - Vicky Drew, NRCS: RSET is not that flexible of a tool. Moving the threshold for water quality is something we have been discussing and the developers could modify for Vermont.
- Does the VESP soil health test capture the soil sponge/soil structure and integrity metric? Mass balance could be added to VESP if so.
- BMPs and the RSET assessment tools are helpful to prevent further erosion of soil capital, but they may not incentivize the building of natural capital. We need to think creatively about different tools and technologies available to incent a shift from tolerable soil loss to building healthy soil. VESP seems to be acknowledging something less bad, rather than outlining where we want to go. It looks like most thresholds are met already.
- The 3 lb. P/acre national number should be translated into a Vermont number.

Meeting reflections: weighing options and key design considerations for a PES program

- The group has several options:
    - Fill out the matrix "homework" and then mix and match options
    - Develop an approach focusing on soil/natural capital
    - Use VESP as a scaffold on which to attach baseline values, determine eligibility, relationship to RAPs, etc.
    - Farmgate model (suggested by UVM students)
- Among key design questions, there seems to be relative consensus on measuring performance.
- It is possible to pay for good baseline levels for those who have adopted good practices, while also paying for additional improvements.
- Equity improves efficiency. This was reflected in hearing from farmers during legislative sessions that they want to be sure those who have been doing it right all along will be rewarded.
- The Working Group should imagine would communities, landscapes, economies, budgets, quality of life would look like with robust soil capital. This is a different approach than identifying benchmarks.
- What would be a "baseline" for natural capital? Would it be BMPs, a score on RSET, etc.? How would we incentivize the construction of more natural capital?
- How could a program allow farmers to get recognition and differentiate themselves in the market? Rewards in the marketplace could help replace transitional payments.
- A challenge with relying on product differentiation is that, once market penetration is reached, the price does not hold. We are also seeking a model that recognizes that the benefits are public goods. If farmers were paid an adequate price for their products, there would be no need for PES, but then only milk purchasers would be paying for it. By hoping that the marketplace will pay the price for the service, we're stuck in the "maximizing product" paradigm.

Public comment

- Andrew Davis, Northeast Organic Farmers Association Vermont: Measurements should reflect a sustainable ecosystem, not just the value the ecosystem provides. Otherwise, we risk getting stuck in the same paradigm of seeking high "productivity" on a metric, which may not be sustainable. Farmers are part of the ecosystem. If we incentivize decreased production of a commodity on a farm in favor of another ES, that may externalize the production methods into something out of control of the system, which could be less sustainable than the current production was.
- Brian Beckage, UVM: The VESP option sounds expeditious. I am concerned about the variability from a one-time snapshot. Also, how does a well-managed farm translate into quantifiable ES? For carbon sequestration, why not link to existing external markets for carbon offsets, etc. rather than creating a new market internal to Vermont? For P, what does 3 lb./acre of P removed translate into for downstream effects?
- Phil Huffman, The Nature Conservancy (TNC): TNC advocated for the creation of this group. We are heartened to see it has been created and to hear this discussion. TNC has been involved nationally and globally in efforts to develop PES frameworks. We hope this could be a resource to you. We support the overarching goals of moving towards enhanced environmental outcomes on critical farm resources, and recognizing support of farmers for environmental outcomes.
- Abe Collins, Landstream: the most viable path forward is to hire farmers to rebuild the natural capital we used to build Vermont. As important as measuring performance is the ability of land managers to use feedback to gauge their efforts. One ES is nutrient retention. A lot of P will be needed to increase organic matter one foot of depth.
- Abbey Willard, AAFM: The group could consider product differentiation for Vermont farms that participate in PES. It could have social value and eventually, through a customer base, financial value.
- Lauryn Sherman, VLS Student: We need to move beyond old models that seek to minimize damage, and instead seek actual regeneration of natural capital.
- John Winsten, Winrock: the focus on soil health will have private benefits for the farmer, and won't require a perpetual subsidy. On the other hand, if the ES requires a cost to the farmer, a program has to keep paying the cost or it won't realize the benefit.

Working Group attendees

1. Jill Arace
2. Paul Doton
3. Vicky Drew
4. Alyson Eastman
5. Nancy Everhart
6. Eric Howe
7. Brian Kemp
8. Maddie Kempner
9. Didi Pershouse
10. Taylor Ricketts
11. Chuck Ross
12. Marli Rupe
13. Tyler Webb

Vermont Soil Health and Payment for Ecosystem Services (PES) Working Group

Waterbury, Vermont
October 21, 2019 Meeting Summary

Next steps

- AAFM will post meeting materials and webinar recordings to the website.
- AAFM will compile and calculate sources and amounts of current funding being spent on water quality issues.
- CBI and AAFM will explore potential future webinars, including:
    - Landstream – discussion of monitoring and modeling technologies
    - Ecosystem Services Market Consortium
- CBI and AAFM will investigate resources and expertise to help quantify the costs of inaction and costs avoided through the provision of ES.
- CBI will work with WG members to begin to capture stories to help illustrate the experienced benefits of soil health, to be used in the narrative of the group's report.
- CBI will revise the September meeting summary to clarify statements about VESP requirements. The summary will then be considered final.
- CBI will revise the ground rules document to clarify that more than one alternate per seat is permitted if necessary.

Summary

The Working Group (WG) reviewed a matrix of design criteria and possible options for a PES system to discuss the pros and cons of various approaches and generate additional options. The content of the matrix was based on ideas and priorities for a PES system that WG members articulated in their responses to a survey. The WG then delved into more detail on several key questions in small groups before reporting back to the full group. Members' comments are summarized below.

Should we build on what we have or consider whole cloth change?

In support of a phased approach:

- We are not yet paying for performance that goes over and above minimum requirements. In the short-term, we should build on what we have and then in the longer-term do a more radical rethink of the system. Public awareness and support and funding would be needed for a more ambitious proposal. In the short-term, we should be pragmatic about how to target a likely small initial funding pot from the legislature.
- To get to the systemic reforms desired, we should take a first "pilot" step of building on the tools and regulations we currently have.

In support of fundamental reform:

- Significant reform is needed. A proposal to build on what we have and build on the baseline of RAPs is in some ways designating a tolerable level of degradation and loss of soil. Rather, we should orchestrate the shift from exploitive practices to generative ones in which we pay for the building of natural capital.

- This is expensive and requires the state to be a significant customer. It will also require creative thinking to integrate public and private sources of funding, plus consideration of the possibility of trading internationally. The framework established could facilitate the electronic trading of commodities. The focus should be on creating the pathway for this market.
- At this point considering the state of farming, dairy, land quality, and climate change concerns, we need to take the risk to build a new program. This may initially involve filling in the gaps in the current framework, but requires us to change the system pathway to reverse the degradation of soil health and natural capital.
- We should avoid the risk of standing up something modest that could preclude the option of revisiting and creating a more ambitious plan later.

Considering short time frame, choose something achievable:

- Considering the short time-frame of this group's work, we should recommend small scale pilot evaluation efforts to answer questions this group identifies, including the effectiveness of shifting from practice- to performance-based approaches. We could report to the legislature what the group resolved and what it hopes the pilots answer. This information could inform recommendations for more systemic change.
- We should choose something achievable and that the legislature will implement.
- If this group created a pilot, the legislation would likely build in a sunset clause for when the program would end and be revisited for review and potential improvements. This work will not be completed quickly and this group may continue to meet.
- The final recommendation of this group should be to provide adequate funding and time for a compensated, more technically advanced group to fully address these questions.

What ecosystem services should be included?

Targeting soil health and soil capital, while incorporating measures to address nutrient issues:

- An approach to compensate for soil health improvements could be combined with compensation for the management of nutrients.
    - Considering the amounts of P that are imported and can't be assimilated, we may want to think about the specific questions of whole farm balance to deal with near-term nutrient issues. Soil health metrics do not alone measure nutrient management metrics, but by putting them together we could keep our eyes on the immediate nutrient problems while still identifying big mechanisms of change.
- If our pilot encompasses payments for soil or natural capital, we should be clear about what benefits and what "stock" we are paying for.
- Our nutrient problems are a result of poor management practices over many decades. A narrow focus on nutrients is using a snapshot view to attempt to find solutions to address a long-term issue. Nutrient issues should not be ignored, but a more fundamental shift to encourage land stewardship and rebuilding natural capital is preferable.
- We should test a pilot approach focused on soil/natural capital to help answer what we can measure, what benefits flow from those outcomes, and how much we can pay. If we can use this test to learn more, it would have the benefit of being simpler than enumerating many different benefits we want. For example, we need to test for the relationship between soil health and nutrient management. Considering the TMDL on P, we need to be able to

demonstrate that a soil health-focused approach deals with the P issues that are a focus of the legislature.

On whether a more comprehensive suite of benefits should be included:

- A comprehensive approach to measure for multiple benefits such as pollination, habitat, and others in addition to soil health would be too much to take on at once.
- If we create a trading framework focused on natural capital, adding in other benefits such as pollination and wildlife habitat—which already sees substantial investment from organizations and the public trust—could be done without too much added complexity.

What is being measured and how? Establishing metrics and determining measurement tools

- Other metrics such as hydraulic conductivity, infiltration, soil aggregate stability, and photosynthetic activity help provide a fuller picture. Tools such as satellite measurements of UV radiation, remote sensing, soil mapping, and others can help provide a fuller picture for some cases. Soil scientists with more expertise than is represented on this group could help address the metrics needed.
- If there is funding for farmers to generate natural capital, private industry will fill the need to develop measurement technologies.
- We should avoid creating something so intricate that it is unintelligible to most people. It has to be simple enough to understand and not prohibitively expensive to measure.
- Avoided costs, such as protections for infrastructure from flooding, should be factored into benefits measured. More data to determine metrics for these may need to be gathered in a pilot. Quantifying avoided costs would be powerful to persuade the public and the legislature.
- Outcomes, rather than practices, should be paid for.

Program design and eligibility

Program creation considerations

- Building on VESP as an existing program would provide flexibility and would not require new rule-making, which was hard fought for VESP.
- Could an RFP process by initiated for bids to run a pilot project of some kind?
- Would a program make any funding available upfront to help with startup costs?
- Any program should make clear that it is not a handout or a subsidy, and that farmers are being hired to provide services. It should also acknowledge that farmers currently provide ES, including doing more than any other sector to address water quality issues.

Creating a market

- Some farmers may not capitalize on an invitation to participate in a less structured market and would be more likely to participate with clearer direction and a program to participate in.
- This group should focus on creating a pathway for the sale of ecosystem services, not a program. The state could commit a quantity of funding to purchasing natural capital and additionally provide funding to technical assistance providers to work with farmers, including VHCB, NOFA, and others. A small pilot targeting a particular watershed with high ambition and high potential for benefits could demonstrate the validity of the services and then potentially be

expanded to a much larger scale in the form of a market. An industry would then spring up to support farmers to participate in the market.
    - Markets need help to get started. The beginning stage of a market can look like a program, which can help establish consistency for and confidence in what benefits are provided, how they are measured, and that investments are worthwhile.
    - It could prove challenging to create private markets for public goods. Additionally, could the design mitigate the potential for the market to drive the price down for these goods, making it less worthwhile for farmers?
    - Ultimately, a funding stream could be secured through a conservation tax that everyone is subject to, with a resource tax for those who do not meet certain standards for stewarding the land.
- There is opportunity to learn from existing markets globally. This process should avoid reinventing the wheel.
    - There are parallels to learn from in the forest carbon market.
- Building a market requires understanding what stimulates behavior change.
- Would services be stacked or bundled in a market? How could multiple payments for the same thing be avoided?
- Care should be taken to make sure that whatever form a market takes, it is equitable across scales.

What baseline should be established for eligibility? Is there a minimum threshold?

- A baseline is needed to know what is being paid for and to ensure that what is being paid for is "new."
- Statute language states that to be eligible for programs, farmers must be in compliance with RAPs or be in good standing, demonstrating that work is being done to fix the out-of-compliance issues.
    - Could RAPs be an eligibility requirement, though perhaps not an appropriate baseline?
    - Could compensation be offered only for what exceeds RAPs?
    - Don't worry about RAPs for eligibility for PES opportunity. RAPs are required practices, separate from consideration of a PES system.
- There is a gap between the RAPs and achieving the TMDL. PES could help farmers meet RAPs and TMDL.
- While separate sources of assistance are available to meet RAPs, the group should be mindful about how available resources for meeting RAPS compare with compensation for ES. Significant environmental benefits (such as water quality) can be gained by bringing farmers into compliance with the RAPs.

Public comment

- Other metrics that may be considered in calculating ES provided include: diversity of plant species, biodiversity, photosynthesis, stream peak flows, algae blooms, and others.
- One concern regarding creating a market is market collapse. Some services are not easily monetized and where benefits are hyperlocalized, for example in avoiding roads washing out, a large-scale market would not capture these. In some cases, hyperlocal sources of funding would be helpful.

- Services should not be calculated based on one metric such as P retention or carbon sequestration. There are methods to measure benefits more comprehensively, which involve using a range of observed and modeled metrics.
- There are other programs that are focused on nutrient management and meeting the TMDL. A PES system should address positive gains, not only pay to mitigate the problem.
- This group should have a broader focus on natural capital rather than just nutrient management. The group should be realistic about what can be achieved in this timeframe, but create something that can be expanded with time.

The meeting was adjourned at 2 PM.

Working Group members in attendance

1. Jill Arace
2. Cat Buxton
3. Paul Doton
4. Alyson Eastman
5. Nancy Everhart
6. Brian Kemp
7. Taylor Ricketts
8. Chuck Ross
9. Marli Rupe
10. Tyler Webb

Vermont Soil Health and Payment for Ecosystem Services (PES) Working Group

Williston, Vermont
November 15, 2019
Meeting Summary

Next steps

- AAFM will post meeting materials, webinar recordings, and the October meeting summary to the website.
- AAFM will share public comments received via email with the Working Group
- CBI will work with the cochairs to develop components of a draft report
- CBI will plan future webinars, including one with Newtrient and potentially one on NRCS.

Summary

The Working Group's discussion focused on further elaborating PES program design criteria for a demonstration project; considering the applicability of and transferable lessons from related tools and projects, including the Conservation Effects Assessment Project (CEAP), the Resource Stewardship Evaluation Tool (RSET) and the Cornell Soil Health Test (CASH); and providing feedback regarding the direction and outline of a draft report.

Program Design Criteria

The group continued its discussions to refine a potential demonstration project. Key questions surfaced and options considered included the following:

What are the advantages and disadvantages of disaggregating the water quality benefits from other ecosystem services that may be provided by soil health, such as flood mitigation?

- Beneficiaries of the water quality benefits are more broad-based, whereas the flood mitigation benefits are likely very localized. Therefore, likely payers could be different.
  - What role could municipalities play? Given municipal investment in flood mitigation, could municipalities become buyers of flood mitigation benefits?
- Improving flood mitigation is a significant part of managing nutrient runoff.
- Valuing soil health in an integrated way may be a key component of the paradigm shift sought by this group, as compared to a more siloed approach to ecosystem services.

The relationship between soil health and nutrient retention is not yet well established. Multiple metrics to measure soil health may be needed to capture the aspects of soil health that this group is interested in measuring and valuing.

- For example, if the CASH test is primarily measuring the capacity to produce viable crops, it is not yet clear if a certain threshold level on the CASH score (e.g. a high score such as 90) also implies significant nutrient retention benefits. One possible question a demonstration project could help answer is what CASH score, if any, indicates that the soil provides water quality (nutrient retention) benefits?

- Could the nutrient management requirements of required agricultural practices (RAPs) address the question of overapplication of amendments/manure that would not be captured by a CASH score?
    - For fields with a medium or low P risk, farmers can apply above crop removal for P and still meet RAPs and pass RSET. There is latitude within existing regulations to build soil health with manure while being compliant with P loss standards.
- If a field is passing in RSET, is it very likely to be meeting the RAPs? If this relationship could be established it could provide efficiencies by avoiding the need for a state visit.
    - RSET does not look at production area compliance, which is a part of RAPs.

Given that much of the demonstration project may be focused on gathering information and establishing the relationships between soil health and desired ecosystem services, how should the project be structured?

- Payments:
    - Could farmers be paid some fixed price for participating?
    - Could graduated payments be made for the quality of natural capital provided as the work is done to calibrate the relationship between quality of natural capital and the desired ecosystem services?
- Since the VESP program includes RSET and CASH, could a payment element simply be added, and learning questions be defined that can be answered by the data gathered by VESP?
    - Where is the verification in such a model? CASH is more focused on healthy crops, and RSET is based on models and is only focused on a limited array of conservation practices meant to limit further degradation of resources rather than more generative practices.
    - The tools VESP uses are not articulated in the statute, so they could be changed.
- Consider focusing on one key watershed, such as the Winooski, South Lake Champlain, or Rock River.
- Avoid creating another program in which farmers can enroll. This should be a focused effort to correlate the relationship between soil health and desired outcomes.

What other issues need to be resolved before proceeding?

- How can measurements avoid penalizing participants for outside influence on their farm? If an upstream neighbor is polluting, how can that be considered?
- To get the statewide buy-in needed to advance a program, it must demonstrate relevance and benefits for the eastern side of the state.
- Natural capital or soil health, once well defined, could be an alternative to paying for practices or performance purely. While the natural capital model is attractive, it may not capture all the benefits the group wants to generate, so other things may need to be measured and paid for as well.
- We need to be mindful that complexity in the program can be a barrier to participation for farmers. Additionally, if the bar is set too high, many farmers will be unable to participate.

- Creative funding options beyond general funds from the legislature should be explored, including impact investment, low-cost forgivable loans, sponsorship money, and others.
- If this Working Group were to continue, how can we engage more farmer input going forward?

Watershed Monitoring and Conservation Effects Assessment Project (CEAP)[1]

Joshua Faulkner, UVM Extension, presented an on overview of CEAP watershed assessment studies. The watershed assessment studies are tightly linked to NRCS programs and focused on understanding the aggregate impact of programs implemented on the watershed scale. CEAP uses a paired watershed experimental design. It begins with a calibration period of the pair, and then a treatment period with the implementation of conservation practices in one watershed and business as usual in the control watershed to monitors differences across the pair over time.

Questions, comments, and discussion *(direct responses from Mr. Faulkner are in italics)*

- *The infrastructure costs approximately $18,000 per station, and total costs are around $300,000 per station for six to seven years.*
- *The project is not currently using CASH tests.*
- We need to be able to quantify the soil reconstruction value for water quality. There is a lot still not well understood. Some conservation practices can result in more runoff, though some of those conservation practices may not actually be improving soil health as this group conceptualizes it but are rather seeking to compensate for the lack of qualities that healthy soil provides (e.g. slit aeration trying to compensate for lack of infiltration ability that healthy soil would provide.)
- How is research such as this being used to set objectives for the TMDL?
    - Ryan Patch, AAFM: Whenever the RAPs are amended, the AAFM reviews research and information available. Rules are supported by documentation of research that can demonstrate the efficacy of regulations and are vetted by the public and committees.
- What treatment practices are of the highest interest? Where else are paired experiments happening like these?
    - *The project has learned a lot from Ohio, where a lot of work is being done. With more no till, we saw improved soil health. This resulted in a decrease in particulate P loss, but an overall increase in soluble P loss. These results are confounding. Tile injection is of interest to explore.*
- This program seems geared towards tweaking the traditional conservation programs we have now. It seems relevant for information exchange to guide stewards who may need that help rebuilding natural capital, though not sufficient alone to get us on the path to the ambitions of this group. Linking this project with CASH to monitor soil growing practices could help test the idea that a well-structured, functional, chemically active, and biologically diverse soil would create the outcomes we are seeking.

[1] For details on Mr. Faulkner's CEAP presentation, see the presentation slides posted at https://agriculture.vermont.gov/pes

Resource Stewardship Evaluation Tool (RSET) in Detail

Judson Peck, AAFM, provided an overview of RSET to give additional detail about the tool, building on the introduction provided in the VESP presentation at the first Working Group meeting[2]. RSET is an online web-based tool developed by NRCS. RSET

- Streamlines multiple tools into one integrated tool
- Is a holistic assessment across multiple natural resource concerns
- Is compared to science-based thresholds set by NRCS
- Incorporates site-specific data of each field (slope, soils, climate)
- Incorporates nutrient application data of P-Index
- Models management and practice changes – farmer see effects and plan accordingly

RSET incorporates five resource concerns: soil management, water quality, water quantity, air quality, and wildlife habitat. It determines the appropriate threshold specific to characteristics of the site to meet a national target.

The group discussed the interactions between RSET, CASH, and other metrics including the P index and observed that though there is some overlap in the metrics of these tools, a field could score well on one while poorly on another. The group discussed the possibility of using CASH and RSET in combination for a demonstration project, as the VESP program does. For example, the group discussed that RSET may be able to capture some dimensions around nutrient management plans that CASH may not address.

NRCS Programs

Vicky Drew, NRCS, provided a brief overview of NRCS programs that may be relevant to the efforts of the Working Group including EQIP, CSP payments, and the RCCP program. She mentioned that Congress directed NRCS to look further into ecosystem services and that this topic could rank more highly in future grant rounds. She mentioned that an RCCP alternative funding mechanism would likely come out in winter or early spring 2020.

Public Comment

- Tom Berry, Office of Senator Leahy: The opportunities laid out by Vicky Drew from NRCS may be the best way to seek federal support in the near term, since there will not be a new farm bill for five years.
- Tom Stoddard, Native Energy: I encourage the group to consider non-farm providers of ecosystem services in the development of a PES program.
- Erica Campbell, Office of Senator Sanders: I encourage the group to look at a new report out on climate change looking at current and potential federal programs *[need reference to report.]*
- Matt Gardner, AAFM: Regarding the discussion of decoupling water quality from flood mitigation: other than stream erosion, those are largely the same thing since flood mitigation is a primary driver of water quality improvements for nutrients going into the lake.
- Graham Unangst-Rufenacht, Rural Vermont: I encourage the group to keep the emphasis on natural capital and landscape function. Soil requires healthy plans, and plants require healthy animal management.

[2] For details on Mr. Peck's RSET presentation, see the presentation slides posted at https://agriculture.vermont.gov/pes

- David Miskell, Real Organic Project: I encourage the group to make sure that the pilots that are suggested by this group have broad enough political support and that you consider where they are located when determining this. This effort is critical to organic farmers, among others.

Working Group Attendance

1. Jill Arace
2. Cat Buxton
3. Paul Doton
4. Vicky Drew
5. Alyson Eastman
6. Nancy Everhart
7. Eric Howe
8. Neil Kamman
9. Maddie Kempner
10. Taylor Ricketts
11. Chuck Ross
12. Tyler Webb

Vermont Soil Health and Payment for Ecosystem Services (PES) Working Group

Williston, Vermont
December 16, 2019
Meeting Summary

Next steps

- AAFM will post meeting materials, webinar recordings, and the November meeting summary to the website.
- CBI will revise the draft report per comments from the WG and develop a draft budget proposal for WG review at the January meeting

Overview

The Working Group's discussion focused on refining the draft interim report to the legislature and brainstorming a prospective workplan for continued efforts into 2020.

NOFA-VT Farmer Survey

Maddie Kempner, NOFA-VT, shared preliminary results of a survey of farmers in the state that she and a small group developed to gain input from small-scale farmers whose interests NOFA represents on the Working Group. Maddie identified the most common themes that arose from the survey responses, including encouraging pasture/perennial forage, ensuring financial viability for farmers, supporting small-scale farming, improving clean water, and reducing nutrient and pesticide inputs into the system. The preliminary results indicated substantial engagement and interest in the topic of PES among farmers, and also the need for more education about PES concepts. All Working Group members had the opportunity to circulate the survey to their networks. Because most respondents were engaged through NOFA and the Vermont Healthy Soils Coalition's networks, the respondents were primarily from small, diversified farms.

Comments and discussion

- Group members were interested in extending an invitation to the survey to a larger and broader community of farmers. The group agreed to keep the survey open and give an opportunity for more responses to be gathered.
- Group members cautioned against extrapolating too much from the survey in the absence of any other community engagement information, since the survey was not conducted scientifically and the responses were not a representative sample.
- The group expressed interest in potentially doing a more rigorous, scientific survey in the future.

Revising the draft interim report to the legislature

Much of the meeting was focused on Working Group members providing input a draft of the interim report to the legislature. This feedback is captured in the revision to the report circulated before the January 9, 2020 meeting.

Public comment

Several members of the public made comments, including suggestions for revisions of the report:

- Phil Huffman, The Nature Conservancy: the charge to the Working Group from the Legislature reinforces the point made in discussions here that soil health is an important factor, but not the only item on which this group should focus. Additionally, it may be helpful for the report to articulate key principles for what a PES program needs to include on which this group agrees, such as outcomes rather than practices, voluntariness, additionality, quantifiability, verifiability, durable outcomes, and others. A clear definition of soil health should be provided. Notably absent from the Working Group is a representative from the environmental/NGO community. The Nature Conservancy may be a useful addition to these discussions. The concept of a pilot effort in the short term coupled with a longer effort to build a full strategy seems wise.
- Abbey Willard, VAAFM:
    - it is helpful to distinguish between two phases being discussed: one focused on buying community benefits such as flood protection for local infrastructure, and the other focused on investing in a functional landscape. An additional, softer value benefit of reputation- and relationship-building is not yet captured in these discussions.
    - The Working Group should look to national opportunities, such as the Ecosystem Services Markets Consortium's announcement of plans to invest in new areas. If Vermont made a small investment to serve as the match to unlock that investment, it could be very valuable.
- Graham Unangst-Rufenacht, Rural Vermont: the emphasis on natural or soil capital should be framed in terms of landscape function. The framing as investment rather than payments is also important. More investigation of what can and cannot be measured is needed. This report needs to explain that a PES system will not be a silver bullet for the larger economic issues hurting farmers. More thought is needed on how to bring this conversation to farmers and watershed groups.
- Andrew Davis, NOFA: more in-depth reflection is needed on why current programs are not sufficient. Look to the models created in other states such as the watershed ag council in New council in New York State, where investments were made in ecosystem services to save money on water treatment. Community organizations should be involved more to allow investment in natural resources. Perhaps the state could create a matching program to make it easier to invest in ag quality.
- Chris Kopman, Newtrient: Advanced models are not simply paying for practices. Payment for practices uses a formula of x dollars tied to y acres of z practice, etc. With a sophisticated model, payments are tied to quantified outcomes, such as nutrient retention or carbon sequestered.
- Jon Winsten: Pilot testing will be essential to get precise information and uncover important questions. Consider options to pay both for transformation of the landscape and more minor improvements via tweaks to management in the short term. The uptake of many farmers may be significantly lower if the only option for participating is in a "transformation" effort.

Working Group Attendees

1. Jill Arace
2. Paul Doton

3. Vicky Drew
4. Alyson Eastman
5. Nancy Everhart
6. Eric Howe
7. Brian Kemp
8. Maddie Kempner
9. Didi Pershouse
10. Chuck Ross
11. Marli Rupe
12. Tyler Webb