REPORT ON FARMING PRACTICES IN VERMONT

Prepared for the Vermont General Assembly in Accordance with
Act 168, Section 9 (2018)

Submitted by
Vermont Agency of Agriculture, Food and Markets

January 15, 2019

Executive Summary

- This report summarizes the discussions of a subcommittee of the Nutrient Management Commission convened to address the requirements of Act 168 of 2018 (Act 168) and the recommendations of Vermont Agriculture, Food and Markets (VAAFM) concerning whether and how to revise future farming practices associated with nutrient management (NM) in Vermont to mitigate environmental impacts and maintain the economic viability of farming in the State.

- Vermont farmers have been and continue to be active participants in adopting farming practices for water quality protection. While expenditures of public and private money have been significant, limitations on available financial assistance sometimes restrict the implementation of several key water quality practices.

- The Commission discussed that many of the concerns identified in Act 168 such as carrying capacity and crop rotation are addressed in current NM standards and regulatory systems. The Commission acknowledged the continued emphasis of NM as a foundation of agricultural management is important to protect water quality. However, the Commission noted that accountability on NM oversight is critical to ensuring water quality protections are in place under this regulatory system.

- The Commission discussed how the present NM standard when properly applied and properly implemented already defines a carrying capacity for a farm unit by prescribing the rates and locations of manure applications and requiring export of manure nutrients in excess of what the land and cropping system can safely accept. These prescriptions are currently enforceable under Vermont's *Required Agricultural Practices* (RAPs) and other water quality regulations. The Commission discussed why a broad application of a rigid numerical capacity limit would ignore inherent variability in field conditions and be unnecessarily restrictive in some cases, and perhaps too permissive in others.

- The Commission acknowledged that the application of vegetated buffers is an essential part of an agricultural water quality management strategy. The Commission provided feedback against an across-the-board increase in mandatory buffer widths and the need for an evaluation of current buffer performance. The Commission discussed the application of more whole-field analysis to install site-specific "smart buffers" necessary to protect water quality.

- The Commission discussed that the appearance of herbicide use has increased with the increased visibility of cover crops, where use of herbicides is sometimes necessary to allow new crops to be planted. The Commission notes that herbicides have been and continue to be part of the agronomic tool kit for much of modern agriculture and there are Federal and State regulations that apply to their use that take water quality into consideration. The Commission discussed that restrictions on herbicide use on cover crops could reduce implementation of this and other conservation practices that are beneficial for water quality

and identified the need for research to improve management systems that benefit soil health and reduce the overall need for herbicides.

- Diversification of farming at the farm level is a personal and financial decision of the farm operator; diversification of the state-level agricultural economy is additionally a matter for public policy and associated economic policies and market forces, not solely the decision of an individual farmer. The Commission discussed the need to expand state policy and financial assistance for agricultural diversification. Noting the current trends for diversification of Vermont agriculture, the Commission also noted that diversification may not always be environmentally beneficial. Non-livestock agriculture may not always be more sustainable or environmentally protective than current practices and may not be as effective in fostering the kind of working landscape that Vermonters and visitors value.

- Cover cropping is now a major practice in Vermont; nearly one-third of all annually tilled fields are now planted to a cover crop in the fall, a significant increase in both total acreage and percentage of fields cover cropped since 2014. The Commission noted that technical and financial assistance is an important aspect for cover cropping to continue and expand in acreage implemented.

- The Commission discussed that reduced tillage and no-till continue to be promoted in Vermont where soils and cropping practice are appropriate as part of overall conservation planning. The Commission further noted that potential negatives of conservation tillage – especially runoff losses of dissolved nutrients and enhanced delivery of pollutants into subsurface drainage when improperly managed – be monitored and evaluated for future action if necessary.

- The Commission discussed that manure injection – when done correctly – can provide multiple benefits to both water quality and farm operations. Potential negative impacts including delivery of nutrients and pathogens to subsurface drainage were noted and further study was suggested. The Commission discussed how current financial assistance programs for the support of manure injection are limiting more widespread adoption.

- The Commission members noted that crop rotations are currently managed through properly developed and implemented NM plans, as well as through whole-farm conservation planning, both of which are accounted for and enforced by existing regulations. Mandating specific crop rotations (e.g. no continuous corn) or forcing corn production to high-risk fields (i.e. potential impact if no continuous corn were required) outside of the current NM planning process would not necessarily be protective of water quality as the high-risk fields could have greater nutrient losses.

- The Commission noted that accelerating adoption of appropriate BMPs such as NM could be beneficial to water quality in Vermont and that such acceleration requires extensive and creative financial and technical support. The Commission discussed issues of increasing performance- and market-based approaches to support BMP implementation and application of the concept of payment for ecosystem services (PES) so that farmers are rewarded for the specific, indirect, and induced environmental improvements they produce.

1.0 Introduction

1.1 Legislative mandate

Act 168 of 2018 (Act 168) calls for the Nutrient Management Commission convened by the Secretary of Agriculture, Food and Markets (Secretary) – a component of the Phosphorus TMDL Phase 1 Implementation Plan for Lake Champlain – to review whether and how to revise farming practices in Vermont in a manner that mitigates existing environmental impacts while maintaining the economic viability of farming in the State. The legislation directed that a report summarizing recommendations of the Nutrient Management Commission on the Future of Farming Practices in Vermont be submitted to the Senate Committees on Natural Resources and Energy and on Agriculture and to the House Committees on Natural Resources, Fish, and Wildlife and on Agriculture and Forestry on or before January 15, 2019.

1.2 Nutrient Management Commission purpose and membership

The Secretary of Agriculture, Food and Markets (VAAFM) convened the Nutrient Management Commission (The Commission) Future of Farming Report subcommittee in December 2018 to discuss and make recommendations as the basis of the report to the Legislature required in Act 168. In these discussions, the Commission focused primarily on the current practice of Nutrient Management (NM) (as defined in the USDA Natural Resources Conservation Service - Vermont [NRCS] 590 practice standard and other technical standards adopted by VAAFM) and Nutrient Management Planning (NMP) and related agricultural Best Management Practices (BMPs) in Vermont and specifically considered whether and how to:

- Revise farming practices to improve or build healthy soils;
- Reduce agriculturally based pollution in areas of high pollution, stressed waters, or impaired waters;
- Establish a carrying capacity or maximum number of livestock that the land used for nutrient application on a farm can support without contribution of nutrients to a water; and
- Provide financial and technical support to facilitate the transition by farms to less-polluting practices through one or more of the following:
    - cover cropping
    - reduced tillage and no-till
    - accelerated implementation of BMPs
    - evaluation of the effectiveness of riparian buffers in excess of 25 feet
    - increased use of direct manure injection
    - crop rotations to build soil health, including limits on continuous corn
    - elimination or reduction of the use of herbicides in the termination of cover crops
    - diversification of dairy farming

The Commission met on December 18, 2018 and January 9, 2019 to discuss the topics contained in this report. Membership of the Commission is listed in Appendix A. VAAFM sought broad representation for the Commission. It should be noted that individual Commission members did not necessarily represent the full or official position of their agency or organization. This report

summarizes the results of Commission discussions, but the recommended actions are solely those of VAAFM.

1.3 Important considerations

The Commission notes that several important considerations apply to the discussion of farming practices and water quality in Vermont. First, because the current effort is closely tied to the Lake Champlain Phosphorus TMDL and to NM, most of the subsequent discussion addresses issues of nutrients and water quality in Vermont agriculture. Other dimensions of water quality (e.g. sediment, pathogens) and issues of agricultural management (e.g. grazing, subsurface drainage) may require additional consideration in the future. Second, the Commission's discussions focused on a management policy level; detailed technical standards for NM planning and the practice of NM at the farm level will be addressed by a NM Technical Workgroup to be convened in 2019. Third, it must be emphasized that agriculture and agricultural water quality issues in Vermont are subject to a number of external influences including national/global economic forces and weather/climate patterns that are out of the control of both individual farmers and agency managers. These forces make planning for farming practices to protect water quality a constant challenge and one that must be addressed on all levels from individual farmers, to technical specialists, to State and Federal policy makers. Lastly, the importance of lag time in measurable in-stream or in-lake water quality response to NM or any other management measure must be considered. While Vermont farmers have been quick to adopt water quality BMPs, effects of changes on the farm move slowly through soils, down streams, and through the Lake before being manifested in improvements apparent to the public. Patience is required.

Perhaps most importantly, the Commission recognized that many of the concerns identified in Section 1.2 above are addressed in current NM standards and regulatory systems (e.g. RAPs). Issues of carrying capacity and crop rotation, for example, are managed as an inherent part of a properly implemented NMP process. The Commission noted the importance of continued emphasis of NM as a foundation of agricultural management to protect water quality, however transparency and accountability to ensure water quality protections are being managed in NM plans is critical.

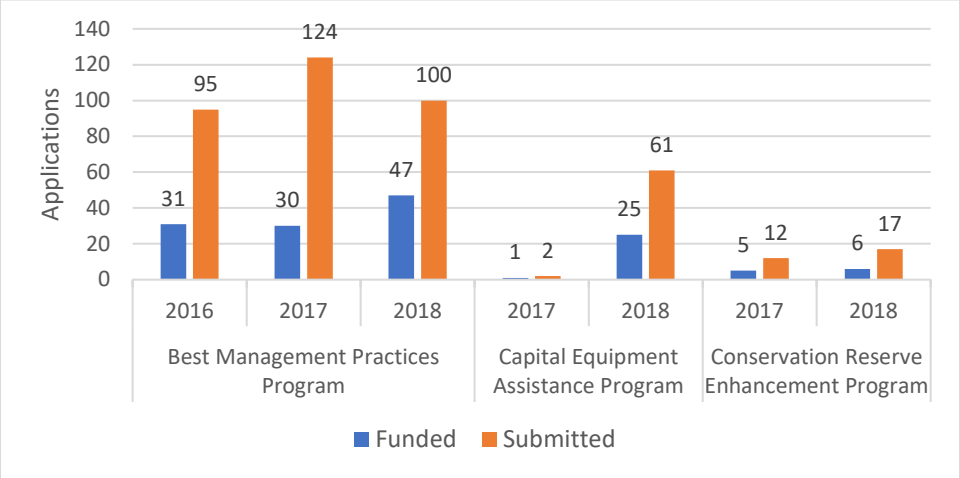
2.0 Current Status and Trends in Farming Practices for Water Quality Protection in Vermont

Vermont farmers have always been active participants in adopting farming practices for water quality protection. Since the 1980s Vermont farmers have matched millions of dollars of State and Federal cost-share funds with their own money. In FY 2018, for example, these voluntary conservation programs enabled $3,227,816.34 in State expenditures to leverage $2,863,877.90 in federal expenditure, as well as $942,889.24 in cost-share contributions from Vermont farmers and agricultural landowners.

Even with high levels of Federal and State funding, the demand for State cost-share programs by Vermont farmers has continued to exceed available funds (Figure 1). These programs help

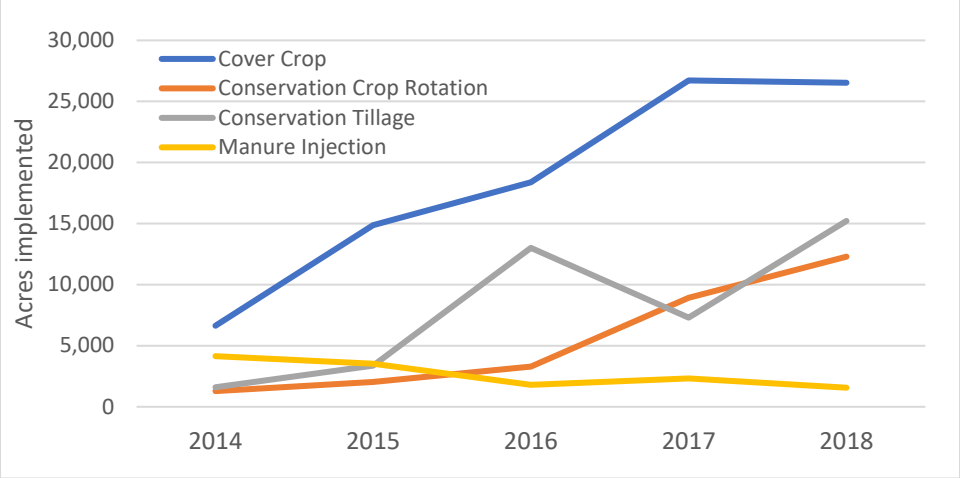
farmers improve farmstead areas (BMP), acquire innovative conservation equipment (CEAP), and protect environmentally sensitive riparian areas (CREP).

Figure 1. Demand for VAAFM Programs that Help Farmers Improve Water Quality



In recent years, farmers have accelerated their adoption of conservation practices that benefit water quality and soil health (Figure 2). These measures include the use of crop rotations, manure injection, reduced tillage, and cover crops. The practice of injecting manure into the soil has also increased, although current tracking data do not reflect actual adoption rates because NRCS no longer pays for and reports injection as a separate practice. Data from VAAFM suggests that nearly one-third of all annually tilled fields in Vermont are now planted to a cover crop in the fall.

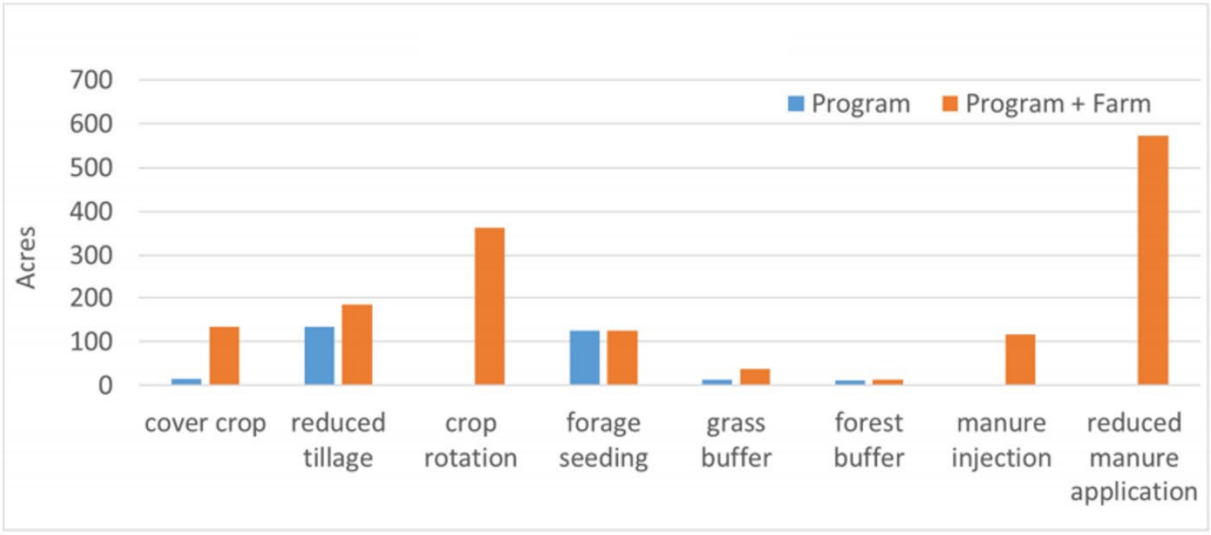
Figure 2. Trends in Farmer Implementation of Agronomic Practices



Recent UVM Extension data from the Lake Carmi watershed show that farmers are implementing water quality practices without program cost-share at a rate equal to, or exceeding,

the rate for practices supported with cost-share (Figure 3). This trend has also been documented in other areas such as western Addison County.

Figure 3. Practices Implemented by Farmers without Cost-share in the Lake Carmi Watershed



3.0 Future of Farming Practices

The Commission addressed each of the topics listed in the legislative mandate (see Section 1.2), but modified the order and organization of topics, as reflected in sections 3.1 and 3.2 below.

3.1 Strategies to reduce agriculturally-based pollution in areas of high pollution and stressed or impaired waters

3.1.1 Livestock carrying capacity Livestock carrying capacity refers to the maximum number of animals a land unit (e.g. field, farm, watershed) can sustain without significant land degradation or off-site non-point source pollution. In the context of NM, carrying capacity can refer to the maximum quantity of manure nutrients generated by the animal population on the land unit that the land can accept while being protective of water quality. Carrying capacity is variable across the landscape, influenced by animal characteristics (e.g. manure generation, nutrient content), land characteristics (e.g. land cover, soils, slope, proximity to water), and management (e.g. manure application rates, methods, and timing; cropping; presence of conservation measures). Because of this variability, no single carrying capacity threshold can be established that is universally applicable.

The Commission discussed how the present NM practice (based on the USDA-NRCS 590 standard and the Vermont Phosphorus Index), when properly applied and properly implemented already defines a carrying capacity for the farm unit by prescribing the rates and locations of manure applications and requiring export of manure nutrients in excess of what the land and cropping system can safely accept. These prescriptions are currently enforceable under

Vermont's Required Agricultural Practices (RAPs) and other water quality regulations. The Commission noted that broad application of a single numerical limit would ignore inherent variability in field conditions and be unnecessarily restrictive in some cases, and perhaps too liberal in others.

The Commission discussed that the notion of carrying capacity as part of the technical basis of NM provides more farm and site specific animal/acre thresholds. The Commission also recognizes that VAAFM programs for NMP oversight and follow-up needs to be strong. Finally, the Commission recognizes that the idea of carrying capacity can apply to other farming activities in addition to NM, e.g. pasture management and grazing, and that this issue may need to be considered in cases where grazing is a major activity.

VAAFM recommended actions:

- Develop better procedures when manure export is required by NMP that the receiving farm also has a NMP (e.g. small farm operations have a different NMP standard);
- Provide meaningful follow-up and enforcement for the development and implementation of NMPs; and
- Improve NMP outreach and technical assistance to farms with deficient or non-existing NMPs.

3.1.2 Evaluation of the effectiveness of buffers greater than 25 feet

Vegetated buffers between cropland and surface waters are widely used conservation measures intended to intercept runoff from agricultural fields and prevent delivery of pollutants to surface waters. Current Vermont RAPs require 25 foot and 10 foot buffers of perennial vegetation between all cropland and surface waters and ditches, respectively. Tillage and mechanical application of manure is prohibited within the established buffer zones, except for establishment of the buffer zones. State law currently allows for farmers to petition of the Secretary to reduce the size of perennial buffers or to change the perennial buffer type based on site-specific conditions, see 6 V.S.A. §§ 4810(b), 4810(a)(6)(B). The RAPs – as effective November 23, 2018 – provide a mechanism through which farmers can request site-specific buffers, known as "smart buffers", according to standards approved by the Secretary, see Section 6.07(i) of the RAPs.

While there is ample scientific evidence that well-managed vegetated buffers of various widths can effectively reduce pollution, the Commission recognizes that the current buffer width requirements represent a compromise between technical effectiveness and regulatory application. The Commission also recognizes that buffer effectiveness is more than a matter of width alone; effectiveness depends on up-slope field conditions and management, topography, buffer design, condition, and maintenance, and other factors. Even buffers greater than 25 feet can be short-circuited by concentrated overland flow between a field and a water body; other situations may exist where a 10 foot buffer may be adequate to protect water quality.

The Commission discussed that the application of vegetated buffers is an essential part of a management strategy that includes aspects of soils, topography, field conditions, cropping, and weather. The efficacy of current buffer widths needs to be assessed, both in terms of real-world performance and in the context of "smart buffers," wherein a site-specific field evaluation would

determine actual buffer width(s) needed to protect water quality. Such smart buffers might be wider or narrower than current standard requirements. The Commission discussed the challenges with an across-the-board increase in mandatory buffer width, but rather focused on ensuring farmers implement whole field management along with the current buffer performance as healthy soils and good management in the field can be more important than the edge of field buffer when it comes to protecting water quality.

VAAFM recommended actions:

- Conduct a regulatory review of current buffer standards; and
- Assess the needs and means for additional planning and technical support for future implementation of "smart" buffers.
- Expand the ability to provide technical support for the Conservation Reserve Enhancement Program to implement more buffers that are site-specific.

3.1.3 Reduction or elimination of the use of herbicides to terminate cover crops Despite the recent widespread adoption of cover cropping on annual crop land (see Section 3.2.1), planting of new crops into the remains of an over-wintered cover crop remains a challenge in the spring. Mechanical means are available for cover crop management and field preparation but are not reliably effective, often still requiring the use of herbicides or further cultivation to manage competition. It has become common practice – both in Vermont and across the nation – to use herbicides to terminate cover crops in the spring to enable subsequent planting.

The Commission recognizes that herbicide use for controlling undesired species is not new, however with cover cropping having a greater vegetative cover in fields, the appearance of herbicide use has increased. The Commission pointed out it may be a mistake to single out cover crops for attention with regard to herbicide use. It must be recognized that herbicides have been and continue to be part of the agronomic tool kit for much of modern agriculture and there are regulations that apply to their use that are tested and approved at the federal level and enforced at the local level that take water quality into consideration. Additionally, for both economic and environmental reasons, farmers continue to strive to minimize the impacts of herbicide use.

The Commission also recognizes the need for improvement in how farmers use herbicides for all crops, particularly in light of ongoing improvements in overall soil health management that may ultimately reduce the need for herbicides. The Commission discussed how restrictions against herbicide use on cover crops can be in conflict with other water quality conservation practice interests, and encouraged research to improve management systems that benefit soil health.

VAAFM recommended actions:

- Investigate the potential for improvements in crop management and soil health to reduce the need for herbicide use.

3.1.4 Diversification of dairy farming The decline of dairy farms in Vermont has been a continuing trend for several decades. Data from the U.S. Agricultural Census and VAAFM

show that the number of dairy farms in Vermont has been decreasing steadily, from 1,940 in 1997 to 704 in 2018. In comparison, the overall number of farms in Vermont has increased from 6,571 in 2002 to approximately 7,300 in 2018. The decrease in the number of dairy farms is somewhat offset by a significant increase in the size of individual dairy farms in the state. Regardless, the overall number of dairy cows in Vermont has decreased from 162,868 in 1997 to around 126,000 in 2018.

The idea of diversification of dairy farming in Vermont likely means very different things to different people. To some, diversification means transition to organic milk production; to others, diversification may mean specialization in a particular component of dairy farming, such as crop production, milking, or stock breeding. Diversification may also mean switching from dairy cows to dairy goats or to changing entirely from dairy to beef livestock, or to vegetable production. The removal of the federal prohibition on hemp production in the Agricultural Improvement Act of 2018 may open additional opportunities for growing high-value crops for Vermont's dairy farmers.

The Commission discussed these topics but did not reach a clear conclusion. For an individual dairy farmer, diversification by adding activities such as feed production and sales or maple sugaring is already commonplace, whereas the likelihood of a dairy farmer abruptly switching to vegetable production seems low. Diversification of the state-level agricultural economy is additionally a matter for public policy and market forces, not solely the decision of an individual farmer. The Commission did discuss the concern that diversification may not always be environmentally beneficial. Whereas transition to organic dairy may mean less corn land and more grass-based production, manure management continues to be critical for both conventional and organic dairies. Available research data suggest that there are no consistent environmental benefits to switching from cows to other animal species for dairying. Non-livestock agriculture may not always be more sustainable or environmentally friendly than current practices and may not be as effective in fostering the kind of working landscape that Vermonters and visitors value.

VAAFM recommended actions:

- Provide programmatic support and education outreach to the agricultural community, as well as technical and financial assistance to farmers for measures that would improve the diversity of Vermont agriculture in a sustainable manner; and
- Apply the concept of payment for ecosystem services (PES) so that farmers are rewarded for the specific, indirect and induced environmental improvements they produce.

3.2 Support for practices that build healthy soils

3.2.1 Cover cropping A cover crop is generally defined as a short term crop (frequently an annual grass) grown after the main cropping season to prevent erosion, take up excess nutrients, improve soil health, smother weeds, and provide other benefits. Cover crops are one of the most valuable management practices available for protecting water quality, especially groundwater quality, which is a difficult resource to protect from soluble nutrients like nitrate Nitrogen. Data from VAAFM suggest that nearly one-third of all annually tilled fields in Vermont are now

planted to a cover crop in the fall; this represents a significant increase in both total acreage and percentage of fields cover cropped since 2014.

The Commission discussed the importance of providing technical and financial assistance for cover cropping to continue.

VAAFM recommended actions:

- Continue to provide technical and financial assistance for cover cropping, with active follow-up to ensure the successful establishment of high-quality cover crops; and
- Support efforts to develop cover cropping management systems that can improve spring planting through overwintered cover crops and minimize use of herbicides.

3.2.2 Reduced tillage/no tillage

Tillage is the practice of plowing soil to prepare it for planting or after harvest to remove crop debris from the surface. Traditional full tillage exposes bare soils to weather and promotes soil loss through erosion, potentially delivering nutrient-bound sediments to waterways. Reduced tillage minimizes soil disturbance and leaves crop residues to protect the soil surface while no-till involves no soil disturbance; collectively, these methods are referred to as conservation tillage. Conservation tillage reduces soil erosion, improves moisture retention, and can promote soil health by building soil organic matter content and soil structure.

The Commission discussed the many benefits of conservation tillage, particularly reducing erosion and soil loss and reducing delivery of particulate phosphorus to surface waters. The use of reduced tillage and no-till on Vermont annual crop land has been increasing since 2014, with 16,458 acres of Vermont annual cropland under conservation tillage, representing 20% of corn acres in the State.

At the same time, the Commission discussed that some barriers to adoption and possible negative externalities to reduced tillage exist. Reduced tillage requires specialized equipment for both tillage and planting operations and is not always feasible for some heavy clay soils that cannot be easily worked in the spring. Often the adoption of conservation tillage on heavy clay in Vermont soils requires the installation of systematic subsurface tile drainage to be feasible; the net difference of non-point source nutrient losses from an undrained versus a drained system is not fully understood. Long-term reduced tillage can lead to nutrient stratification in surface soils because applied nutrients are not well-mixed into the crop root zone. Accumulation of nutrients – especially phosphorus – at the soil surface has led to increased runoff losses of dissolved nutrients in some parts of the U.S. Finally, long-term reduced tillage often promotes the formation of soil macropores (soil cracks or large vertical channels formed by plant roots or animal burrowing) that can quickly deliver sediment, nutrients, and other pollutants into groundwater or subsurface drainage.

The Commission discussed that if reduced tillage and no-till continue to be promoted in Vermont where soils and cropping practice are appropriate as part of overall conservation planning it would be beneficial for water quality. Trade-off issues around conservation tillage should be addressed through the kind of whole-field management strategy that considers soils, topography, field conditions, cropping, and weather as part of the overall management of vegetated buffers (see Section 3.1.2). The Commission further identified the potential negatives of conservation

tillage – especially runoff losses of dissolved nutrients and enhanced delivery of pollutants into subsurface drainage when improperly managed – be monitored and evaluated for future action if necessary.

VAAFM recommended actions:

- Continue to provide technical and financial assistance for reduced tillage and no-till as part of comprehensive conservation planning; and
- Monitor potential issues associated with conservation tillage such as dissolved nutrient losses and pollutant delivery to subsurface drainage as necessary.

3.2.3 Increase use of manure injection Manure injection is a method of manure application in which manure is mechanically applied into the root zone with surface soil closure at the time of application. In contrast to traditional surface broadcast application, manure injection significantly reduces nutrient loss to the atmosphere and via surface runoff (including both dissolved and sediment-bound nutrients) by limiting the quantity of material left on the soil surface, reducing soil disturbance, and closing soil openings immediately. Injection also protects the erosion control performance of reduced tillage because it disturbs 30% or less of soil surface area. Manure injection offers many direct benefits to the farmer, including retention of valuable manure nutrients, potential improvement in farm phosphorus balance, and odor control. For these reasons, incorporation of manure into the soil has long been favored over broadcast application to the soil surface.

The Commission identified several important issues around manure injection. Manure injection requires a high capital investment by the farmer, particularly for the specialized equipment required; current levels of available cost-share may not be adequate to sufficiently promote and implement manure injection. Currently under EQIP, NRCS only provides a payment of $15/ac for manure injection while the State FAP pays $25/ac. However the FAP payment is limited to $5,000 per farm with only $150,000 in general fund monies available to support implementation. Improved funding in VAAFM's FAP will be valuable in this regard. Second, manure injection can lead to some potential negative water quality impacts. For example, potential interaction between manure injection and tile drainage is a concern. Injecting manure into the soil may in some circumstances promote the delivery of manure pollutants into subsurface drains via soil macropores. Injecting manure into the soil may also promote the survival of manure-borne microorganisms like *E. coli* or *Giardia* by sheltering the organisms from sunlight and air-drying. This latter issue may be of particular concern in watersheds impaired by pathogens. Finally, some Commission members identified a problematic interaction between injection and the P Index, where reduced risk from manure injection might allow increased P application rates, possibly leading to excessive levels of soil P.

On balance, the Commission discussed the importance of promoting manure injection – when done correctly – because of the multiple benefits to both water quality and farm operations, while noting that use of manure injection should continue to be field-specific, in order to avoid the potential drawbacks mentioned above. Current financial assistance programs administered by VAAFM for the support of manure injection are structured to give farms the opportunity to try

manure injection, but the current levels of funding and program caps on payments per farm do not support long-term adoption on a large scale. The Commission is generally supportive of increasing state cost-share to support manure injection implementation.

VAAFM recommended actions:

- Continue to provide sufficient technical and financial assistance to promote the appropriate use of manure injection;
- Conduct research and/or monitoring to track and evaluate potential negative impacts of manure injection, particularly interactions with tile drainage and survival of manure microorganisms;
- Improve the handling of manure incorporation in the Vermont P Index; and
- Improve funding support and equipment availability to farmers for implementation of manure injection, e.g.:
    - Lift the monetary cap on FAP if there is increased funding support
    - Continue to provide partners grants for technical assistance and farmers grants for equipment from the Clean Water Fund to support manure injection on more farms; and
    - If there is an opportunity, increase overall funding for FAP, while maintaining tracking and accountability for adoption of manure injection.

3.2.4 Conservation crop rotations and limiting continuous corn Farmers follow conservation crop rotations, regular cycling of particular fields between silage corn and hay production, for example, to maintain and enhance soil health, reduce overall soil loss, and to manage crop pests. Due to favorable soil conditions and topography, some fields do not need to be rotated and may be in silage corn for many years without concern for water quality, i.e., "continuous corn." There is sometimes a public perception that continuous corn is always bad for water quality and soil health. This is not always true, because some flat fields with deep soils can support extended corn production without major soil or nutrient runoff, whereas some steep fields could generate significant water quality impacts if rotated out of grass and into corn. All of these site-specific field conditions are considered in a NMP and regulated by existing water quality regulations. It is worth noting that for a given animal population in common dairy production systems, a farmer must produce a consistent amount of corn silage feed each year, so the acres planted in corn on a farm remain about the same year-to-year. Farmers must balance this need to produce adequate feed with crop rotation schedules.

Members of the Commission explained how crop rotations are currently well-managed through properly developed and implemented NMPs, as well as through whole-farm conservation planning, both of which are accounted for and enforced by existing regulations, e.g., RAPs. Mandating specific crop rotations or forcing corn production to high-risk fields outside of the current NMP process may not be protective of water quality.

VAAFM recommended actions:

- Continue to provide sufficient technical and financial assistance to promote use of proper conservation crop rotation through existing tools of NMP and conservation planning.

3.2.5 Accelerated implementation of BMPs

Public calls to accelerate the implementation of NMP and other BMPs for water quality are common. The Commission discussed this issue at length, noting that (as discussed in Section 2.0 above) adoption of water quality practices by Vermont farmers has been very active and has already been accelerating over the last decade. Additionally, high priority watersheds have been targeted with additional technical and financial assistance for accelerated BMP implementation. In considering the issue of further accelerating BMP implementation, the Commission focused on the need for improved financial and technical support, as well as the need for documentation of BMP effectiveness through research. One approach would be to move from a succession of short-term programs to mechanisms of sustainable financial support for BMP implementation. There was much discussion of the need to bring many players – not just those concerned with NM – together to focus on central issues, such as understanding and removing constraints (financial and otherwise) that limit practice adoption. Several Commission members identified a need to explore performance-based BMP implementation and to retool the entire financial support system to combine public funding with market-based solutions. The need to build a strong foundation for rewarding farmers for the ecosystem services they provide through the adoption of BMPs was also identified.

The Commission discussed that the accelerated adoption of appropriate BMPs such as NM would be beneficial to water quality in Vermont and that such acceleration requires extensive and creative financial and technical support.

VAAFM Recommended actions:

- Convene a broad group of researchers and managers to identify needs and priorities for future BMP research;
- Continue to develop BMP tracking and accountability measures to capture both cost-shared practices and those implemented solely by farmers; and
- Support research into performance- and market-based approaches to support BMP implementation; and
- Accelerate movement to performance-based and market based approaches to support BMP implementation.

4.0 Recommendations for further study

- Assess the application of carrying capacity principles to areas of pasture management and livestock grazing.
- Conduct a regulatory review of current vegetated buffer standards.
- Conduct an evaluation of real-world buffer performance, with emphasis on understanding factors contributing to buffer failure.
- Assess the needs and means for planning and technical support for “smart” buffers.
- Investigate the potential for improvements in crop management and soil health to reduce the need for herbicide use.
- Monitor and evaluate issues associated with conservation tillage such as dissolved nutrient losses and pollutant delivery to subsurface drainage.
- Research and/or monitor the potential negative impacts of manure injection, particularly interactions with tile drainage and survival of manure microorganisms.

- Convene a broad group of researchers and managers to identify needs and priorities for future BMP research.
- Continue to develop BMP tracking and accountability measures to capture both cost-shared practices and those implemented solely by farmers.
- Support research into performance- and market-based approaches to support BMP implementation.
- Apply the concept of payment for ecosystem services (PES) so that farmers are rewarded for the specific, direct and induced environmental improvements they produce.

Appendix A. Membership of Nutrient Management Commission

Name	Affiliation
Roger Albee	Citizen
Mark Cannella	UVM Extension
Jared Carpenter	Lake Champlain Committee
Jeff Carter	UVM Extension
David Conant	Chittenden Co. dairy farmer
Heather Darby	UVM Extension
Laura DiPietro	VAAFM
Joshua Faulkner	UVM Extension
Matt Kittredge	Nutrient Management Planner
Rhonda Miller	Caledonia Co. dairy farmer
Ryan Patch	VAAFM
Marli Rupe	VT DEC
John Thurgood	NRCS
Rebekah Weber	Conservation Law Foundation
Project support staff	
Mary Montour	VAAFM
Judson Peck	VAAFM
Clarice Cutler	VAAFM
Hisa Kominami	Stone Environmental, Inc.
Don Meals	Stone Environmental, Inc.
Kip Potter	Stone Environmental, Inc.