FARM INPUTS

Soil

What kinds of agricultural soils does Vermont have? What can be done to reduce soil input costs and reduce soil erosion?

The *USDA National Resources Conservation Service reports* that there are more individual organisms in a teaspoon of soil than there are people on earth, and that this biodiversity is the key to the success of agricultural systems. Despite the importance of soil, nearly 25 million acres are lost every year.[21] This section focuses on soil quality and best practices for maintaining soil fertility and minimizing soil erosion generated by agricultural activities.

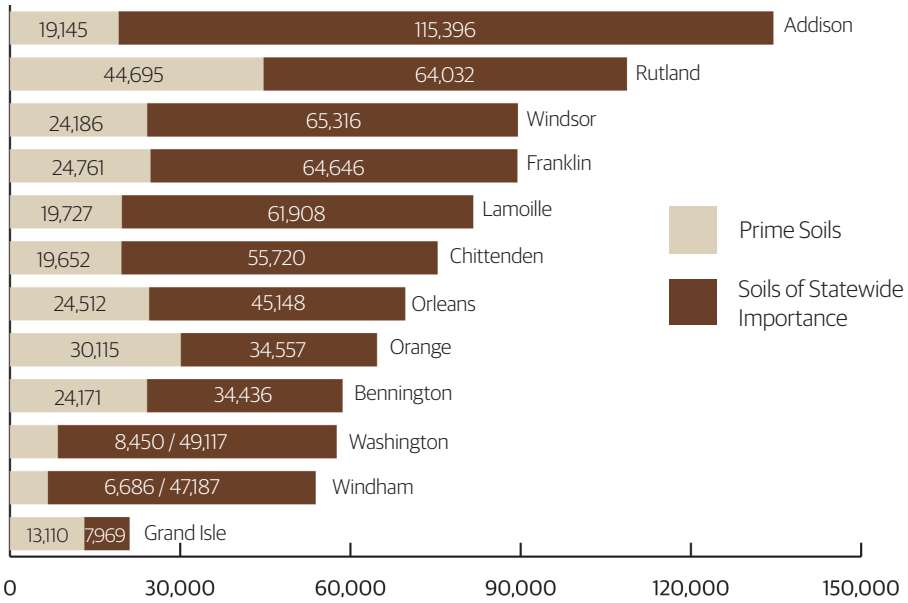
We all have that need to develop our soils and to move into a stronger resource management culture to find ways to bring all of this "waste" into our compost facilities, or we are missing out on so much.

—Bennington focus group participant

CURRENT CONDITIONS

Vermont has over 250,000 acres (21% of total acres in agriculture) of "prime" soils and almost 650,000 acres (54% of total acres in agriculture) of "farmland of statewide importance". The amount of high-quality agricultural soils varies considerably by county. More than a quarter of the statewide total is in Addison and Rutland counties (Figure 3.2.10).

Figure 3.2.10: Total Acres of Good Farmland Soils by County



Source: NRCS, 2005.

According to Danny Peet, soil conservationist with the *Vermont Natural Resources Conservation Service* (NRCS), "I work with farmers on *Vergennes Clay* to *Hadley Loams*, and they all say it's about the soil. As far as the dairy farms on the Hadleys, they never have a poor crop year. In 2009, in a year of continual rains, you could not get on a Vergennes Clay, whereas the better soil areas had a normal harvest. This affects farmer's outlook and state of mind. You can say the same about our vegetable farmers."

What Are Prime Soils?

- Prime soils have the best combination of chemical and physical characteristics for the production of crops.
- Soil temperature and growing season are favorable.
- Soil moisture is adequate to sustain crops 7 out of 10 years.
- Water moves readily through the soil.
- Soil is neither too acid nor too alkaline.
- Soil is not frequently flooded.
- Slope is generally less than 8%.
- Soil is typically deep (greater than 40 inches to bedrock).

Soils of statewide importance are similar to prime soils, but they differ in such characteristics as slope (greater slope) and the ability of the soil to store moisture (less able to store moisture).

Vermont does not have a comprehensive soil management and monitoring program, but agricultural producers have access to technical assistance from UVM Extension, NRCS, the *Vermont Association of Conservation Districts* (VACD), and other private consultants. NRCS provides incentives for farmers to develop *Comprehensive Nutrient Management Plans* (CNMPs) to improve soil productivity and environmental protection on their farms. NRCS also offers access to cost-share programs for new equipment such as *high tunnels* to advance season extension techniques, as well as watershed protection strategies such as purchasing and planting native trees and shrubs in surface water riparian buffers. VACD, representing 14 Natural Resources Conservation Districts, also provides technical assistance and education to farmers and landowners, including the *Agricultural Resource Specialist program*, which provides technical assistance for manure management and water quality management.

Although there are good maps showing where prime agricultural soils are located, it is not known how many acres are actually in agriculture or available for agriculture since Vermont does not have comprehensive statewide land use maps. We don't know how many acres of "prime" and "statewide" land have already been developed or paved over; or how many parcels are too fragmented or are difficult to access. Such data can be very helpful to those seeking to identify and prioritize investments in farmland preservation. Based on stakeholder feedback, a mapping inventory of available fertile farmland is a very high priority for strengthening Vermont's food system.

Soil Fertility

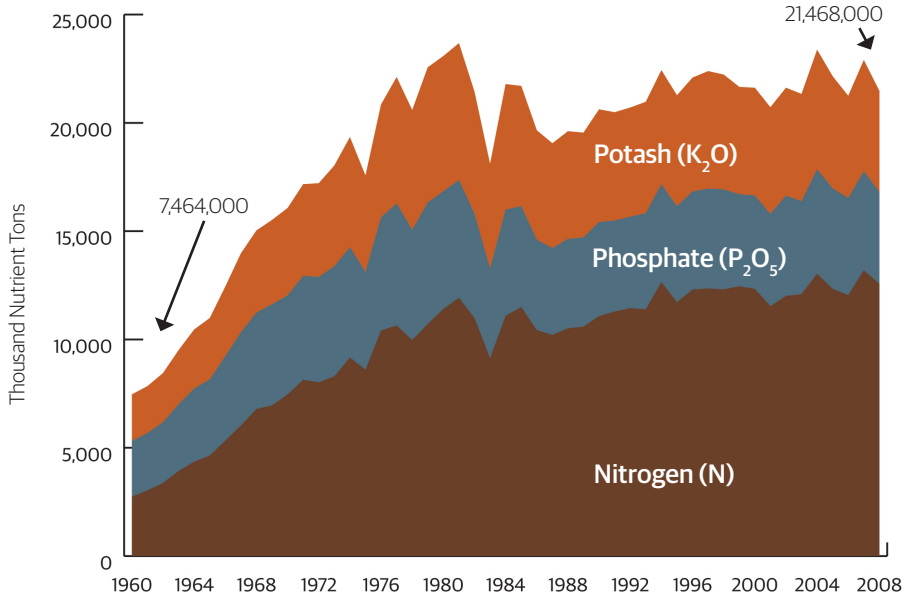
Fertilizers, Lime, and Soil Conditioners

Vermont farmers spent about $20 million on fertilizers, lime, and soil conditioners in 2007 (equal to 3.6% of total production costs), 50% more than was spent in 1997. The USDA Census of Agriculture estimates that 1,941 Vermont farms used manure as a fertilizer on 216,025 acres in 2007, while 2,346 farms used commercial fertilizer, lime, and soil conditioners on 228,040 acres.[22]

The use of inorganic (i.e., fossil fuel or mineral based) fertilizers has increased dramatically in the United States. From 1960 to 2008, total fertilizer use increased about 188%, the use of nitrogen increased 359%, the use of phosphates increased 65%, and the use of potash (i.e., potassium-based) fertilizers increased 116% (Figure 3.2.11). In 2008, nitrogen constituted 58.5% of primary nutrients given to plants, while potash and phosphates equaled 21.7% and 19.8%, respectively.[23] The use of fertilizers increased while the total amount of land in farms and total cropland in the United States decreased (4.4% and 8.3%, respectively, from 1987 to 2007). Agricultural runoff of fertilizers has been implicated in the growth of *ocean dead zones* (i.e., an abundance of these chemicals can lead to algal blooms that deprive the water of oxygen).[24]

Corn appears to receive the most fertilizer of any crop in the United States, with over 95% of the corn planted in the country receiving nitrogen, over 80% receiving phosphate, and over 60% receiving potash in 2008. Corn for grain (5,368 acres) and silage (87,403 acres) made up 18% of total cropland in Vermont, the largest amount of any field crop after hay in 2007.

Figure 3.2.11: Fertilizer Use in the United States, 1960-2008



Source: USDA Economic Research Service, *www.ers.usda.gov/Data/FertilizerUse/*

Lime is used to increase the pH of acidic soils and to increase the uptake of primary nutrients (e.g., nitrogen, phosphorus, and potassium) on acidic soils. Because lime is expensive to spread (it is heavy and can be difficult to get onto wet and steep slopes), it generally is put only on the best soils. We do not have data on this, but it is assumed that most fertilizers and soil conditioners are imported from out of state.

Many fertilizers and soil conditioners are designed to help boost nutrients for one crop year, not to build the soil's health over time. To ensure continued productivity, soils require regular testing for biological, physical, and chemical properties, and ongoing soil-building amendments to sustain nutrients and build organic matter. Both sustained nutrients and organic matter can be provided by carefully produced and tested **compost**, a growing industry in Vermont that serves multiple bottom lines (e.g., waste reduction and soil building). Compost is addressed in more detail in Chapter 3, Section 7, Nutrient Management.

Cover Crops and Crop Rotation

Cover crops (e.g., grasses and legumes) and *crop rotation* have become popular alternatives to improve soil quality. Cover cropping refers to the use of crops to cover soil between harvests. Cover cropping has other benefits besides preventing soil erosion, including adding organic matter, suppressing weeds, and, in the case of some legumes, producing nitrogen. If the cover crop doesn't get planted soon enough in the fall, however, its benefits are not maximized. In contrast to monocropping (i.e., growing the same crop in the same place year after year), the idea of crop rotation is to sequence crops so that one crop benefits the crop that follows it. According to UVM Extension vegetable and berry specialist Vern Grubinger, "Crop rotation is one of the most effective tools for managing pests and maintaining soil fertility, but there aren't many specific recommendations for how to go about it."[25] Grubinger provides some *examples of crop rotation in Vermont*, as does the *National Sustainable Agriculture Information Service* website.

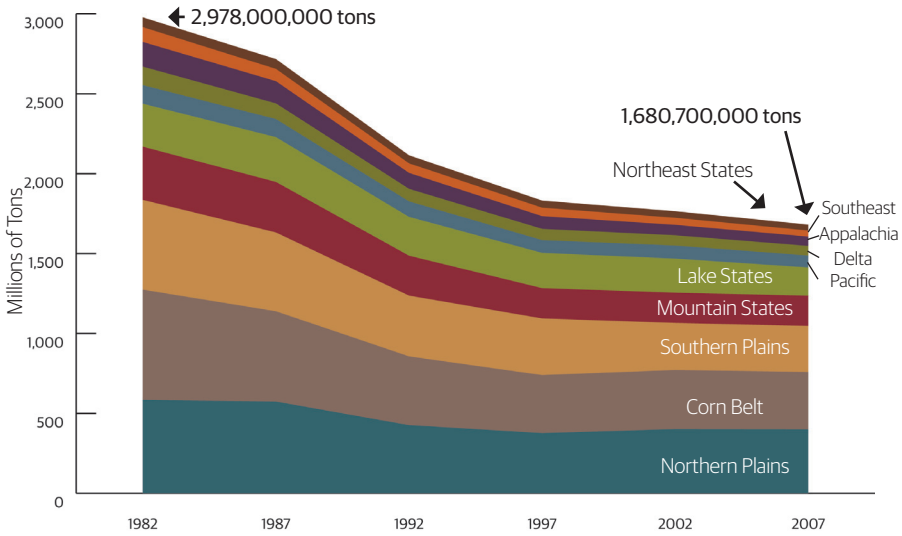
Soil Erosion

According to USDA NRCS, total soil erosion rates from wind and water decreased nearly 44% in the United States from 1982 to 2007 (Figure 3.2.12).[26] The Dust Bowl of the 1930s—caused when a major drought intersected with extensive agricultural practices that did not conserve the soil—was a major wake-up call. The United States and Europe now have the lowest cropland erosion rates in the world, but with nearly 1.7 billion tons of soil lost in 2007, we are losing soil about 90% faster than the natural replacement rate.[27]

The Great Plains and the Corn Belt accounted for over 62% (over 1 billion tons) of soil erosion in the United States in 2007, whereas Northeastern states contributed 2.2% (about 37 million tons), the least of any region in the country.

Soil erosion data specific to Vermont was unavailable. Nevertheless, soil erosion can be a serious issue in Vermont because degraded or eroded soils may limit Vermont's ability to boost local food production for local and regional consumption. Soil erosion from agricultural production can adversely affect water quality in Lake Champlain and other important water bodies and contribute to added municipal expenditures for roadside ditch dredging, road repair, and impaired waterways.

Figure 3.2.12: Soil Erosion in the United States, 1982-2007



Source: USDA Natural Resources Conservation Service, *www.nrcs.usda.gov/technical/NRI/2007/fprreports/fpr_eros_wat.html#table* **and** *www.nrcs.usda.gov/technical/NRI/2007/fprreports/fpr_eros_wnd.html#table*.

Federal technical assistance and cost-share programs administered through the USDA are available to help support farmers to improve soil quality, retire certain environmentally sensitive lands from production, and advance watershed protection best practices

The *Conservation Reserve Enhancement Program* (CREP) is a voluntary land retirement program administered by NRCS, the *USDA Farm Service Agency*, and VAAFM that pays landowners to take land near streams out of production for 10 or 15 years. The land is usually planted with a riparian buffer containing shrubs and trees or a filter strip made up of grasses. Vermont had 201 farms representing 2,038 acres enrolled in CREP in 2009, and farmers received an average of $104.45 per acre.[28] A *Vermont Department of Environmental Conservation* study found that the installation of buffers and animal fencing in three watersheds in Franklin County reduced nitrogen, phosphorus, and sediment runoff by 30 to 40%.

The *Environmental Quality Incentives Program* (EQIP) also provides payments for natural resource conservation, including the reduction of soil erosion and sedimentation, and the promotion of at-risk species habitat conservation. As of 2010, there were 419 EQUIP contracts in Vermont, equal to nearly $8.7 million and covering 48,178 acres for such conservation practices as filter strips, riparian buffers, fences, and roof runoff management.[29] The *Farm Agronomic Practices Program* also provides financial and technical assistance for soil conservation practices, such as cover cropping and crop rotation.

The *Franklin and Grand Isle Farmer's Watershed Alliance* (FWA) was established in response to adverse water quality in Missisquoi Bay of Lake Champlain caused primarily by agricultural runoff. In addition to the many services it provides to farmers to improve nutrient and environmental management, FWA received grant funding to purchase six soil aerator tools to be used by area farmers to help maximize the amount of rainfall moving vertically into the soil, minimizing horizontal water runoff and erosion. These tools are proving to be a good investment for minimizing surface runoff and soil erosion.

According to Roger Rainville, chair of the FWA board, "The FWA bought 6 machines and aerated 13,000 acres [in 2009]. Our goal was to show farmers that if you aerate your land before applying liquid manure, you can significantly reduce the potential for surface runoff. It did, and many other benefits were noticed also, such as better utilization of nitrogen. It goes in the soil and does not all volatize into the air. The aerator breaks up compaction and loosens the top 8 inches of the soil for better water absorption. Many farmers saw up to a 100% crop yield increase. The aerators are being used for a $2.00 per acre fee by farmers. There are two machines in Addison County that are administered by the Conservation District and three here in Franklin and Grand Isle and one in Orleans County that the FWA oversee. All 6 are the responsibility of FWA."

Strip-Till or No-Till Cultivation

Strip-till or no-till cultivation methods can deliver dramatic benefits such as soil fertility, soil stability, and farm viability, as well as increase carbon sequestration in the soil. These methods require special tractor implements that are expensive, but can save farmers a lot of time—and money—in the field over the long run. In contrast to conventional field plowing, which disturbs all of the soil, strip-till cultivation plows about a third of the space more precisely where seeding will occur, and leaves strips of undisturbed soils between the planted rows. No-till cultivation uses equipment and GPS technology that can cut an even narrower row for planting, but many of Vermont soils are not suited for no-till methods.

Strip-Till Cultivation: Addison farmer Paul Boivin recently invested in strip-till equipment for growing corn in Vergennes Clay soils, which are heavy and easily compacted. Based on his research of strip-tilling practices used throughout the country and his experience on his own farm, Paul is confident that strip-tilling will reduce production costs and enhance soil into the future. He has already seen the benefits of this cultivation method, with dramatic reductions in the time it takes to prep the field for planting because fewer tractor passes are needed and GPS-like equipment supports more precise tilling patterns. Less tractor time ultimately means less fuel used and less soil compaction. Reduced soil disturbance preserves organic matter and stabilizes nutrients, and fertilizer is absorbed more efficiently because it is directed more carefully to the 10-inch planting row, instead of being broadcast on the field. Finally, reduced soil disturbance means less soil erosion and runoff, and greater carbon sequestration services.

PHOTO CREDIT: Pete's Greens

Tineweeding at Pete's Greens.

Ecological Services Provided by Soil

Carbon stored in coal, oil, and natural gas for millennia is now being released into the atmosphere, altering Earth's climate. Increased attention is being paid to the possibility of reducing the amount of carbon in the atmosphere by increasing the amount of carbon stored in soils. Soils are major carbon sinks, containing more carbon than occurs in vegetation in the atmosphere.[30] One Vermont business, Carbon Farmers of America, LLC, attempted to develop a market for businesses and consumers to purchase carbon credits from eligible farmers to offset their carbon footprints. Although Carbon Farmers ultimately did not get off the ground, the basic idea is being pursued in various iterations across the country. For example, carbon trading programs could be modeled on water quality trading programs that exist in the *Chesapeake Bay region*, the *Ohio River Valley*, and *New York City*.

ANALYSIS

Soil health is the foundation of every food system, but there remains a lack of information about several aspects of Vermont's soils. Vermont does not have a comprehensive soil management and monitoring program or land use maps that show how many acres of "prime" and "statewide" land have already been developed or paved over. Although we could not identify soil erosion rates for Vermont, the Northeast region has the lowest erosion rates in the country, and many programs are available to curb erosion and build soil health. Vermont farmers are vulnerable to price increases in petroleum based products: they spent 94% more on fertilizers, lime, and soil conditioners in 2007 than they did in 1997.

Research

Soil mapping: Mapping is needed to overlay both prime agricultural soils and soils of statewide significance with existing land use, to identify key parcels where different types of farming or crops would be most viable.

Conduct research on volatile and other losses of nitrogen from storage and land application techniques as a way to reduce nitrogen purchased input costs: There are data from many studies that demonstrate that spreading manure by distribution from 6-10 feet above the ground, and failure to incorporate into soli immediately

results in significant nitrogen losses. In addition to contribution to ammonia emissions into the atmosphere, this is a costly management error. Data are needed using typical Vermont manure application techniques to determine the potential cost savings from modification of manure application methods.

Technical Assistance and Business Planning

Comprehensive soil management and monitoring program: According to various stakeholders, a more comprehensive soil quality management and monitoring program is needed to increase soil health and the ecological services provided by healthy soil. Monitoring systems for measuring a wide range of biological, chemical, and physical soil properties should be developed. Additional resources are needed to assist farmers with getting regular soil tests, interpreting and evaluating fertility and soil-building strategies, and creating in-depth nutrient management plans.

Farmers should implement best practices to minimize soil erosion on a more regular basis. Cover cropping, crop rotation, and maintaining high water infiltration capacity of cropland and grazing land are common means of arresting soil erosion and maintaining soil health. Soil aerator equipment should be more regularly used to minimize storm water and nutrient and sediment runoff and soil erosion. Midfield buffers made with grassy swales or waterways or native trees and shrubs to capture runoff on sloped fields are other strategies for minimizing soil erosion. Outreach by farmers to farmers about the benefits of CREP and EQUIP grants, nutrient management plans, and the implementation of best practices to increase organic matter in soils should be increased.

Additional technical assistance and demonstrations of the benefits of strip-till, zone and no-till practices should be implemented, and cost-share programs should be considered to allow farmers to lease appropriate equipment to implement these practices. According to stakeholders, producers are eager and ready to adopt these practices but do not have the financial resources to cover start-up capital expenses.

Promotion of good grazing management (incorporated with cropping, and with additional resources such as soil aeration, microbial inoculation, effective manure management, diverse seeding strategies, etc.) is low-hanging fruit. Ongoing support of the *Vermont Pasture Network's* grazing technical support and the development of a comprehensive livestock management program will be critical to improving soil quality over time.

Locally produced compost at commercial operations and on farms is a very important long-term soil-building strategy to replace imported fertilizers.

Financing

Economic incentives to private landowners for enhancement of soil properties: Soils provide a variety of ecological services, including water purification, flood mitigation, erosion control, carbon sequestration, atmospheric regulation, and agricultural production. Opportunities or programs for incentivizing topsoil formation or compensation for these ecological services should be investigated. These could include tax incentives, direct payment between upstream land managers and downstream services beneficiaries (e.g., municipal water quality managers), participation in carbon and nutrient credit trading schemes, and others.

Network Development

Sharing good soils: Matchmaking services could help connect interested farmers or landowners interested in renting out a portion of their larger fields or properties to a vegetable farmer. For example, a dairy farmer could carve out a 5- to 10-acre corner of a large prime agricultural soil field and lease it to a vegetable producer, or even support diversification of the dairy farm itself (e.g., by growing vegetable crops). This sharing of the best soils may be a win–win for both the landowner and the vegetable farmer.

Regulation and Public Policy

Revisit winter spreading ban: Some experts question whether the current ban on winter manure spreading is helping or hindering soil and water quality. Suggestions have been made to change the program to a performance-based program, in which spreading is scheduled for appropriate times, based on soil condition. Winter spreading may be better for soil and water quality than spreading at other times of the year when soils are extremely wet and tractor tires can cause major disruption to soil. One stakeholder suggested looking to New York, where a winter spreading ban does not exist, but most large farms have nutrient management plans that dictate where and when manure can be spread.

GETTING TO 2020

Nationally, soil erosion decreased nearly 44% from 1982 to 2007, but soil erosion rates are still higher than natural replacement levels. The use of fertilizers (i.e., nitrogen, phosphate, and potash) has increased about 188% from 1960 to 2007 in the United States, even though the amount of land in agriculture shrank during that period. Vermont farmers spent 94% more on fertilizers, lime, and soil conditioners in 2007 than they did in 1997. To meet Goals 4 through 7 of the F2P Strategic Plan, Vermont's already substantial technical assistance network will have to expand its capacity to monitor and report on the health of Vermont's soils, while more widely sharing opportunities for preventing soil erosion and promoting soil health to Vermont's farmers (e.g., cover cropping, crop rotation, composting, and other soil building methods).

Table 3.2.8: Objectives and Strategies for Improving Soil Health

OBJECTIVE	STRATEGY
Research Strategies	
Improve access to viable and affordable agricultural land and secure tenure for farmers (ownership and leases).	Create and update a land use statewide spatial LiDAR database of agricultural land usage and an inventory of agricultural land that captures information on soil type, current land use, accessibility to roads, proximity to market areas, etc. Call attention to publicly owned land locations conducive to food production that are adjacent to publically owned buildings.
Improve soil quality through improved pasture management.	Conduct research trials of soil building through pasture management (e.g., soil aeration, microbial inoculation, effective manure management, diverse seeding strategies).
Technical Assistance and Business Planning Strategies	
Improve water quality, soil fertility, and organic matter and reduce erosion.	Develop a more comprehensive soil monitoring program for a wide range of biological, chemical, and physical soil properties, including offering additional assistance to help farmers conduct regular soil tests and develop nutrient management plans, develop soil fertility enhancement and erosion control strategies, and comply with *Clean and Clear* best practices through matching funds. This would include creating funds for ongoing crop trials for short-season corn varieties and cover crop perennials.
Increase technical assistance for best practices in soil enhancement and grazing.	Coordinate with NRCS, VACD, Farmer's Watershed Alliance, and other Vermont agricultural organizations to invest in skilled land managers and experienced farmers to work directly with other farmers to increase topsoil fertility and minimize soil erosion.
	Ensure the ongoing support of UVM's Pasture Network's grazing technical assistance and outreach services and events.

OBJECTIVE	STRATEGY
Financing Strategies	
Improve water quality, soil fertility, and organic matter and reduce erosion.	Leverage USDA and other funding to purchase additional equipment to share among farmers to facilitate soil aeration, no-till, strip-till and zone-till cultivation, and state-of-the-art soil quality monitoring and analysis.
Create market-based incentives to improve soil and water quality.	Incorporate into food sector financial transactions the high economic value of environmental services provided by stewarding healthy soils.
Provide financial incentives to farmers to implement best practices (cover cropping, crop rotation, midfield buffers, strip tillage, aeration, on-farm composting of manure, and use of composted manure on fields) and meet performance targets.	Increase outreach by farmers to farmers to communicate the benefits of CREP and EQUIP grants, nutrient management plans, and the implementation of best practices to increase organic matter in soils.
Network Development Strategies	
Increase opportunities for farmers with good soil who are interested in mentoring or renting a portion of their land to new farmers or diversified producers.	Establish a soil-sharing matchmaking program. Through farmer-to-farmer networks and outreach by agricultural organizations (VFAN, VLT, VHCB, NRCS, NOFA VT, etc.), identify and arrange partnerships between farmers interested in leasing a portion of their larger parcels with excellent agricultural soils and diversified producers seeking good soils.
Education Strategies	
Increase consumer awareness of the value of ecological services provided by well-managed soils.	Increase consumer awareness of carbon sequestration in soils, and make purchases of carbon sinks or credits available to consumers.
	Develop a consumer awareness campaign regarding nutrient trading programs such as the one operating in the Chesapeake Bay region.
Regulatory and Public Policy Strategies	
Minimize the agricultural impact on environmental resources.	Encourage legislators and VAAFM to revisit the winter manure spreading ban, review New York protocols, and maximize performance-based rules.

Farm Assets and Debts

Farm Assets

According to the USDA, Vermont farmers had $4.1 billion in assets from land, buildings, and machinery in 2007 (Table 3.2.9). More than half of the assets are held by dairy and livestock producers, while the vast majority of crop production assets are used for growing feed and bedding (Table 3.2.10).

We started out thinking we could do with just the rototiller, but the demand was there and we couldn't get the beds prepped fast enough. What we really needed was for our system to get mechanized to save our backs and farm longer. So the investment in tractors, manure spreaders, and equipment is huge. It's really stressful. People compare farms to regular businesses, but the capital above is incredible.

—Upper Valley focus group participant

As the number of dairy farms has decreased, the value of land and buildings held by dairy farms has decreased from 44% of the total market value of land and buildings in 1997, to 39% in 2002, and 33% in 2007. Likewise, the estimated total market value of machinery and equipment held by dairy farms decreased from 58% in 1997 to about 50% in 2002, and 44% in 2007 (all numbers adjusted for inflation to 2010 dollars).[31]

As agriculture production has changed toward commodity crops, more farmers are producing fewer overall products. Farms that once grew a diversified range of products had more tools to cultivate and harvest those products. When Vermont farms stopped growing grains and started importing them from the Midwest, for example, farmers had less use for certain equipment and infrastructure, such as combines and mills. The number of combines in the state decreased from 126 in 1997 to 64 in 2007.[32] Vermont's food system now needs to rebuild some of this lost infrastructure. Small-scale producers can have difficulty accumulating assets, which can lead to other business challenges. A Bennington County focus group participant explained: "I'm trying to get insurance for our farm because we process basil made into pesto and I haven't been able to find an insurance company to insure us because we don't own our land and we don't own our equipment."

Farm Debt

One primary input cost for Vermont farmers is the debt owed for farm assets, including land and machinery. Vermont farmers spent a little over $75 million for debts in 2007, including over $32 million for property taxes (5.6% of total); over $28 million for interest payments (4.9% of total expenses, Table 3.2.10); almost $12 million rent for land, buildings, and grazing fees (2.0% of total, Table 3.2.11); and over $2.8 million on rent and lease expenses for machinery, equipment, and vehicles (0.5% of total, Table 3.2.12). Over a quarter of Vermont farms had debt in 2007, with an average annual interest payment of $14,619 (up from $13,321 in 2002).

So much land in Vermont has been held in a way that basically leaves farmers borrowing against it over the years. When you borrow against your equity for 20 years, you end up in a position of high debt and low cash. The whole process has become like the snowball effect of the banking process, where you borrow too much money and get yourself into a box where the only way out essentially is to sell it all off to a buyer.

—Northeast Kingdom focus group participant

Typically, interest rates are lower for farms than other types of businesses, largely because of a connection between the lending agency and federal or state government. For instance, the *Vermont Agricultural Credit Corporation* (VACC) at VEDA is lending at a variable 4.5% rate, *Yankee Farm Credit* lends in the 5% to 6.5% range, while commercial banks lend at 6% to 7.5%, depending on the level of risk. VACC and the *USDA Farm Service Agency* typically handle the riskiest loans for those farms that can't get other forms of credit. While there is generally enough credit available to meet the demand for it, there does appear to be a gap in credit for very small projects, especially those projects without sufficient collateral.[33]

For more details on farm financing, see *Chapter 4, Section 5: Financing the Food System*.

Table 3.2.9: Estimated Assets from Land, Buildings, Machinery, and Equipment Used for Agricultural Production in Vermont

Type of Activity	Value of Land & Buildings	Value of Machinery & Equipment	Total	Percent of Total
Dairy cattle and milk production	$1,229,075,990	$242,511,711	$1,471,587,701	34.12%
Hay farming	$689,156,074	$86,857,840	$776,013,914	17.99%
All other crop farming	$442,738,676	$43,714,937	$486,453,613	11.28%
Beef cattle ranching and farming	$311,775,914	$40,203,678	$351,979,592	8.16%
Horse and other equine production	$244,121,128	$26,279,964	$270,401,093	6.27%
Sheep farming	$116,955,269	$9,477,769	$126,433,038	2.93%
Nursery and tree production	$107,506,986	$12,661,134	$120,168,121	2.79%
Vegetable and melon farming	$93,808,376	$11,153,170	$104,961,546	2.43%
Apple orchards	$90,174,488	$8,717,268	$98,891,756	2.29%
All other animal production	$82,509,243	$11,109,185	$93,618,427	2.17%
Chicken egg production	$62,511,027	$9,163,501	$71,674,528	1.66%
Floriculture production	$54,802,413	$10,772,630	$65,575,043	1.52%
Berry (except strawberry farming)	$39,953,914	$2,785,735	$42,739,649	0.99%
Corn farming	$31,470,582	$7,031,699	$38,502,280	0.89%
Goat farming	$28,182,487	$5,964,930	$34,147,417	0.79%
Cattle feedlots	$26,716,959	$4,294,210	$31,011,169	0.72%
Apiculture	$20,323,697	$1,633,631	$21,957,328	0.51%
Hog and pig farming	$13,002,053	$1,944,943	$14,946,996	0.35%
Other noncitrus fruit farming	$12,710,872	$1,240,358	$13,951,230	0.32%
Turkey production	$11,803,886	$1,689,324	$13,493,210	0.31%
Food crops grown under cover	$10,425,689	$1,969,521	$12,395,209	0.29%
Animal aquaculture	$9,654,359	$1,577,409	$11,231,768	0.26%
Grape vineyards	$9,224,740	$1,525,111	$10,749,845	0.25%
Other poultry production	$5,714,639	$620,128	$6,334,768	0.15%
Broilers and other meat-type chicken production	$4,389,463	$309,055	$4,698,518	0.11%
Fur-bearing animal & rabbit production	$3,896,234	$216,182	$4,112,416	0.10%
Strawberry farming	$3,011,573	$669,489	$3,681,062	0.09%
TOTAL	**$3,755,616,732**	**$546,094,511**	**$4,301,711,243**	**100.00%**

Source: USDA Census of Agriculture, *www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_1_State_Level/Vermont/st50_1_046_046.pdfst50_1_046_046.pdf*.

Table 3.2.10: Vermont Interest Expenses

Farms with expenses of	# of farms with debt		Average annual interest paid		Interest paid	
	2002	2007	2002	2007	2002	2007
$1 to $999	309	278	$482	$514	$171,829	$143,028
$1,000 to $4,999	604	628	$3,267	$2,878	$2,274,299	$1,807,826
$5,000 to $9,999	297	371	$8,754	$7,427	$2,996,542	$2,755,383
$10,000 to $24,999	338	397	$18,820	$15,786	$7,331,398	$6,266,920
$25,000 to $49,999	112	154	$39,988	$35,047	$5,161,874	$5,397,186
$50,000 to $99,999	39	69	$81,366	$70,859	$3,657,318	$4,889,228
$100,000 or more	19	39	$218,433	$180,619	$4,783,290	$7,044,106
TOTALS / AVERAGES	**1,718**	**1,936**	**$13,321**	**$14,619**	**$26,376,550**	**$28,303,678**

Source: USDA Census of Agriculture, Table 4, *www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_1_State_Level/Vermont/vtv1.pdf*. 2002 interest paid adjusted for inflation to 2007 dollars.

Table 3.2.11: Rent for Land, Buildings, and Grazing Fees

Farms with expenses of	Farms	Expenses	Average
$1 to $499	193	$50,480	$262
$500 to $999	164	$117,787	$718
$1,000 to $4,999	422	$1,047,466	$2,482
$5,000 to $9,999	206	$1,548,063	$7,515
$10,000 to $24,999	147	$2,280,027	$15,510
$25,000 to $49,999	55	$1,991,869	$36,215
$50,000 or more	43	$4,914,468	$114,290
TOTAL	**1,230**	**$11,950,161**	

Source: USDA Census of Agriculture, Table 4, *www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_1_State_Level/Vermont/vtv1.pdf*.

Table 3.2.12: Rent and Lease Expenses for Machinery, Equipment, and Vehicles

Farms with expenses of	Farms	Expenses	Average
$1 to $499	83	$17,878	$216
$500 to $999	38	$28,395	$748
$1,000 to $4,999	122	$340,742	$2,793
$5,000 to $9,999	50	$363,879	$7,278
$10,000 to $24,999	40	$572,110	$14,303
$25,000 to $49,999	17	$585,782	$34,458
$50,000 or more	10	$931,782	$93,178
TOTAL	**360**	**$2,838,466**	

Source: USDA Census of Agriculture, Table 4, *www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_1_State_Level/Vermont/vtv1.pdf*.