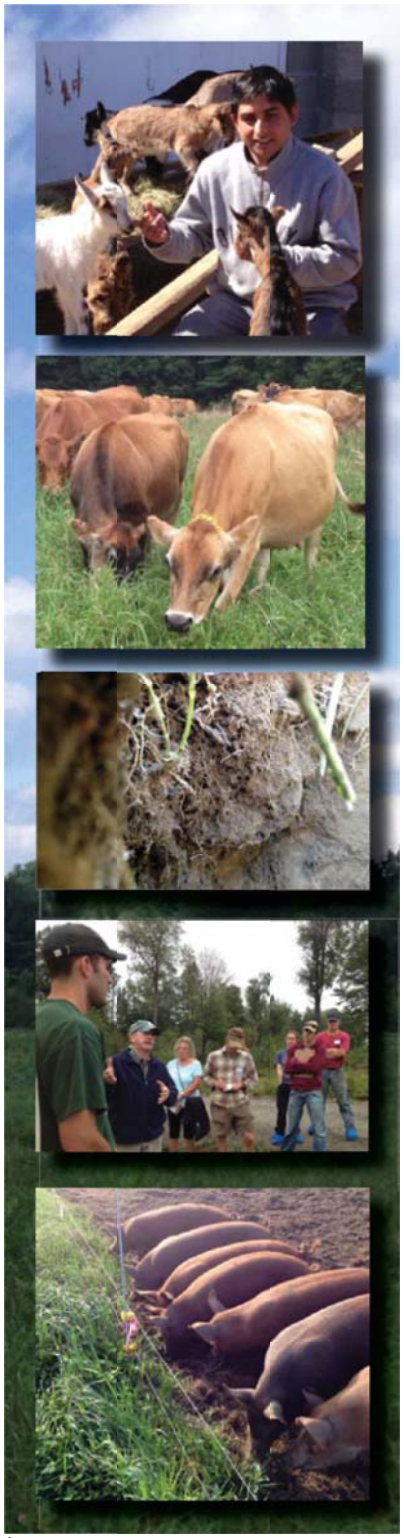

An Assessment of

Vermont Grass-Based Farmers, Technical Assistance, Pasture Education, and Federal Programs

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[1] Data collected via a 2011 Masters' thesis survey (Colby), VT Grazing & Livestock Conference evaluations (2005-2014), workshop evaluations (2010-2014), 2014 Masters' thesis survey (Miller), field observations, and case studies from individual farm visits.

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All photos by Jennifer Colby, unless otherwise noted.

Figure 1 Workshop attendees collecting weeds in order to demonstrate teaching cattle to eat Goldenrod.

Summary

Vermont livestock farmers have used intensively-rotated grazing management systems for over 20 years but there is very limited information on their performance based on comprehensive evaluations. The purpose of this report is to assemble data examining how economic, environmental, social, and demographic factors have affected the self-reported success, satisfaction and net profit of Vermont grass-based livestock farms; to document the effectiveness and use of outreach, technical assistance and NRCS programs; and to identify future opportunities and challenges for this unique group of farms.

Grass-Based Farmer Data

A mail survey was distributed to 1,088 Vermont grass-based livestock producers in April 2011, yielding 229 responses, a 21.6% response rate. Survey respondents had an average age of 54, and 31.8% were female. Responding farmers managed a total of 51,528 acres of combined pasture, forest, and crop land, with 26.6% containing certified organic land and 20.1% with certified organic animals. Average farm size was 177 acres including 34% of acreage in perennial pasture and 38% in hay/pasture. For livestock, 32% of the farms grazed dairy animals, 38% beef, and 30% grazed sheep. Other livestock included goats, swine, horses, and poultry. Grazing management was diverse with 75% of dairy cows moved to new pasture every 3 days, while less than 44% of sheep or beef received new pasture every 3 days. The responses suggest that 68% reported grazing plants shorter than recommended. Business plans were in place on 28.8% of farms. The total gross income reported by participating farmers was $20.5 million, total net income was $1.6 million, and 61.1% reported positive net profit. Woody plant species decreased by 5% or more on 57.6% of the farms described. Part-time farmers represented half of the responders, 38.1% of whom plan to farm full time within ten years. Full-time farmers had strong correlation to net profit, but 40.5% of full time farmers plan to decrease farming activities within the next ten years. Over 45% of responders interacted with non-family school age children in 2010 and the reported rates of medical conditions were lower than state averages.

Outreach and Education Impacts

Over the past 18 years, the Vermont Grazing & Livestock Conference has hosted approximately 5,500 attendees typically representing at least six Northeastern states plus Canada. During the same period, the Pasture Program has hosted, co-hosted, facilitated, or participated in more than 250 on-farm workshops and events, with an estimated 4,950 attendees. Conference evaluations showed an average of 29% of respondents indicating they have made changes on their farms (or in their lives) as a result of attending past grazing conferences and events. Implementation rates collected after workshops and on-farm events showed an average of 51%. Based upon the comparative results, one observation could be made that on-farm events typically take more time and resources for fewer bodies per event, but have a higher resulting rate of implementation. Data collected after the 2014 Conference workshops indicated that 72% of the respondents experienced increased farm success as a result of attending past workshops and events.

Technical Assistance Impacts

Since 1996, approximately 1,250 farm visits have been made by the Pasture Program to over 500 farms in Vermont. Of the 61 farmer/producers provided with technical assistance or consultation during 2014, 49.2% improved some part of their grazing/farm practices. Changes implemented included dividing pastures into smaller paddocks to increase plant recovery times and encourage more even grazing and manure distribution; improving paddock water supplies, reducing the concentrated congregation of animals at a water location and creating erosion issues; installation of fencing systems to prevent “back” grazing (a cause of overgrazing by repeated biting of regrowing plants); and establishment of grazing practices to encourage greater forage residue for healthier plant roots and quicker recovery. According

to evaluations completed at the 2014 Vermont Grazing & Livestock Conference, 29.1% of the respondents have received technical assistance from the Pasture Program within the past ten years. Within this group, technical assistance has had beneficial impacts on environmental conditions (56.9%), animal health and farm success (51.7%), forage production (43.1%), farmer quality of life (36.2%), and profitability (34.5%).

NRCS Programs

The 2011 survey indicated 38.9% of farmers reporting involvement with USDA-NRCS programs within the past ten years. The presence of formal NRCS plans has more than doubled within the past three years among Vermont Grazing & Livestock Conference attendees, with number of plans significantly correlated by year ($p<.019$). These results are concurrent with increased technical assistance and outreach focused on grazing supported by NRCS.

A combined paper and online survey was distributed in early 2014 to capture data describing the usage and perceptions of farmers choosing to participate (or not) with NRCS programs. There were 61 respondents who completed the survey. Half of the respondents indicated that cost was the biggest challenge when implementing conservation practices on their farms. Finding time to implement practices was the second most frequently cited challenge. Respondents' contracts included structural improvements more frequently than best management practices (BMPs). The structural improvements most often cost shared were waste storage facilities and fencing, while the most commonly funded management practices were pasture reseeding and prescribed grazing. These structures and practices are most commonly used by dairy farmers.

Future Considerations

- Technical assistance for small farms and areas of agricultural growth (swine, value-added livestock, meat production) is essential to meet small farm regulatory enforcement goals and statewide efforts to expand Vermont's working agricultural landscape.
- Overgrazing within current management continues to be an ongoing issue and requires education and assistance to overcome through improved management.
- Grazing management for riparian and forested/silvopasture are potential hot button issues between policymakers, environmental managers and farmers. Determining appropriate management strategies represent new areas of education and research expansion, in order to make appropriate recommendations meeting environmental, economic and policy goals.
- External policy pressures including water quality legislation, small farms regulation, food safety, and climate change are affecting Vermont livestock producers. In some cases, these policies, rules, and laws are inconsistent in description or enforcement, leaving farmers and agricultural service providers to make their best interpretation.

Pasture Program Highlights

Figure 2 Attendees assembling water system parts at a 2012 workshop.

Outreach and Education

Over the past 18 years, the Vermont Grazing & Livestock Conference has hosted approximately 5,500 attendees during the event. Attendees typically represent at least six Northeastern states plus Canada. Keynote and topical speakers have ranged from very local (less than one mile from the conference) to national (California, Missouri, Pennsylvania, Virginia). Topics have been largely driven by requests collected from the previous year, conversations at pasture workshops, and emerging themes. Past themes have included mob-style grazing, understanding ecosystems, animal behavior, raw milk, holistic farm management, grazing economics, and grass-based dairy. In 2009, a second day was added to the conference allowing for an in-depth focus on topics of interest such as butchering, soil health, business planning, teaching livestock to eat weeds, watering systems, composting, poultry production, and marketing.

During the same period, the Pasture Program has hosted, co-hosted, facilitated, or participated in more than 250 on-farm workshops and events, with an estimated 4,950 attendees. Often, topics have been guided by follow-up requests from the conference or by seasonal or grant themes. Workshops and events have included keyline plowing and tillage radish demonstration, teaching livestock to eat new foods (weeds), season extension, pasture improvement, finishing animals on pasture, bedded pack manure management, outwintering, fallow land reclamation, grazing basics, and focused livestock topics (beef, sheep, dairy, etc.).

Impacts

In the years where evaluation data has been collected after conferences and workshops (2005-2014), the post-event response rate has typically ranged from 17-34%. Data collected after the 2014 Conference workshops indicated that 72% of the respondents experienced increased farm success. An average of 29% of evaluation respondees indicated they had made changes on their farms (or in their lives) as a result of attending past grazing conferences and events. Implementation rates documented after workshops and pasture events vary widely from 30-100%, with a very basic average of 51% calculated over five years. Based upon the comparative results, one observation could be made that on-farm events typically take more time and resources for fewer bodies per event, but have a higher rate of implementation.

Conference Evaluation Responses	2010	2011	2013	2014
Attendees reporting implementation as a result of past conferences (n=361)	29.6%	26.2%	28.6%	31.6%

Comments from workshop attendees:

- *"We've designed and built our whole farm operation based on a rich collection of these plus what we've learned on the web... too numerous to mention but tons of influence. Thanks."*
- *"I attend these workshops to be able to take the information back to my farmers who may not be able to attend because they cannot leave the farm."*
- *"This information will be a boost to the justification for rotating animals on pastures and when that should be done, and provide good guidance for the farmer on how to make that decision."*

Comments from conference attendees:

- *(Regarding workshop intensive) "Enthusiasm and knowledge of presenters. I loved that we just dealt with issue all day and could go into some depth. Loved combo of science and practical example."*
- *"Great gathering of people committed to the improvement of the environment."*
- *"I always look forward to going home with a few new ideas to improve our efficiency."*
- *"Definitely implementing a rotational grazing plan for our farm. We are just getting started so having the information from the conference is perfect. We are so lucky to live in VT and have such an amazing resource in our own backyard!"*
- *(Regarding changes made as a result of attending) "Intensified the pasture rotation, better observation of pastures, closer attention to genetics for better grazers."*

Figure 3 Young swine managers demonstrate swine judging at the 2014 VT Grazing & Livestock Conference.

Technical Assistance

It is difficult to identify the actual number of farmers visited by the Pasture Program during its tenure, however a conservative estimate is that 1,250 technical assistance visits have been provided at more than 500 farms. Largely this assistance provision has been part time, in addition to grant-funded research and education projects. In the past three years, through targeted SWAT funding, the Pasture Program has been able to reach over 90 farms. Some of the farms working through transition from confinement to grazing or improving a large-scale existing farm management system have needed multiple visits in order to gain comfort with new ideas, choose small achievable projects, implement them, and prioritize next steps. In some cases farmers simply need a new set of eyes to provide alternative suggestions for the farmers to evaluate, which requires only a single visit. Case studies describing representative technical assistance approaches and effects start on Page 17.

Impacts

According to evaluations completed at the Vermont Grazing & Livestock Conference, 29.1% of the respondents have received technical assistance from the Pasture Program within the past ten years (n=199). Of those, respondents were asked to describe the areas of farm management that technical assistance had positively affected (below).

Conference Evaluation Responses (n=58)	Farmer Quality of Life	Animal Health	Environmental Conditions	Farm Success	Profitability	Forage Production
	36.2%	51.7%	56.9%	51.7%	34.5%	43.1%

A two-year project funded by the VT Agency of Natural Resources (ANR) focused on grazing assistance to protect water quality supported individual technical assistance on 28 farms. Of those, 19 were within the Lake Champlain watershed. Based upon technical assistance notes, at least 13 of the farms actively made changes based upon recommendations made by the service providers working with them *during the project period*. An additional 14 farms gathered new information and/or considered their management options with the assistance of the service provider.

Figure 4 Pasture Program Grazing Specialist Kimberly Hagen meeting with farmer Jennifer Reynolds to discuss pasture conditions.

For farms making change/improvement, the service providers noted particular themes. Not all farms made the same changes but these were some highlights:

- Reduction in animal numbers to better match the land capacity.
- Intensifying the animal rotation; either by creating smaller paddock subdivisions and/or rotating animals through paddocks more quickly. This is an essential piece of grazing success; shorter periods of animal occupancy more evenly distribute manure (nutrients), reduce soil erosion and compaction by animal (hoof) impact; and adequate recovery time allows plants to establish and maintain healthy, deep root systems.
- Adjustment of grazing patterns to respond to periods of excessive and minimal moisture. In some cases, this meant use of "sacrifice" paddocks (or the barnyard) where animals were fed stored feed in limited areas so that the greater paddocks could be protected.
- Improved management of summer pastures in order to extend the grazing season (earlier and later). This has a strong economic importance for the longevity of the farm, but it also has an important effect on plant/soil health and nutrient distribution.
- Reduced "overgrazing". Overgrazing is a result of animals biting and rebiting a plant, forcing it to use its carbohydrate reserves for regrowth until photosynthesis can take over. Overgrazing can be caused by continuous grazing, but can also be seen when rotated animals bite the plants too low. Leaving an adequate plant residual to encourage immediate photosynthesizing will assist pastures to grow back more quickly as well as providing important plant cover habitat for soil biology.
- Planting of complementary species such as Japanese millet, forage radish, clovers, etc. Increasing the diversity of pasture plants into four main groups (warm and cool season grasses and warm and cool season broad leaves) has been connected with improved soil health through the feeding of a wider range of soil microbes.

Comparatively, from the 2014 end of year report, the Pasture Program shared these indicators of success:

> *"Of the 61 Farmer/Producers provided with technical assistance/consultation this past year, 30 improved some part of their grazing/farm practices. For example, 24 divided their pastures into smaller paddocks for improved rotational grazing; 9 improved the water supply to paddocks and their livestock, reducing the concentrated congregation of animals at a water location and creating erosion issues; 4 started a fencing system that prevented back grazing; and 7 started taller grazing practices - preventing livestock from grazing plants lower than 5 inches."*

A Snapshot of Vermont Grass-Based Livestock Farmers: Land and Environment

Land Management

According to the 2012 USDA Census of Agriculture, 59.6% of the farms in Vermont include some amount of permanent pasture. Permanent pasture represents 11.2% of the total acres in agriculture. From 2002 to 2012, the number of Vermont's farms utilizing some amount of permanent pasture increased by 186%. A survey conducted in 2011 (Colby) and post-conference evaluations conducted from 2005-2014 provided additional detail to better understand land use within this farmer group. Where possible, the pasture-based farm data is compared to statewide agricultural data.

Land Use	**2011 Survey**		**Conference data (n=621)**	**VT Ag Census (2012)**	
	Percent	*Avg. acres*		*Percent*	*Avg. acres*
Perennial pasture	33.9% (n=195) of land managed by each farmer	55	33.0%	11.2% total VT ag acreage	32 per farm with perennial pasture
Hay/pasture rotation	37.9% (n=179)	77	18.0%	--	--
Crop/alternative forage	9.0% (n=94)	17	10.8%	35.6% total VT ag acreage	96 per farm with harvested cropland
Woodland	40.8% (n=162)	125	--	42.8% of VT farms include woodland 16.1% of VT farms have pastured woodland	97 per farm with woodland 3.0% of all VT ag land is pastured woodland
Acres owned	63.3% (n=160) of the total acreage being farmed is owned	171	95.9% owned some of the acreage they are farming (n=222)	--	170 per farm statewide
Acres managed (not owned)	36.7% (n=160) of the total acreage being farmed is not owned	87	95.0% manage land that they do not own (n=120)	--	--
Acres negatively affected by weeds	See below	--	12.9%	--	--

When surveyed about negative impacts from weeds, 57% of [conference] respondents reported weeds affecting 20 acres or less, 10% reported weeds affecting 40-80 acres, and some farms reported up to 400 acres being negatively affected. When referencing the 2012 Ag Census, 8.3% of total agricultural acreage was treated to control weeds, grass or brush, as compared to 7.0% in 2007. This represents an increase of 17,060 acres. According to 2011 survey responses, 57.6% of respondents reported observing a decrease in woody invasive species of greater than 5% within the previous five years. Over 17% of respondents observed a greater than 51% decrease in woody species.

Livestock Management

Using data collected in the 2011 survey (describing 2010 grazing management, primarily), the average number of ruminant animals on the responding farms was approximately 69, with 95% of the responders managing 0 to 240 ruminant animals. Based upon data collected through the 2011 survey and conference data, the distribution of livestock types is as follows:

Livestock Type	2011 Survey (n=229)	Conference data (n=621)
Dairy	31.9%	27.9%
Beef	38.0%	43.5%
Sheep	30.1%	27.5%
Goats	9.2%	10.6%
Swine	14.0%	28.8%
Poultry	47.1%	46.1%
Horses	22.7%	14.7%

Discussion:

- The difference in percentage of beef producers may reflect the partnership between the VT Grass Farmers and VT Beef Producers' Associations and resulting educational content focused specifically on beef production.
- The difference in swine may reflect the growth in swine production over the last five years. During the period from 2007 to 2012, the number of Vermont pig farms increased by 100% and the number of pigs in inventory grew by 43%, according to the USDA Ag Census. The majority of growth is in small farms—24 pigs and hogs or fewer—but signs point to continued increases into the future. One indicator is the expansion of farms raising breeding stock; a 30% increase within this period.

Figure 5 Grazing management in clay soils has affected the soil surface on this farm. This situation was caused by allowing cattle to graze plants too close to the ground, so that plants were unable to contain surface moisture.

Grazing management

According to the 2011 survey, 60% of respondents with dairy cows move them once per day or faster and 57% of beef cattle are moved at least once per week. Nearly 14% reported grazing beef continuously (described as moving no more often than 30 days). Seventy-two percent of sheep are moved at least once per week. When asked to describe grazing habits, including pasture sward height on animal entry and departure, the average pasture was approximately 8 inches in height when animals were introduced, and 2.7 inches when they depart. The data indicates that 68% are leaving a residual of 3 inches or less, with close to 30% leaving a [self-described] residual of 2 inches. The average number of grazing days reported (for the 2010 calendar year) was 177, with nearly 19% of the respondents reporting they grazed longer than 200 days within the reporting year (2010).

Nutrient management

Nutrient management on Vermont grass-based farms tends more toward solid manure management systems, according to 2011 survey data. Over 29% of respondents use a bedded pack system, 35% use a managed compost system (for animal and non-animal waste), and 53% have solid manure applied by spreader. Less than 15% use liquid manure applied by spray and 2.2% used liquid manure applied by drag line. This may reflect the size of grass-based farms in animal numbers and acreage, but also may

reflect an avoidance of making large equipment investments, a preference for natural systems-based management, a reduction in soil compaction, and a commitment to water quality.

Compost was described as being applied to all of farmers' land under management within the previous three years on 12.2% of reporting farms. Of farms unable to spread compost on all of their land, the average land percentage they were able to cover was self-reported as 33.4%. In 2013, a bedded pack manure management workshop series hosted 112 attendees in multiple locations statewide. According to post-event evaluation responses, many farmers prefer a bedded pack system because of the beneficial animal health impacts they observe from a well-functioning pack.

Energy

Self-reported data from Vermont grass-based farms describing tractor use (Colby) indicated that 37.6% of respondents used 100 hours or fewer in 2010 and that 50.6% used 200 hours or fewer. Cross-tabulation comparing ruminant animal number and number of tractor hours is significantly correlated ($p<.000$); farms with more ruminant animals use more tractor hours. When looking at types of fuel use ($n=225$), including alternative and renewable energy sources, 11.1% reported using solar or wind power, 5.3% reported using biodiesel, 5.8% used draft animals, and 0% used methane for energy production. According to the USDA On-Farm Energy Production survey (2009), 43 Vermont farms (0.6% of farms statewide) reported 54 wind turbines and 8 farms reported methane digesters.

Biodiversity

When asked about observations of varying classes of forage and animal life, 51% indicated they typically see 3-5 different forage species and 35.6% indicated they typically see 6-10 forage species (Colby). Research in the Northeast has not shown increased forage species to improve livestock production (Soder et al., 2006), and it has been difficult to identify whether increased species also increase overall yield and/or quality (Sanderson, 2010) but increased forage diversity is associated with lower pressure from weed species (Tracy and Sanderson, 2004). Among different classes of animal life, respondents averaged notation of 8.45 different species out of 11 classes. Some of the highest species' percentages noted were earthworms (90.8%), meadow birds (93.9%), and deer (90.0%). Soil quality species included insects on the soil surface (79.9%) and dung beetles (47.6%).

A Snapshot of Vermont Grass-Based Livestock Farmers: Human Capital

Business Planning, Success and Profitability

Of the farmers completing the 2011 survey, 28.8% reported that they have written business plans (n=212). When comparing farmers by gender, 32.8% of male farmers had a plan and 22.4% of female farmers had a plan. According to data collected through the VT Grazing & Livestock Conference (n=252), 32.5% of farmers have written plans, with another 4.4% having plans in process. Over time, the trend has generally been upward for written plans, self-reported farm success, and presence of a web site. In the 2011 survey, 71.2% of respondents described their farm businesses as "somewhat to highly successful". The most important element to business success was identified as animal health (75.5%), followed by farmer quality of life (45.4%) and environmental stewardship (40.2%). When actual business success (net profit) was compared to the self-reported measures of success, there was statistical correlation with profitability ($p<.003$), healthy animals ($P<.000$) and, to a lesser degree, engaging the next generation of farmers ($p<.029$). Presence of a business plan and self-reported success were highly correlated ($p<.005$), (n=212).

Conference Evaluation Responses	2010	2011	2013	2014
Written business plan (n=252)	25.4%	30.6%	33.9%	39.1%
Farm is successful (n=205)	75.0%	83.3%	79.5%	83.1%
Farm has web site (n=139)	--	--	39.7%	47.4%

Business Management

Respondents to the 2011 survey (n=150) represented a sum of $20.5M income in 2010, with a mean of $120,616 and a median of $21,252. Among the participants, 72.9% reported making $100,000 or less. Of that group, 68.6% included net income numbers. The mean net income was $10,357 and median was $1,750. The sum of all net income was $1.6M. Within the farms reporting, 62.7% showed some net profit, 18.0% broke even and 19.3% had a loss, as compared to USDA Ag Census data (2007), where 43.7% of all Vermont farms reported net gains. This is only an approximate comparison as net profit and net gains are not calculated in the same way. When comparing profitability with management within the 2011 survey, the decision to farm full time was highly correlated with net profit ($p<.002$) (n=151). For the farmers with a net gain, 68.1% were full time and 31.9% were described as part time (n=94). Regarding non-family employment, 46.7% reported hiring outside labor in 2010. This represented 303 people, of whom 6 were non-U.S. citizens.

Health

Healthy habits and overall health can be societal indicators of individuals who can and do contribute to the communities in which they live. When asked about a list of twelve health issues, the average number of health issues per person was 1.17 (n=229). Of this group, 38.4% reported no health issues at all. Approximately one third experienced at least one day of restricted activity in 2010. At least 50% indicated zero days of restricted activity. Age was correlated with joint pain ($p<.012$), but not with restricted days of work. When asked about health insurance coverage, 44.8% have insurance through their job or a spouse's job, 22.2% purchase private insurance, and 20.4% are on Medicare (n=229). Regarding the choice to smoke, 99.1% of the farmers completing the survey are non smokers. Overall, 67.7% rated their own health as excellent or very good.

Social and Community Interaction

According to theories of social and civic engagement, the multiple ways in which the survey respondents participate in social activities may have an impact on personal health and quality of life. Thus a range of social activities were documented as a way to better understand the habits of Vermont grass-based farmers and connect those habits to success, personal satisfaction and net profit where such connections exist. With the exception of religious activities, responding women were more engaged in every activity as a percentage of their total populations.

In addition, farmers were asked about interaction with non-family, school-aged children. The respondents reported that 45.4% interacted with children within the previous year, with an average of 11 interactions. Interactions included farm visits, letter writing with students, and visits to school or relevant off-farm events.

	% Self-society improvements [a]	% Religious activities	% Patronized arts [b, c]	% Amateur arts [c]	% Hobbies [c]	% Non-farm physical activity	% Media/ virtual [d]	% Social interaction	% Travel/ tourism
Male	77.0	42.1	59.2	51.3	38.8	63.2	71.7	52.0	65.1
Female	84.5	35.2	78.9	71.8	59.2	78.9	73.2	57.7	76.1
Overall	77.7	39.0	64.2	56.3	44.1	66.4	72.2	52.4	66.8

Significant positive correlation with age [a]($p<0.05$), [b]($p<0.1$)
[c]Significant positive correlation with female: Patronized arts ($p<0.01$), Amateur arts ($p<0.01$), Hobbies ($p<0.01$), Media/virtual [d]($p<0.05$)

Demographics

Aging and Education

The person completing the 2011 survey averaged 54.5 years old. The average age of the primary operator from the 2012 National Ag Census is 58.3 and the Vermont Census is 57.3. When looking at the third operator, respondents to the grass-based farm survey averaged 35.5 years old, the Vermont census averaged 43.5 years old, and the National census averaged 46.0 years old. When examining education levels of the farmers participating in the grass-based farm survey (n=229), 66.1% have an Associate's degree or higher, 39.4% have Bachelor's degrees and 7.2% have Ph.D.'s.

Gender Diversity and Multiple Decision Makers

	Primary operator/ decision maker, 2011 grass-based farms survey	Primary operator/ decision maker, 2012 Vermont Ag Census	Primary operator/ decision maker, 2012 National Ag Census	Third operator/ decision maker, 2011 grass-based farms survey	Third operator/ decision maker, 2012 Vermont Ag Census	Third operator/ decision maker, 2012 National Ag Census	Total operators/ decision makers, 2011 grass-based farms survey	Total operators/ decision makers, 2012 Vermont Ag Census	Total operators/ decision makers, 2012 National Ag Census
Male	68.2%	77.6%	86.3%	70.9%	58.2%	61.2%	57.4%	60.1%	69.5%
Female	31.8%	22.4%	13.7%	29.1%	41.8%	38.8%	42.6%	39.9%	30.5%

Survey respondents included a third decision maker 24.0% of the time, as compared to 5.1% listed on the census. The higher percentage of female operators and the increase in shared decision making may require new approaches to programming in the future.

Years Farming

According to the 2011 survey, 25.6% started farming within the past 10 years and 38.9% started grazing within the same period. An assumption could be made that farmers new to grazing include a combination of new farmers and farmers who have made a transition from a different production system. Incorporating conference evaluation data, 49% of farmers responding (n=266) began farming within the past ten years and 50% (n=237) began grazing within the past ten years. Based upon field experience, this is not surprising, as new farmers tend to be more interested in attending workshops and conferences to gather more information, and it is easier to start farming within a new production paradigm (like grazing) than transition out of an existing one. That said, 24% of evaluation respondents have been farming for 21-40 years and 17.7% have been grazing within the same period, indicating that some experienced farmers are still looking for new ideas.

Full-Time Farming Trends

	2011 Survey of Grass-Based Farms	2012 VT Ag Census	2012 National Ag Census
Farming as primary occupation	50.7%	51.5%	47.5%
Farmers over age 75	9.2%	9.8%	12.2%
Farmers under age 35	13.2% (*under 40*)	5.7%	5.7%

Vermont grass-based farmers have been surveyed to determine their full/part-time status through formal surveys (Colby 2011) and conference evaluations. When surveyed more closely, 18.8% responded that they plan to farm full time in the future (36 people). Of this group, 64.9% plan to transition to full time within the next five years. Conversely, 40.5% of full-time farmers (47 people) indicated a plan to reduce farming activities in the next ten years, primarily citing age as the reason for their labor decrease. Looking at grass-based farmers, 24.4% of respondents planning to farm full time within ten years were under 40. Compared to national agriculture trends, the next generation of Vermont's grass-based farmers appear that they are being replaced more quickly, but still not at the same rate as farmers are retiring. An important age group to consider in the "new farmer" category are 50-69 years old. In the grass-based farm survey, 61% of those planning to farm full time are in this age range. These results are consistent with field observations and requests for technical assistance.

VT-NRCS Programs and Grass-Based Farms

NRCS Grazing Plans

Within the 2011 Colby survey, 38.9% of farmers reported being involved with USDA-NRCS programs within the past ten years (n=229). Consequently, the question was also added to conference evaluations for each year afterward (n=257). The presence of formal NRCS plans has more than doubled within the past three years within conference attendees, with number of plans significantly correlated by year (p<.019). These results are concurrent with increased technical assistance and outreach focused on grazing supported by NRCS.

	2010	2011	2013	2014
Percent with plans within the year	20.3%	43.1%	41.5%	43.1%
Percent by year within all NRCS plans	14.9%	23.4%	28.7%	33.0%

NRCS' Relationship to Success, Satisfaction, Net Profit, and Full-Time Farming

As described previously, the 2011 survey attempted to capture some of the elements connected to success, satisfaction and net profit. Within that examination it is useful to look at how participating in USDA-NRCS programs has contributed to these factors. Cross tabulating programs against success, satisfaction and net profit (n=212), 40.6% indicated that they had participated in programs within the past ten years. Of these, 83.7% considered their farms to be at least somewhat successful, compared to 62.7% of the farmers who had not participated federal programs. This data result correlated significantly (p<.015), while the comparison to personal satisfaction did not. That said, 92.6%-94.3% of the respondents reported that they were personally satisfied, whether participating in NRCS programs or not. This leads to the likelihood that personal satisfaction for Vermont grass-based farmers lies more strongly within ecological systems, healthy animals, and other interactions detailed on Page 15 than the completion of a grazing plan.

Figure 6 Throwing a dart and assessing surface conditions at its point is a simple way to measure ecosystem health.

Addressing net profit; cross tabulation indicated a significant correlation (p<.027) between 71.9% of farmers participating in NRCS programs and net gains (n=151), as compared to 55.2% of farmers not participating in programs. Since full and part-time farmers showed statistically significant differences in net profit, results were compared between full/part time status and NRCS program participation. Respondents who reported farming as their primary occupation represented 68.5% of the program participants. This was highly significant (p<.000), (n=229). In order to better understand the interactions between farming status, program participation and net profit, ANOVA regression analysis was applied. According to the regression results, farming as the primary profession is highly correlated (p<.001) with net profit, but participation in NRCS programs is not. While not definitive, this might suggest that helping farmers be profitable will allow them to farm full time and apply to more conservation programs.

Aligned goals of NRCS and farmers

How do the stated goals of VT-NRCS and grass-based farmers align? According to the responses detailed on Page 12 and the drivers identified on Page 20, environmental stewardship is a clear measure this group of farmers considers important to success, even if it not correlated to net profit. The percentage of renewable energy use among the group of Colby survey respondents is higher than state and national

farmer data indicates. It has been a challenge to find comparative numbers for tractor use, which is significantly correlated with farm acreage in the Colby survey, on a statewide or national basis. Small farms may purchase hay from larger operation or hay-focused farms; further research is needed to refine numbers about tractor use on grass-based farms.

Manure management systems favored by Vermont grass-based farmers are consistent with the stated goals of VT-NRCS to build soil health, reduce nutrient runoff, and increase soil biological life. The high rates of bedded pack, managed compost and solid manure systems in combination with targeted application of raw animal manure through pasture rotation are all connected with desired soil health strategies. As Ray Archuleta of the USDA-NRCS Soil Health Team states, "*manure (and more specifically, organisms within the manure) has a great way of buffering the ecosystem*." Creating perennial vegetative cover to soften the effects of surface compaction and growing strong roots to address subsurface compaction enable water to infiltrate and be held within soil, rather than running off into waterways. When applied properly, this approach reduces or eliminates erosion and sequesters carbon.

Where self reported in the 2011 Colby survey, ecosystem measures of biodiversity were high, averaging 8.45 different classes of animal life out of 11 choices. Over 90% of the farms reported visually observing earthworms and 47% observed dung beetles. Since these were self-reported numbers and not objective field counts, this is not conclusive data, however it does illuminate perceptions of the farmers that grass-based farming supports diverse life. Similarly, the forage species count data was based on memory, not field observation. A limitation of three to five species or count of six to ten may actually reflect the ability of the farmer to identify multiple species as much as the actual existence of different plants. Follow up projects are beginning to include more objective methods of capturing these data in pasture, forest, and riparian areas.

Interaction with Federal Programs

In 2014, UVM graduate student Jennifer Miller conducted a survey among farmers in Vermont regarding their experiences using agricultural conservation assistance programs. The survey captured responses from 61 farmers selling fluid milk (55.7%), meat (29.5%), vegetables (14.8%) and hay or other crops (9.8%). The respondents most commonly had farms between 180 and 499 acres, sell primarily in the wholesale market, and farm organically. Half of the respondents indicated that cost was the biggest challenge when implementing conservation practices on their farms. Finding time to implement practices was the second most frequently cited challenge. With regards to program structure, EQIP was most often preferred by respondents (36.1%). However it is important to note that 24.6% of respondents felt they lacked enough information to accurately differentiate between program structures and 16.4% indicated they did not have a preference.

Farmers were asked whether they had applied for and received an EQIP contract. The majority (67.2%) of respondents had applied and all but four had then enrolled in the program. No significant demographics differences existed between respondents who had participated and those who had not. Farmers growing hay and other crops for animal feed had the highest rates of participation in EQIP while meat producers had the lowest. Value-added producers did not engage with the program at all. The average number of practices per contract was 2.6 though respondents' contracts included a range of one to eight practices. The mean and range of practice numbers was largest for meat and dairy farmers while vegetable, hay, and farmers growing other crops tended to contract for one to four practices.

Respondents' contracts included structural improvements more frequently than best management practices (BMPs). The structural improvements most often cost shared were waste storage facilities and

fencing, while the most commonly funded management practices were pasture reseeding and prescribed grazing. These structures and practices are most commonly used by dairy farmers.

Case Studies

While surveys and data collection can give us hard numbers, pasture technical assistance on farms in Vermont can take many forms. Each farm is unique and to support them, we need to adapt and understand the conditions under which they are working. As Ray Archuleta says, "*when you are invited onto a farm, you are invited into a life*." The following examples represent some of the diverse situations in which technical assistance has been offered in the last five years. In most examples, the farmers' names have been changed to protect confidentiality.

Dairy farm transition from corn-feeding to certified-organic rotational grazing

John Smith (*not his name*) comes from a large family that has farmed in Franklin County, Vermont for four generations. He has siblings and extended family members who own many of the nearby farms. All of these operations are crop-based conventional dairy farms, and the one he owns – the home farm, over 250 acres of sugar woods and open land--was also farmed conventionally until three years ago when John made the decision to transition to organic dairy. This decision came from the difficulties of growing corn on the clay type soils over much of the farm, and the realization that it had become even more difficult in the recent years of heavy rainfall events and low crop yields. John also did not enjoy the many tractor and equipment hours required for growing corn.

Starting in the early spring of 2012, technical assistance visits initiated to help John plan a grazing system to meet his organic transitioning requirements and improve his pasture forages. Since then, five site visits and five phone calls have taken place, as well as a formal NRCS grazing plan and EQIP contract. Through the planning and transition process, John determined that it would be more economically feasible to purchase organic cows rather than transition his existing herd. Pasture planning calculations also helped him better fit the number of cows to his available acreage; he reduced his cow numbers from milking 120 animals to 80-85 animals.

In July of 2014, those portions of Johns' farm formerly in conventional corn will have completed their transition to organic hay/pasture land, and become a part of his farm's feed production once again. In late June John and his technical assistance advisor made a walk around some of the pastures to assess, and talk about strategies for improvement of the forage and grazing system. John is still learning about how his pastures respond to grazing at different times of the season, and what pattern of moving the cows works best. When he started this process, he knew that it would take some time and several seasons to trial the best approaches – so only the perimeter has permanent fencing as he experiments with temporary fencing for the interior set-up of paddocks.

John is glad he made the transition to organic. He likes the principles of organic farming, and enjoys the process of putting the animals out to graze on new paddocks every day. He enjoys being out in his fields and setting up fencing. He has been a little frustrated by the slow pace of his former cornfields to high quality pasture, but there has been enough improvement for him to believe it will continue to develop. He is interested in trials with methods and/or seeding different forages to see what approaches bring improvements to his animals or his pastures. He is especially pleased with the health of his animals, and looks forward to when his land has recovered to produce high quality pasture. He is also interested in planting some trees and shrubs along the river edge that borders the eastern boundary of his farm. He would like to contribute to a healthier river, and improved water quality.

Grazing improvements on medium-sized farm dairy operation

A medium-sized Vermont dairy farm has roughly 250 acres sandwiched between the interstate and a state highway in the Connecticut River valley. They manage approximately 200 dairy cows, plus an

equal amount of dry cows and young stock. Owner Bob Jones (*not his name*) made a technical assistance request in the summer of 2012 due to frustrations with numerous health issues in his cow herd, particularly the young heifers, caused by barn conditions. He wanted to keep the heifers, and a few cows in the process of drying off, outside and grazing with the hope that it would improve the animals' health issues. The milking herd would remain inside on stored feed and grain.

Bob had set up some separate pastures to move the 36 target animals in a rotational system. They stayed out all winter with some pine woods for cover. The animals lost some weight, but were healthy. However, he was unsure about the tentative fencing design and was unsatisfied with the cows' grazing efficiency– they wandered around the paddock and did not eat much of it. He was looking for additional advice.

Bob and his technical assistance advisor measured the forage production and identified plants to determine basic pasture quality. Bob's pasture had high quality potential, but the plants were over mature and quality was beginning to decline. Together, they established a plan of action for the rest of the 2013 grazing season, which included some pasture clipping, increased paddock subdivisions, faster paddock rotations, and adjusted paddock shapes to encourage more even grazing and manure distribution. Those were the steps Bob felt he could work with for the immediate grazing season. If that went well, he wanted to consider putting more of his animals into this feeding/grazing system.

In the spring of 2014, Bob sent an email describing his grazing results.
"…I think it went well and accomplished our goals. We deliberately slowed cows down prior to dry off yet we sold 1.9% more milk, 3.8% more BF and 2.8% more protein and only milked 0.9% more cows. I THINK we had some health benefits from no concrete and green grass/exercise/flies/sun/ snowstorms/better muscle tone/healthy livers. Thanks. Would love to have you come to smarten us up a bit. Need all the help we can get! "

Bob and his technical advisor are continuing to work together with other agricultural resource personnel to increase the number of animals they are grazing, both young and adult animals.

Moving from a fallow farm into a managed beef grazing system

Sally Sargent was transitioning from a medical profession into a retirement career focused on high quality, direct-marketed beef. The farm they purchased in south-central Vermont had a long history of production, but the pastures had significantly reduced condition and had been fallow for years. Sally began attending periodic pasture workshops in 2009 and gathering information about rotational grazing. She and her farm staff have attended multiple workshops and conferences.

Initially starting with a small herd and using embryo transfer to build a herd quickly, as well as develop markets in high-end New York restaurants, Sally has seen continual improvement in her pastures. She has moved from attending workshops to offering them. The farm's carrying capacity has increased, but Sally has needed to balance her market demands with animal numbers. This has required that the farm rent and lease additional land nearby. Again, the land has often been underutilized or fallow, and Sally has continued to use the information she has gleaned to manage and improve these leased properties.

She has worked with grazing and agronomy support personnel to target areas for application of soil amendments, advise on grazing management, and increase cattle intake of weeds in fallow areas.

Establishment of a managed grazing and browsing system for meat goats

Three years ago, Karen Freudenberger (*her real name*) started volunteering with the Vermont Refugee Resettlement Program (VRRP), after years of working abroad largely in Madagascar. As she spent time with elders from Somalia, Bhutan, and Nepal in the greater Burlington area, they shared stories of living outside, taking care of their animals, and having an important position within their communities as the providers of food. As Karen looked around Vermont, she learned that 1) Vermont produces more goat kids from the goat dairy industry than are needed, and 2) the New American communities purchase over 3,000 goats per year through Burlington markets alone. Most of these originate in Australia or New Zealand. The solution seemed simple.

Early in the process, Karen reached out to the UVM Center for Sustainable Agriculture for technical assistance on teaching goats to become weed managers, husbandry and feeding issues, and business planning. She reached out to partners like Sterling College to help with a business plan and Fat Toad Farm to learn more about raising goats. Her compelling concept was that this project could help people celebrate their cultural heritage, replace imported food from across the world with a "waste" product from Vermont, bring extra money into the family, and manage natural resources wisely.

The Vermont Land Trust (VLT) was in the process of receiving a Colchester farm within close travel distance of Burlington and Winooski. A farm manager was found in Chuda Dhaurali, a Bhutanese farmer who raised goats as a child before coming to the U.S. In 2013, the first goats arrived for a pilot year of establishing real numbers to compare with the estimates and practice learning how to raise and manage goats in a Northeastern climate. The effort is now called the Vermont Goat Collaborative and was awarded a grant from the Working Lands Enterprise Fund to renovate the farm milkhouse as a state-inspected custom slaughter facility. The Collaborative successfully raised and processed 84 goats last year. In 2014, two additional farmers, Theoneste Rwayitare and Theogene Maharo, joined the Collaborative, bringing the total number of goats being raised to more than 250.

The Collaborative's advisors have now expanded to an ecologist, a forester, and agroforestry, pasture, and agronomy Extension personnel. Additional partners have included farmer neighbors, students and faculty from local colleges and universities. The initial Vermont Goat Collaborative is one portion of the holistic Pine Island Farm collective, which is hosted through a partnership of VLT and Association of Africans Living in Vermont (AALV). Multiple goals evolving on this shared land include rice and vegetable cultivation by additional members of the New American community, protection of water quality and forested areas, maximizing the potential of young goat growth and profitability, managing for hay production, reducing invasive species, and more. A strip-grazing/browsing design was initiated for testing and research this spring, and data is currently being collected to measure the effects of this design.

The Vermont Goat Collaborative represents an example of exciting new projects evolving around grass-based farming systems which seek to meet environmental, production, economic, and community goals within impaired watersheds and near high-density populations. It also illustrates some of the changes in farmer demographics and production animals that Vermont has been experiencing in recent years.

Priorities and Drivers of Vermont Grass-Based Livestock Farmers

According to Colby's 2011 survey data, healthy animals, profitability, engaging the next generation, business longevity, and farming lifestyle were statistically positively correlated with self-reported success. Health insurance, decrease in woody plants, total acres owned, and presence of a business plan were positively correlated with satisfaction. Binary logistical regression identified the presence of a business plan, participation in amateur arts, increasing number of tractor hours, and increasing farmer education statistically impacted the predictability of success. The results indicate that the presence of health insurance, full-time farming, presence of a business plan, and soil testing statistically impact the predictability of satisfaction.

The applied research from 2011 shows that the Vermont grass-based livestock farmers participating in the survey were mostly self-described as successful at some level, and overwhelmingly described themselves as satisfied. They based their success on a variety of factors including animal health, farmer quality of life, environmental stewardship, profitability, and engaging the next generation. More than half of them experienced a net profit in 2010, particularly those who farmed as their primary occupation. They observed high levels of on-farm biodiversity. The Vermont grass-based farmers responding to the survey participated in civic and social activities, as well as self re-creation. They represented a higher percentage of female farmers than state or national averages, which may have wider implications for farming assistance needs and community interaction. They appear to have more shared-decision making than the most recent state average, and with a younger group of farmers.

At the 2014 VT Grazing and Livestock Conference, some of the themes highlighted in the Colby thesis were tested through a "pop survey" format. 100 iClicker devices were used to record real-time opinions of farmers and service providers within the audience.

- The number one reason respondents farm in (or like) grass-based systems is to care for the working landscape (63.4%), followed by making money (18.3%) and enjoying family/community (11.0%). (n=82)
- The most important contributor to success was farmer quality of life (40.2%), followed by healthy animals (31.2%), profit (15.6%), and soil/water quality (13.0%). (n=77)
- When describing what they keep in mind when making decisions, 52.3% identified their children or grandchildren, 25.4% identified themselves and 22.2% identified the needs of the current day. (n=63)
- The number of generations involved in the farm were primarily two (45.8%), followed by one (34.7%) and three (19.4%). (n=72)
- When asked about the use of compost, 89.5% of the farmers responding indicated that they have used it within the last three years. (n=76)
- Farmers asked about weed pressure changes as a result of their grazing practices indicated that 24.2% saw in increase, 56.4% saw a decrease and 19.3% saw no change. (n=62)
- Nearly 75% of respondents said that they participate in off-farm recreational activities at least once per month. (n=83)

The real-time survey method illustrated consistencies with the previously collected data. While not every number was exact, the grass-based farmers affirmed the priorities of quality of life and animal health, the involvement of multiple generations and future planning, soil building management techniques (compost), declining weed pressure as a result of grazing, and care for the working landscape.

Lessons Learned Based Upon Data Collection and Field Experience

Over the past 18 years, continual themes have emerged based upon quantitative data, networking communication with local farmers, agency personnel, and colleagues; and regional and national experts in the field. The following list appears in no particular order, but represents a range from challenges and barriers to emerging information about grass-based systems.

Barriers to adoption

For the farms considering options and making small or few changes (if any), barriers to change varied. In some cases, the technical assistance person helped evaluate a strategy and the ultimate decision was to keep management the same for now (and keep monitoring the situation). In other cases, issues such as lack of funds, labor, time, or commitment were the barriers. These might be described as **internal barriers**; differences of opinion between generational family members; investments in mechanical equipment or infrastructure; high debt loads reducing flexibility; inconsistent labor availability, etc. In some cases, there were **external barriers** such as waiting in order to meet federal requirements (*NRCS will not pay for practices that have already been implemented, for example*), or waiting for an organic contract before starting to graze more intensively as part of a transition period.

Complex simplicity

Good rotational grazing (regardless of its title—rational, rotational, mob, MIG, etc.) has some very simple principles. Short periods of animal occupation, herbivory (biting plants) stimulating root growth, adequate plant recovery. Properly sizing paddocks to match the animal types/numbers/feed needs with forage production and quality levels.

These are essentially math problems and can be solved largely degree on paper (or by spreadsheet) without seeing the farm. The complexity of grazing is when calculated math meets the real world; when varying amounts of water fall from the sky, when individual animal behaviors and nutritional needs impact how, where and how much feed they wish (or need) to eat, and when farmers' personal or off-farm work lives cause shifts in the rotation schedule. It's a delicate balance, sometimes called "the art and the science" of grazing. The overriding theme is that even though the basic principles stay the same, how a person manages that system on a day-to-day basis is highly variable. That's why there's the "management" intensive part of management-intensive grazing. To be done well, grazing isn't a system that can be prescribed in a one-size-fits-all way. That's why individual technical assistance is so essential. Farmers can learn the basics through multiple channels (including the grazing conference and pasture workshops), but to reach the next step in good management they will most benefit from a farmer mentor or TA provider.

All of that said, part of the stability of a grazing system comes from the complexity just described. A good grazing system works in harmony with the larger ecosystem in which it resides, which can help ensure continued farm production, profitability and environmental protection. A good grazing system creates synergy; much more than the sum of its individual parts.

Grazing pays, if managed well

On the simplest calculation level, one day of grazing saves $3 in feed for one cow (the cost of one square hay bale). For a herd of 40 cows, this equates $120/day. One week of additional grazing for the herd means $840. This isn't an absolute number for all farms (knowing that labor and stored feed costs may vary widely), but it does give a comparison of how a farm can save or spend money. Vermont, as a Northeastern state, experiences a large portion of the year (six months+) where grass growth is slow or stopped. Farmers spending money on stored feed can undo the financial benefits of grazing quickly if

not careful. Extending the grazing season by planting small grains or warm season grasses, stockpiling pasture plants, or using planned grazing to manage forage availability are some strategies to help keep grazing farms financially viable.

Healthy soil means clean water

True soil health includes chemical, physical and **biological** properties. Often, farmers take soil samples which are used to adjust the chemical requirements of their soils, but that's where they stop looking. Adding lime or nitrogen in recommended quantities may help serve short term production needs, but they may not be what's best for the long-term health of the soil (and by extension, water quality). Healthy soil contains diverse biological life, including bacteria and fungi, protozoa, nematodes, arthropods, and more. Each stage serves important functions, such as decomposition, photosynthesis, feeding and shredding. When they work in concert together, this biological system creates an aggregate structure that allows water to sink through rather than flow over the surface. This biological life cycles nutrients and minerals from deep below the soil to the surface, making it available for plants. In short, by encouraging improved soil biology, *some farmers have reduced or eliminated the use of applied fertilizers*.

National soil health experts point to four consistent factors needed within soil management in order to maximize soil health:

1. Minimize soil disturbance
2. Maximize plant diversity
3. Keep living roots in the soil
4. Keep soil covered with plants and plant residue

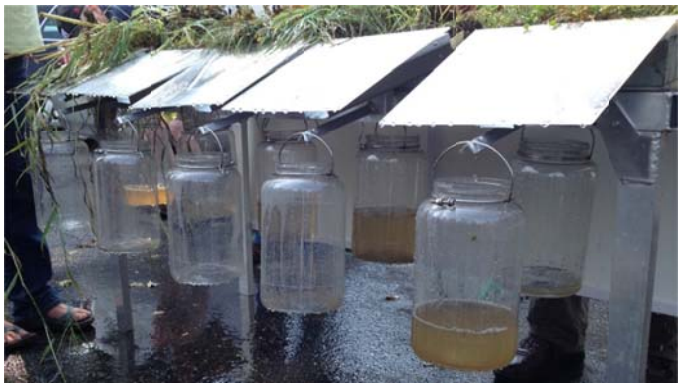

Figure 7 Rainfall simulation showing how water sinks into, or flows off, soils under different management styles. Note the two rotated pasture samples (2nd and 3rd from right) vs. continuously grazed soils (right).

Rotational grazing accomplishes some of these, however *how* a farm is grazed makes a big difference, as shown in the picture to the right. Overgrazing or continuous grazing minimize plant diversity and do not feed the soil organisms, because soil becomes exposed and the soil surface ecosystem does not provide protection for the organisms.

Related to all of this is the ability of rotational grazing to increase soil organic matter (SOM). From data shared at the 2012 National Grazing Lands Conference by Doug Peterson of NRCS:

- 2% SOM will hold 32,000 gallons water, or 21% of a 5.5 inch rain
- 5% SOM will hold 80,000, or 53% of a 5.5 inch rain
- 8% SOM will hold 128,000 gallons of water or 85% of a 5.5 inch rain

For every 1% increase in SOM, there is an increase of as much as 25,000 gallons of water holding capacity within the soil (NRCS).

Animal exclusion isn't a one-size-fits-all plan

Increasing pressure has been mounting for all livestock to be excluded from riparian areas, all of the time. While we would not argue that continued presence of livestock in waterways and riparian areas can cause manure contamination of water, reduced vegetation, and soil erosion, ***proper*** application of livestock (in short managed periods) to riparian areas can be beneficial. The biological mechanism of

biting a plant and then allowing the plant to recover encourages root tillering (proliferation). This creates a stronger streambank. Plants such as grasses (particularly sod-building varieties) hold soil more strongly than many broadleaved plants, which may have upward growth patterns rather than spreading patterns. Removal of livestock can allow invasive species (both broad leaved and woody) to outcompete native species and further expose soils to erosion. One example is wild chervil, a nutritious and highly edible plant with a canopy that makes it appear to cover soil. When cut, bare soil is exposed beneath the canopy.

There are excellent examples of proper livestock application being used to heal landscapes and streambanks. A good grazing system mimics natural systems, and healthy systems include groups of ruminant animals approaching water sources for short periods of time and moving on to new grazing areas. Research data published in July/August 2014 Journal of Soil and Water Conservation using both data and modelling to look at the impacts of various conservation practices and managed grazing on Phosphorus and sediment runoff in a watershed in MN, shows that grazing resulted in an 85% reduction in runoff.

Figure 8 Sheep grazing on wild chervil in flower. Grazing it at this stage will require the plant to use more root carbohydrate reserves to recover, allowing other plants to better compete.

Riparian areas have been the primary example discussed, but the same concept applies to agroforestry systems. Excluding livestock unilaterally without allowing for targeted, managed livestock application may not be the best course for the long-term health of forest or edge (fallow land/neglected pasture) areas.

The human element

The establishment of habits is related to continuous pathways in the brain, and to change habits is a great challenge. Easy examples are quitting smoking or starting a new exercise regime. For farmers jumping from one form of farming (row cropping, for example) to another (grazing), there are many barriers to making the change. Some more obvious barriers are the economic investments, changing tools from tractors to fences, learning new skills. Under that is the changing of habits and patterns on a personal level. That can be scary and uncomfortable, and hard. It's much easier to stay in the same pattern than try a new one. This is where trust in a technical assistance provider can be helpful, both for the farmer's ability to ask for help and the provider's ability to put extra time in while the patterns are being developed.

There are moments of opportunity, where change is imminent and patterns are shifting naturally. Often those become the times when changing the farm system is more likely and possible. Farm transfer, new farmers (establishing the grazing pattern right away), negative situations like foreclosures or debt collection forcing change. The important things to address are how to identify those opportune times and how to be there to support the switch to grazing for farmers ready to change their habits. These are the challenges ahead that we are hoping to address.

There are no short cuts to building relationships

One of the strongest arguments for continued availability of one-to-one technical assistance is the relationships built through time. It takes time to build trust, to get to know one another's strengths and

challenges, and to feel comfortable enough to ask for help. Farmers are an independent lot (even the grass farmers, who are known to embrace networking amongst one another). It does not necessarily come easily to ask for assistance from anyone. When there is a short or bad experience, the request may never come. It takes time to establish trust in the expertise of the technical assistance provider. After all, the advice provided will affect the bottom line of the farmer's livelihood. Many successful farmers are successful because they cautiously weighed new opportunities.

The challenge in giving relationships time is that grant cycles do not last very long. If technical assistance is grant funded, it's often tied to the goals of the grant rather than the farmer's goals. If funding is tied to specific planning resources (such as NRCS grazing plans), there may be limitations placed on the amount of flexible time a TA provider will have to simply problem solve a range of options with a farmer. This is not a criticism of the general grant funders who have supported grazing assistance in the past 15+ years; more it's recognition that **if Vermont wishes to encourage more grazing for improved water and soil health (and farmer economic viability), stable funding for technical assistance should be a major priority**.

Pasture research is essential

As agricultural resource staff working in the field, we continually receive a stream of questions about plant toxins, regrowth patterns, impacts of different management choices, energy use, pasture production limitations, animal husbandry, and much more. The data on soil health is largely based on case studies and needs to be further researched. The impacts of animal hooves and saliva on plant growth, different grazing management techniques for clay and gravel soils, pasture improvement tools, and the health impacts of grazing management; these are all questions needing answers. The Northeast Pasture [Research] Consortium attempts to coordinate research among Northeast universities and institutions, however many of the faculty doing this work are retiring and not being replaced.

Figure 9 A VT-NRCS CIG grant-supported grazing demonstration project--the team is practicing a shared exercise with a forage assessment tool.

Grazing for adaptation, mitigation and farm resiliency

On so many levels, good grazing management is an essential tool as Vermont looks at adapting to and mitigating climate change. An ongoing research project currently being conducted at UVM is looking at a suite of best management agricultural practices as related to climate change. Rotationally managed pastures have been shown to increase soil organic matter (sequestering carbon), reduce energy use (using less fuel), and increase water absorption and retention (essential in weather extremes). Many of the targeted environmental goals in establishing a more stable system during periods of instability can be met by well-managed pasture. USDA-NRCS' Ray Archuleta recently stressed the importance of biomimicry in natural systems, and the importance of creating systemic redundancies (like nature) that increase the stability of these systems under times of environmental stress.

Looking to the Future of Vermont's Grass-Based Farms

In addition to ongoing themes described previously, such as aging farmers, the influx of new farmers, diversification of farmer background and production systems, transition of existing confinement or cropping systems into pasture, etc., new trends are emerging in Vermont and the Northeast. Proactive awareness and action will help Vermont's natural resource and agriculture service providers plan to address the issues raised.

Trends and Issues

- *Swine production is on the increase*. Based upon personal communications, Ag Census data and farm visits, Vermont's pork production is likely to increase into the future. One farm identified a 900% increase in animal numbers within a three-year period. Based upon the demands of local restaurants and farmers' markets, raising pigs in a pasture or woodland setting rather than a barn is preferable. That said, farmers struggle with identifying the correct number of animals and/or total weight for pasture and woods as well as period of occupation. This is a new area of study and it's difficult for technical advisors to make recommendations. Since the natural action of swine is to remove vegetative cover, the use of swine in steeply sloped and wooded areas represents a technical challenge.

- *Interface of grazing, water quality policy and impacts, and riparian area health*. As noted on Page 22, total livestock exclusion in riparian areas can lead to increased weed pressure, reduced sod-holding vegetation, and decreased biodiversity. Few would argue that continuous animal impact on riparian areas has negative repercussions by denuding surface vegetation, creating compaction and increasing runoff of nutrients and sedimentation. Research studies have shown that properly managed grazing can have beneficial impacts on riparian areas, but little of that research has taken place in Vermont or the Northeast. Between pending state legislation encouraging total livestock exclusion, and the potential loss of grazing acreage as well as fencing expense, this issue is timely and likely to continue into the foreseeable future. Grant proposals focused on riparian health and grazing have been submitted to gather more pertinent data in or order to make appropriate recommendations to farmers and policymakers.

- *Interface of woodland management and appropriate management to reach intended goals*. Much like the riparian grazing question, Vermont farmers are continually pressing against state, federal and county policies for forest management. In some cases, farmers are seeking to establish silvopasture systems that create multiple tiers of livestock and tree products concurrently. In order to achieve the goals of multi-tiered production and natural resource protection of sensitive areas, more information needs to be collected in order to make appropriate recommendations.

- *Increased attention to soil health*. National partnerships between USDA-NRCS, SARE, Howard Buffet Foundation and others have stimulated a high-level focus on soil health as a functioning biological system. Well-managed grazing systems have long contributed to the soil food web, but the increased attention and support allows for new partnerships and new opportunities to present information to farmers and policymakers.

- *The importance of the Connecticut River Watershed*. For the past twenty years, much attention has been paid to the Lake Champlain Basin (and rightly so), particularly in the area of Phosphorus runoff. Photos taken showing the sedimentation runoff from the Connecticut River

into Long Island Sound after Tropical Storm Irene illuminated the impacts that Vermont and New Hampshire farm management have on the populated areas downstream. Increased interest has prompted new and expanded partnerships to address water and soil runoff, riparian areas, and soil health.

- *The cumulative effects of small farms*. After historically working with large and medium farm operations, the Vermont Agency of Agriculture has recently begun a focus on education and regulation enforcement of Accepted Agricultural Practices (AAPs) on small farms. The majority of farms in Vermont are considered to be small by size and income standards. Arguably, many of the growth areas in Vermont agriculture (young, female, retirement, direct market, value-added, non-dairy products) fall within the "small farm" category. Vermont has owners of more than 2,500 equines, who have often been missed through traditional farm education channels. While working with many smaller farmers will take more time than fewer farms with larger acreage, the cumulative impact overall has the potential to be significant. This adjusted prioritization toward small farmer education and enforcement will require increased sharing of resources and new partnership development in order to reach farmers statewide.