APRIL 2017

Impacts of Massachusetts dairy farms and key farm assistance programs: A summary of the 2016 Massachusetts Dairy Farm Impact Survey

A report prepared for the Massachusetts Dairy Promotion Board

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Executive Summary

This report describes the contributions and impacts of Massachusetts (MA) dairy farming on the Commonwealth of Massachusetts and key assistance programs. It is based on results from a 2016 survey of MA dairy farmers and other information and was funded by the Massachusetts Dairy Promotion Board (MDPB). MA dairy farmers significantly contribute to the economy of the Commonwealth and local communities through jobs, revenue, taxes, and local purchases. They continue to be much more likely to apply measures to conserve natural resources than other U.S. farmers. They also provide support to their local communities by conserving farmland and agriculture heritage, producing local food, volunteering, and providing recreation access at levels greater than those of other U.S. farmers, landowners, and/or citizens. Thus, almost 90% of MA dairy farmers reported that their local communities were supportive or very supportive of dairy farming; a level of support that has increased from about 70% in 2010.

Many MA dairy farmers have increased the viability of their farms by participating in state and federal programs that improve their farm business, conserve farmland, and minimize negative impacts. The MA Dairy Farmer Tax Credit Program is one such program that has played a key role in maintaining the economic viability of dairy agriculture and the flow of benefits that they provide to the Commonwealth and its communities. The implementation of this and other new programs has been followed by a dramatic slowing in the decline of dairy farm numbers in MA after decades of rapid decline.

Economic Impacts

» MA dairy farms generated $44.3 million in sales in 2012 and accounted for 10% of MA agricultural products' value. Their milk may have supported up to $500 million in sales from dairy products processed in MA.

» MA dairy farms added $150 million into the state's economy by supporting companies that provide supplies and services to farms. Almost two-thirds of their farm supply and service expenditures were spent in MA.

» MA dairy farms directly employed an estimated 450 people with an average wage that is greater than the living wage for MA in 2016. Their total payroll was an estimated $10 million in 2016.

» Each MA dairy farm reported paying on average $15,100 in property and excise taxes. Their tax contributions have helped financially support town services in over 27% of MA municipalities.

» The economic benefits of MA dairy farms to MA and local communities were slightly greater in 2015 than in 2010.

Benefits to Communities

» MA dairy farms have been important to local food production. MA dairy farms produced an equivalent of 23% of the milk consumed in MA. Over 44% of MA dairy farmers sold food products (meat, dairy products, eggs, maple syrup, vegetables, baked goods, honey, apples, and berries) directly to consumers.

» Statewide, MA dairy farms provided recreational access to an estimated 29,000 acres. More than 90% of MA dairy farms reported allowing public recreational access. Dairy farms reported an average of 2.9 recreational visitors/acre/year, about half the visitation rate of national parks.

» About 97% of MA dairy farmers indicated that they had land with conservation restrictions (ease-

ments) that prevent conversion to other land uses.

» MA dairy farmers cared about farm appearance, with 91% of farmers reporting the application of practices that enhance the scenic value of agriculture.

» About 64% of MA dairy farmers reported volunteering in their communities, a frequency that exceeded that of MA residents. Dairy farmers reported volunteering an average of 90 hours/year, three times the level of MA residents.

» Nearly all MA dairy farmers reported applying at least one practice to minimize farming nuisances for neighbors.

» The community benefits of MA dairy farmers to MA and local communities were high and increased from 2010 to 2015, and exceeded national averages.

Environmental Conservation

» Over 90% of dairy farmers reported applying practices to minimize nutrient runoff and protect clean water.

» About 80% of dairy farmers reported applying practices to minimize soil erosion and use of nutrients (fertilizers and manure) that can pollute water.

» About 70% of MA dairy farmers reported managing some of their lands for wildlife for an estimated total 17,700 acres of wildlife habitat.

» The application of environmental conservation practices by MA dairy farmers has increased from 2010 to 2015, and exceeds that of national averages.

Importance of Voluntary Assistance Programs

» Nearly all farmers (97%) indicated that the MA Dairy Farmer Tax Credit Program from 2010-2015 was important for maintaining the economic viability of their farm. MA dairy farmers primarily used their income tax credit to pay for operating costs. This program helps dairy farmers pull through tough economic times when wholesale markets do not pay dairy farmers what it costs them to produce milk. Following the passage of the MA Dairy Farmer Tax Credit Program in 2008, declines in numbers of licensed MA dairy farms were reduced by 50%, though this change may not be statistically significant.

» About 90% of MA dairy farmers reported enrollment in one or more of 22 state or federal conservation assistance programs to improve farming practices or reduce environmental impacts.

» Both the MA Taxation Law Chapter 61, 61a, 61b, or 61c and the MA Farm Energy Program (MFEP) had >50% enrollment of dairy farms and were also identified by many MA dairy farmers as being important to the economic viability of their farms.

» About 67% of MA dairy farmers were either satisfied or very satisfied with MDPB's efforts to communicate with dairy farmers and to promote MA dairy products to consumers (this study).

Introduction

To assess the contributions and impacts of dairy farms and the importance of state programs to dairy agriculture in 2015, Manomet worked with the Massachusetts Dairy Promotion Board (MDPB) in 2016 to randomly survey 100 MA dairy farmers[1]. This report uses survey results and information from other sources to describe how MA dairy farms affect local economy and communities, practice conservation, and rely on existing assistance programs.

Like other small business owners, MA dairy farmers have worked hard to make their businesses succeed despite these challenging economic times. Their greatest challenges have been low and unstable wholesale milk prices coupled with ever-increasing milk production costs. After the historic low wholesale milk prices in 2010, prices paid to farmers significantly rose in 2014, only to plummet in 2015 and 2016. When milk prices were low, most farmers were not paid what it costs to produce the milk and so have struggled to cover their expenses. In 2010, 38% of MA dairy farmers were paid milk prices that did not even cover their short-term operating costs (Whitman 2011). This number grew to 46% of MA dairy farmers in 2015 (this study). Unstable milk prices have made it difficult for dairy farmers to invest in the future. Fluctuating federally set milk prices and the high cost of milk production in MA make it difficult for MA dairies to be profitable when milk prices are low (Massachusetts Department of Agricultural Resources 2012). Production costs also have increased by 64% between 2007 and 2012 (2007, 2012 US Census of Agriculture).

Dairy farmers also have been squeezed by skyrocketing health care costs (American Farmland Trust 2008). Moreover, they uniquely face the pressures of increasing land prices and property taxes, which can induce them to sell their land to developers in tough economic times.

Most MA dairy farmers have used over a dozen state and federal programs to overcome these challenging pressures. One goal of this survey was to assess whether these programs have significantly helped MA dairy farmers address environmental challenges, conserve agriculture lands, and overcome economic challenges as these are key stepping stones to increasing the sustainability of dairy agriculture in MA.

Economic Impacts

MA dairy farms generated $44.3 million in sales in 2012 (USDA National Agricultural Statistics Service 2013) and accounted for 10% of the value of agricultural products sold in MA (USDA National Agriculture Statistics Service 2013). Dairy product manufacturing (NAICS code 3115) generated another $1.6 billion in sales and $128 million in payroll while dairy machinery, equipment, and supplies wholesalers (NAICS code 4238) generated $2.1 million in sales in 2012 (2012 Economic Census of the United States).

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[1]The 100 farmers were selected from the total population of MA dairy farmers (n=157) based on a list of MA dairy farmers provided by MDPB. The MDPB provided advice about survey wording to ensure that the questions could be easily understood by farmers. Non-respondents were reminded up to three times by email and/or mail. Results were consistent with results from other recent surveys of dairy farmers in New England (A. Whitman, unpub. data; J. Majut pers comm.). Because farmers in another regional dairy farmers survey never under reported negative impacts and tended to under report positive impacts (G. Clark, pers. comm.), it is likely that negative impacts were not under reported by participating dairy farmers. Although all surveys are subject to errors, every effort was made to ensure reliable results. Forty-three dairy farmers (43%) responded. Their herd sizes (t-test, t=1.030, df=76.127, P=0.306), gross sales (t-test, t=0.87, df=179, P=0.385), and geographic distribution (Kolmogorov-Smirnov test, dmax=7, df=179, P >0.15) statistically mirrored those of all MA dairy farms. Hence, these survey results are likely to accurately represent impacts and practices on MA dairy farms.

Jobs and Payroll: MA dairy farms employed an average of 2.9 full-time equivalent (FTE) employees in 2015, which amounts to an estimated 450 employees across the state. The average wage was $26,300 with benefits in 2015, which was slightly higher than the living wage for MA $25,600; (Glasmeier 2016). The average dairy farm payroll was $65,000 (including the value of benefits) and the statewide estimated total payroll was $10 million. If one includes jobs in the dairy processing industry, the impact may be even greater. In nearby Connecticut, each dairy farm job supported about three additional jobs in the dairy processing industry (CT DECD 2009) which suggests dairies in MA might support almost 1,800 jobs in 2015.

Local Taxes: In 2015, MA dairy farms paid an average of $15,100 in local taxes (property plus excise taxes), generating an estimated $2.33 million in local tax revenue up from $1.5 million in 2010 (Whitman 2011). Their local taxes averaged nearly three times that of MA farmers overall ($5,400) and nearly four times that of the national average ($3,800; 2012 Census of Agriculture). Even when assessed at its farmland value under the MA Taxation Law Chapter 61b Program, farmland financially supports town services (American Farmland Trust 2008). Over 27% of the municipalities in MA have dairy farms.

Sales and Marketing: MA dairy farmers averaged gross sales of milk of $463,601 per farm in 2015, an increase from $292,000 in 2010. In 2015, gross sales of milk ranged from $10,000 to $1,860,000. Their gross sales for all agricultural products averaged $630,000 per farm, with values ranging from $10,000 to $2,840,000 in 2015 (this study). Their average gross sales were two-thirds of the U.S. average for dairy farms ($711,000, 2012 Census of Agriculture). Half of MA dairy farms reported total gross sales <$323,000 in 2015. Because it takes about $300,000 in gross sales to generate $50,000 of family income (Shoemaker et al. 2008), the income of many MA dairy farmers may be <$50,000, a situation unchanged from 2010.

Local Sourcing: An average of 66% of MA dairy farm supply and service expenditures were spent in MA (this study), an increase from 58% in 2010 (Whitman 2011). This includes fuel, fertilizer, repairs, veterinary care, and supplies, hardware, milking equipment, chemicals, and seed. As some farmers anecdotally reported in the survey, sourcing from other states may be necessary to use the nearest or cheapest supplier.

Indirect Impacts: Dairy agriculture also is indirectly responsible for jobs in support services, such as feed suppliers, veterinary services, equipment suppliers, and financial services, which also multiply its economic impact. Dairy farms may generate up to $150 million in economic activity for the MA economy through the purchase of goods and services (Massachusetts Dairy Farm Revitalization Task Force 2007). In nearby Connecticut, each dollar of dairy farm milk sales generated about twelve more dollars in economic activity in the dairy processing industry (CT DECD 2009). Using this multiplier effect, MA dairy agriculture might generate as much as $500 million in economic activity through the dairy processing industry.

Table 1. The percent of MA dairy farmers and others that provided natural resource and social benefits to local communities in 2010 and 2015.

BENEFITS TO LOCAL COMMUNITIES	MA DAIRY FARMERS (%)		REFERENCE VALUES
	2010[1]	2015[2]	
Local Food			
• sold food products directly to consumers	27	44	6% of U.S. farms[3]
Recreational Access			
• provided some public recreational access	87	91	13% of U.S. forest landowners[4]
• provided access for hunting	75	71	-
• provided open access to anyone	28	45	11% of northern U.S. landowners[5]
Agricultural Conservation			
• owned farmland with conservation restrictions that prevent conversion	80	97	23% of MA farmers[6]
• used >1 practice to add to their farm's scenic appeal	90	91	-
• maintained farm buildings >60 years old that are reminders of agricultural heritage	67	68	30% of U.S. farmers[3]
• planned to transfer to next generation	67	81	-
Good Neighbor Activities			
• employed at least one farm practice to support good neighbor relations	98	82	-
• employed practices to minimize the effect of fly populations and odor	77	68	-
• volunteered in community	80	64	24% of MA residents[7]

[1]Whitman (2011)

[2]This study

[3]Maryland Department of Planning (2007) and National Park Service (2011)

[4]Butler (2008)

[5]Cordell et al. (1993)

[6]2012 Census of Agriculture

[7]Corporation for National and Community Service (2014).

Benefits to Local Communities

MA dairy farms contribute to a local food supply, manage and conserve the natural resources that they use, provide recreational access, preserve local agricultural heritage, are active in their local communities, and apply practices to minimize impacts to neighbors.

Local Food: The greatest contribution of MA dairy farms is food production, including the food production for their local community. MA dairy farms produced about 27,098,000 gallons (233 million pounds) of milk in 2014 (USDA National Agricultural Statistics Service 2014). They produced an equivalent to 23% of the milk consumed in MA in 2015[2], which might be a modest increase over 18% in 2007 (Whitman 2011), 12.9% in 2004 (Timmonds et al. 2008), and 14% in 1997 (Holm et al. 2000). This makes MA more self-reliant for dairy products than for any other major food commodity.

Moreover, a greater percentage of MA dairy farmers sold food products directly to consumers than did U.S. farmers, selling meat, dairy products, eggs, maple syrup, vegetables, baked goods, honey, apples, and berries (Table 1). The percentage of dairy farmers who directly sold food to consumers has also nearly doubled in five years. Dairy farms are significant sources of local food in MA.

Local food is often associated with small farms (Martinez et al. 2010). Although the U.S. trend has seen an increasing number of large dairy operations (> 500 milk cows; USDA National Agriculture Statistics Service 2015), milk produced in MA continues to come from smaller dairy farms (<120 milking head). MA has 147 dairy farms (MDAR Division of Animal Health, unpublished data) with a mean milking herd size of 114 milk cows/farm (this study), which is a small increase from an average of 88 cows/farm in 2010 (Whitman 2011) and 20% less than the U.S. mean milking herd size of 144 milk cows/farm (USDA National Agriculture Statistics Service 2012).

Recreational Access: Public access to private property enhances the quality of life in New England, but is a disappearing tradition. Almost 90% of MA dairy farmers reported providing some public recreational access to their land, a level that greatly exceeds access provided by U.S. forest landowners (Table 1). Nearly a half (45%) of MA dairy farmers reported providing open access to anyone, an increase from 28% in 2010 (Whitman 2011), which compared to only 11% of northern U.S. landowners (Table 1). They reported providing access for hunting, winter trail use, summer trail use, painting, fishing, bird watching, photography, picnicking, boating, camping, biking, dog walking, snowshoeing, and motorcycling. Over 70% of dairy farmers indicated that they provided hunting access.

MA dairy farmers reported making available to recreational users an average of 200 acres per farm in 2015, similar to what was reported in 2011 (218 acres; Whitman 2011). Statewide they provided an estimated 29,000 acres of private lands available for outdoor recreation. Farmers reported an average of 576 recreational visitors per farm in 2015 (nearly double that of 2010; Whitman 2011) or 2.9 recreational visitors/acre/year (this study). This compares favorably with U.S. national parks, which average 9.8 visitors/acre/year (Walls 2009). MA dairy farmers provided many opportunities and a large acreage from their private lands for public recreation.

[2]233 million lbs of milk produced in Massachusetts (2014 NASS, USDA); estimated milk consumption = 1053.1 million lbs (6,794,422 people in Massachusetts in 2015 [U.S. Census Bureau 2016] X estimated annual U.S. per capita milk consumption of 155 lbs [2015 NASS USDA]).

Agricultural and Heritage Conservation: Ninety-seven percent of MA dairy farms reported having conservation restrictions (including easements) that prevent conversion to other non-agricultural land uses. These restrictions/easements protected an estimated 29,000 acres of farmland from development to non-agricultural uses. This helped maintain the Commonwealth's farmland and agricultural heritage and provided communities with local food production.

MA dairy farms typically stayed in a family for three generations, but sometimes up to 13 generations (Whitman 2011). Although about two-thirds of MA dairy farmers reported planning to transfer their farm to the next generation, only about half reported having a transfer plan.

By using leased lands, MA dairy farmers keep farmland in production. Nearly all (90%) MA dairy farms reported leasing land, although only 8% relied on leased land for >80% of their farmland. About 26% of acres leased by dairy farmers in 2010 were protected by a conservation restriction (Whitman 2011), leaving the remaining leased land vulnerable to liquidation to meet the financial goals of landowners.

MA dairy farmers look after farm appearance, with 91% of farmers reporting using more than one practice that adds to their farm's scenic value (Table 1). These practices included: mowing along roadsides, placing conspicuous farm signs, pasturing cows along roadsides, removing trash along roads, cropping in areas visible from the road, painting or re-siding visible buildings in the last 10 years, and landscaping their farm entrance. About 68% of dairy farmers reported maintaining farm buildings >60 years old that are visual reminders to local communities of their agricultural heritage, twice the national farm average of 30.1% (Table 1).

MA dairy farmers reported educating the public by hosting farm visits for public groups, averaging 175 visitors/farm/year or 0.7 visitors/acre/year (Whitman 2011), which is 9% of the visitation rates for some national parks (Walls 2009). Overall, MA dairy farmers helped maintain the Commonwealth's agricultural heritage by conserving farmland, preparing the transfer of their farm to the next generation, making their farm visually appealing, maintaining old farm buildings, and educating the public about agriculture.

Volunteering and Neighbor Relations: Dairy farmers reported contributing to their local community by volunteering their time and employing practices to minimize impacts to neighbors. About 64% of MA dairy farmers reported volunteering in their communities, which is far greater than the volunteer rate of 25.2% for MA residents in 2014 (Corporation for National and Community Service 2014). Dairy farmers reported volunteering an average of 90 hours/year, which is worth about $0.5 million/year. Their volunteering hours were more than three times as many hours as the average volunteer time of 25.2 hours/year for MA residents in 2009 (Corporation for National and Community Service 2014).

Nearly all MA dairy farmers reported applying at least one practice to support good neighbor relations (Table 1). Almost 70% of MA dairy farmers reported applying practices to minimize odor and the effect of fly populations on their neighbors. About 35% of farmers reported providing their contact information to neighbors and 78% indicated that they routinely talk to neighbors. Almost 91% of MA dairy farmers indicated that local communities were supportive or very supportive of local dairy farming (this study) an increase from 75% in 2010 (Whitman 2011).

Table 2. The percent of MA dairy farmers and other U.S. farmers applying environmental conservation practices in 2010 (Whitman 2011) and 2015.

ENVIRONMENTAL CONSERVATION PRACTICES	MA DAIRY FARMERS (%)		REFERENCE VALUES
	2010[1]	2015[2]	
Water Quality Protection			
• applied farming practices to minimize nutrient runoff and protect water quality	90	90	-
• used buffers along waterways which protect water quality	30	32	8% of U.S. family farmers[4]
Soil and Wildlife Conservation			
• used farming practices to minimize soil erosion	80	91	-
• tested soils frequently enough to ensure best management of nutrients and manure	80	70	-
• had a state- or NRCS-approved nutrient management plan	50	46	9% of U.S. corn farmers[5]
• managed a portion of their farm for wildlife	46	70	4% of U.S. family farmers[3, 4]

[1]Whitman (2011)

[2]this study

[3]USDA National Agricultural Statistics Service (2001)

[4]Lambert et al. (2007)

[5]Lambert et al 2006.

Environmental Conservation

MA dairy farmers frequently applied stewardship practices to protect and conserve natural resources in MA, including water, soils, wildlife habitats, and energy sources (Table 2). This helped maintain the natural resources necessary for drinking water, food production, and quality of life while minimizing the negative environmental impacts of dairy agriculture. Their conservation efforts provided an estimated $120 million of non-market values, such as open space, clean water, scenic views, wildlife habitat, food production, wood products, and real estate values for local communities (Breunig 2003).

Water Quality Protection: Clean water is essential to supply drinking water and habitat for aquatic wildlife. Over 90% of MA dairy farmers reported applying practices to minimize nutrient runoff and protect water quality in 2010 and 2015 (Table 2).

About 30% of MA dairy farmers reported using buffer strips along waterways that protect water quality in 2010 and 2015, which was nearly four times the level found among U.S. family farmers. Although buffering all water bodies ensures the protection of water quality, some farmers may not have used buffer strips because they lacked agricultural lands that bordered water bodies. A review of MA waterways

surveys between 2000 and 2009 revealed that very few impaired segments (7 of 225) had impairments that were attributed to nearby dairy farms (A. Whitman, unpubl. data, based on Water Quality Reports found in Massachusetts Department of Environmental Protection 2011). Poor stormwater management and failing septic systems were much more frequently cited sources of impairments.

Soil Conservation: Healthy soils are the basis of agriculture stewardship and essential for productive farms. About 80% of MA dairy farmers indicated that they applied soil conservation practices to minimize soil erosion and avoid the overuse of nutrients (fertilizers and manure) that can pollute water in 2010 and 2015 (Table 2). About 50% of MA dairy farmers indicated that they had a state- or NRCS-approved nutrient management plan in 2010 and 2015, which was nine times more frequent than U.S. corn farmers. Farmers employ these nutrient management plans to efficiently use manure and fertilizers so that they produce reliable quantities of feed, improve farm soils, minimize the cost of wasted nutrients, and avoid nutrient runoff into lakes and rivers (Bruulsema and Ketterings 2008).

Wildlife Conservation: Wildlife is a key part of every ecosystem and provides viewing enjoyment and opportunities for hunting and fishing. About 46% of MA dairy farmers managed some portion of their farm for wildlife in 2010 and nearly 70% did so in 2015, which was much greater than a statistic of 4% of U.S. family farmers who enhanced their land for wildlife (Lambert et al. 2007). On average, MA dairy farmers reported managing 21% of their lands primarily for wildlife in 2010 (Whitman 2011) and about 35% of their land in 2015 (this study). This amounted to an estimated 17,700 acres of private lands managed for wildlife in 2015[3], an increase from 11,500 acres in 2010 (Whitman 2010).

[3]34.4% of land on MA dairy farms is managed to benefit wildlife (this study) and MA dairy farms occupy 50,000 acres (USDA Ag Census 2012).

Table 3. MA Dairy farmers' participation levels in 21 voluntary assistance programs and percent of MA dairy farmers who indicated that different voluntary farm assistance programs were important to the economic viability of their farm.

VOLUNTARY ASSISTANCE PROGRAMS	PARTICIPATION LEVELS (% OF FARMERS)	PERCENT OF FARMERS WHO INDICATED THAT A PROGRAM INCREASED THE FARM ECONOMIC VIABILITY (% OF PARTICIPATING FARMERS)
State and Local Programs		
• MA Dairy Farmer Tax Credit Program	97	88
• MA Taxation Law Chapter 61, 61a, 61b, or 61c	97	79
• MA Farm Energy Program (MFEP)	53	78
• Agricultural Preservation Restriction (APR)	41	64
• Farm Viability Enhancement Program (FVEP)	29	60
• Agricultural Environmental Enhancement Program (AEEP)	27	89
• Agricultural Preservation Restriction Improvement Program (AIP)	18	50
• Lease/rent state land	15	80
• Agricultural Energy Grant Program (AEGP)	15	60
• Conservation restriction/easement on my farm	9	33
• Agriculture Business Training Program (ABTP)	3	0
• MA Renewable Energy Trust (MRET)	3	0
• Matching Enterprise Grants for Agriculture (MEGA)	3	0
Federal Programs		
• NRCS Environmental Quality Incentives Program (EQIP)	38	85
• USDA/Rural Energy for America Program (REAP)	24	38
• NRCS Grassland Reserve Program (GRP)	12	75
• NRCS Farm & Ranchland Protection Program (FRPP)	6	50
• NRCS Agricultural Management Assistance (AMA)	6	0
• NRCS Wildlife Habitat Incentive Program (WHIP)	6	0
• NRCS Conservation Security Program (CSP)	3	0
• NRCS Wetlands Reserve Program (WRP)	3	0

Importance of State and Federal Programs

Most MA dairy farmers participate in state and federal programs that help them improve their farm business, conserve farmland, and reduce impacts.

Did the MA Dairy Tax Credit Law reduce declines in numbers of MA dairy farms?

Three analyses were undertaken to assess whether the 2008 MA Dairy Tax Credit Law reduced declines in numbers of MA dairy farms using (1) feedback from MA dairy farmers on surveys, (2) comparison of average trends in licensed dairy farms in MA and nearby states between 2003-2008 and 2009-2015, and (3) a statistical analysis of these trends.

MA Dairy Farmer Feedback: The MA Dairy Tax Credit Program was the assistance program most frequently selected by MA dairy farmers as being important to the economic viability of their farm, as well as vital to the sustainability of dairy agriculture in MA (Table 3). This program provides farmers with a tax credit in years when farm milk prices are less than operating costs, which protects farmers from cyclical downturns (Holstead 2009). Its enabling legislation, the 2008 Dairy Preservation Act, requires that the MA agriculture commissioner sets the milk price at which the tax credit becomes available and the amount of the tax credit (in relation to the volume of farm milk production). This program can allocate up to $4 million in tax credits each year to MA dairy farmers. Tax credit distribution is triggered in months when low milk prices threaten to undermine the economic viability of MA dairy farms.

Nearly all responding farmers (97.1%) indicated that their MA Dairy Farmer Tax Credit payment for tax years 2010-2015 was important for maintaining the economic viability of their farm (Table 3). Over 51% of MA dairy farmers used their tax credit to pay for operating costs. Of these farmers, many also used a portion of the payments to pay debts (42%) and to pay for capital improvements (28%). All MA dairy farmers used the program to pay operating expenses and reduce debt when milk prices were at nearly record lows.

Feedback from dairy farmers shows that the program has financially helped dairy farmers when wholesale markets did not pay the costs of milk production. About 83% of farmers indicated that it was unlikely or extremely unlikely that they would be in business if the MA Dairy Farmer Tax Credit Program was discontinued (this study).

MA Dairy Farm Trends: Declines in dairy farm numbers in MA have nearly halved since the passage of the MA Dairy Tax Credit law in 2008. The average percent annual decline in licensed dairy farm numbers was -5.3% (SD = 3.9%) from 2003-2008 and was reduced to -2.5% (SD = 2.6%) from 2009-2015 (Table 4). However, it was not clear whether this can be statistically attributed to the enactment of the MA Dairy Tax Credit in 2008 (see below).

Statistical Analysis of MA Dairy Farm Trends Declines: To assess the impact of the 2008 MA Dairy Tax Credit Law on MA dairy farm loss, the annual percent declines in licensed dairy farms for each state were compared to determine whether 2008 MA Dairy Tax Credit Law affected dairy farm trends in MA differently from other states. State annual percent declines were compared from before and after the passage of the 2008 MA Dairy Tax Credit Law. Analysis of Variance (ANOVA) was used to statistically compare the effect of the time period (pre-law - 2003-2008, post-law - 2009-2015), state (CT, MA, ME, NH,

and VT), and average annual milk price for each state (2015 USDA NASS). An interactive term (state X time period) was used to determine whether states had different trends in each period. If the MA Dairy Tax Credit in 2008 was effective, percent declines in dairy farm numbers would be predicted to statistically be less after 2008 in MA, but not in nearby states. A Type III ANOVA was applied using SYSTAT (2016) and residuals were normal (K-S Test, Test statistic=0.083, P=0.352).

Table 4. Average percent annual decline in number of licensed dairy farm in two time periods for five New England states (based on USDA NASS 2016).

STATE	AVERAGE PERCENT ANNUAL DECLINE IN NUMBER OF LICENSED DAIRY FARMS IN TWO TIME PERIODS	
	2003-2008	2009-2015
CT	-5.35	-2.06
MA	-5.28	-2.83
ME	-3.77	-3.45
NH	-4.26	-3.36
VT	-4.81	-3.45
Mean	-4.80	-3.03

Overall, the ANOVA was statistically insignificant (P>0.20). The percent annual decline in licensed dairy farm numbers in each state was so variable that it was not statistically different among states (F=0.406, df=4, P=0.803), among time periods (F=0.912, df=1, P=0.344), or among time periods for each state ((F=0.171, df=4, P=0.952; Table 4). Annual milk price for each state was not a significant covariate (F=0.886, df=1, P=0.351) suggesting perhaps that the current year's milk price had little bearing on whether farm exited dairy farming.

It is noteworthy that two New England states with strong policies for supporting dairy farms, MA and CT, suffered less decline in licensed dairy farm numbers from 2009-2014 when the average value of production less operating costs for the Northern Crescent region (including New England) was 70% less than 2003-2008 (based on USDA NASS 2014). Support programs in nearby CT (Foltz 2004) and ME (Bouchard 2016, Drake 2011) have been found to help retain dairy farms in those states. The trend data suggest that MA's and CT's programs may have reduced dairy farm loses more than ME's Dairy Relief Program.

Farm support program payments are likely important income sources to farm families and provide income stability that supports farm households and persuades the next generation of farmers to stay on the farm (Mishra et al. 2014). Other factors such as producers age (e.g., older farmers more likely to exit), off-farm income (e.g., higher off-farm income more likely to exit), returns over variable cost (e.g., less profitable farms are more likely to exit), and diversification of farm income (e.g., diversified farms more likely to exit) (Bragg and Dalton 2004), as well as development pressure, also may influence a farmer's decision to exit dairy farming (Foltz 2004). Hence, other state and federal programs may also play a vital role in sustaining dairy farming in MA.

Other State and Federal Programs

About 90% of MA dairy farmers were enrolled in one or more of 21 state or federal assistance programs for conserving their farmland. Among the 21 programs, enrollment levels and their economic importance to MA dairy farmers varied from high to low.

Two assistance programs had >50% enrollment and were also selected by many MA dairy farmers as being important to the economic viability of their farms: the MA Taxation Law Chapter 61, 61a, 61b, or 61c and the MA Farm Energy Program (MFEP) (Table 3). The MA Taxation Law Chapter 61 reduces farmland property taxes to rates corresponding to current use (as opposed to highest real estate value). It reduces property taxes and the pressure from development and spiraling land prices on farmland (American Farmland Trust 2008). Even though this program reduces taxes, the property taxes of dairy farmers may still exceed the cost of their use of local government services (American Farmland Trust 2008). The second highly rated program was the MA Farm Energy Program (MFEP) which helps farmers install energy efficient practices and equipment and reduce their costs.

Five other programs had modest dairy farmer participation but were rated by about 50% or more of participants as increasing their farm viability: Farm Viability Enhancement Program (FVEP), Agricultural Environmental Enhancement Program (AEEP), Agricultural Preservation Restriction Improvement Program (AIP), Lease/rent state land, and Agricultural Energy Grant Program (AEGP) (Table 3). Both the MA APR and MA AEEP had high participation rates and were highly rated as contributing to farm economic viability in 2010 (Whitman 2011). In the MA APR Program, the Commonwealth buys a deed restriction from the landowner to preclude activities that reduce agricultural viability. This program reduces property taxes and the pressure from development and spiraling land prices on farmland (American Farmland Trust 2008). The MA AEEP pays for materials for farming practices that keep surface water clean, promote energy efficiency, conserve water, and reduce greenhouse gas emissions. It helps dairy farmers comply with clean water laws and avoid costly litigation (American Farmland Trust 2008).

More than 25% of participating MA dairy farms identified one or more of three energy conservation programs (MFEP, REAP, and/or AEGP) as being important to the economic viability of their farms, with MFEP being cited most frequently as important (Table 3). These programs provide technical and financial assistance to help farmers implement renewable energy systems and/or energy conservation measures.

Almost two-thirds of MA dairy farmers participating in the MA Farm Viability Enhancement Program identified this program as being important to the economic viability of their farms (Table 3). This program helps participating farmers develop and implement a farm viability plan in exchange for a term easement that protects farmland from conversion. It leverages bank and farmer financing.

The NRCS Environmental Quality Incentives Program (EQIP) was the one federal program also identified by MA dairy farmers as being important to the economic viability of their farms.

Dairy Farmer Satisfaction with the MDPB

Dairy farmers were surveyed about their satisfaction with the MDPB with regards to communication with dairy farmers and promotion of dairy products. About 67% of MA dairy farmers surveyed were either satisfied or very satisfied with the level of communication from the MDPB to dairy farmers and 67% of dairy farmers were satisfied or very satisfied with the efforts of MDPB to promote MA dairy products to consumers (this study). The balance (33%) were either indifferent or dissatisfied with the MDPB (this study).

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Acknowledgements

I thank the 43 Massachusetts dairy farmers who took the time to respond to the survey and made it possible to describe the impact of dairy agriculture in Massachusetts. The Massachusetts Dairy Promotion Board made suggestions that improved the 2015 Dairy Farmer Survey and this report. MDAR Division of Agricultural Markets and the Division of Agricultural Conservation & Technical Resources, Danielle Sarmir (Manomet), also provided helpful input and feedback. This project was funded by the Massachusetts Dairy Promotion Board.

Recommended citation: *Whitman, A. 2017. The 2015 Massachusetts Dairy Promotion Board Dairy Farm Impact Survey Results. Manomet, Inc., Sustainable Economies Program, Manomet, MA. Report SEP-2017-3.*

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