



## Pennsylvania Dairy Farms and Marcellus Shale, 2007–2010

**T**here has been much speculation about the implications of Marcellus shale development for Pennsylvania farms and farmers. Many farmers across the Marcellus shale region have received dollars from leasing their land, and they stand to receive royalty dollars as wells are drilled and begin producing on their land. Common anecdotes portray this new income as helping farmers pay off debt, invest in new equipment, and remain on their land. Other anecdotes suggest that some farmers are taking their lease and royalty dollars and either leaving farming completely or making major changes in their farm operation.

Much of Pennsylvania's agricultural activity is in the ridge and valley portion of the Commonwealth, rather than in the Marcellus shale region, which in contrast is located on the Allegheny Plateau. Only two of Pennsylvania's top ten agricultural counties as measured by sales, Schuylkill and Bradford (ninth and tenth, respectively), have Marcellus beneath them, and of these two, only Bradford has experienced gas development so far. The other counties with much Marcellus shale development activity generally rank much lower in agricultural production; Greene ranks 58th, Lycoming ranks 31st, Susquehanna ranks 33rd, Tioga ranks 30th, and Washington ranks 44th out of the 67 counties (all data from 2007 U.S. Census of Agriculture). The six

counties with the most Marcellus shale wells (Bradford, Greene, Lycoming, Susquehanna, Tioga, and Washington) together only account for a total of 5 percent of all agricultural production in Pennsylvania, while the 34 counties that have not had Marcellus wells account for 79 percent of agricultural activity in the Commonwealth.

Agriculture does play important local economic, environmental, social, and other roles, regardless of how a county ranks statewide in agricultural production, so it is important to understand the implications of Marcellus shale development on farming. Those implications currently are unclear and likely will remain so until Pennsylvania has longer experience with gas shale development and standard data series about farming catch up with its development. Anecdotes about its impacts range from positive to negative, but overall information so far has mostly been lacking. The U.S. Census of Agriculture, one of the most common sources of information about farming, is only conducted every five years and is not due to be repeated until the 2012 production year, with the data being released much later. Until then, available information on farming in Pennsylvania only provides limited perspectives on how farming is changing as Marcellus shale development occurs. The National Agricultural

Statistics Service (NASS) does collect and release annual data from Pennsylvania dairy farms, which can be used for analysis on Marcellus shale and farms. This fact sheet uses that data series to examine trends in dairy production and cow numbers in relation to drilling activity.

Dairy farming is an important part of Pennsylvania's agricultural economy, accounting for about 33 percent of the total farm receipts and with 8,407 farms in 2007 (U.S. Census of Agriculture). It also has important connections with other segments of the agricultural sector, including crop farms and beef farms, and provides support for local agricultural input supply firms on which other farms rely. The health of the dairy industry thus has very important implications for agriculture within Pennsylvania. The past few years have been very rough for the dairy industry, entirely separate from any issues associated with natural gas development. Milk prices dropped substantially between 2007 and 2009, significantly reducing income to dairy farmers. At the same time, feed costs were high due to increasing demand for corn.

### Method of Analysis

Changes in milk production and cow numbers in each Pennsylvania county between 2007 and 2010 were calculated using data from NASS. Cow numbers are based on the number of animals on the farm as of January 1 each year, so we used the data from January 1, 2011, to represent numbers in calendar year 2010.

We stratified these changes by the level of Marcellus shale drilling activity in each county using Pennsylvania Department of Environmental Protection data about the number of wells drilled in each county between 2007 and the end of 2010. Numbers for eleven counties are combined together in the NASS data due to the relatively small size of their dairy industry, so we were unable to calculate cow or production changes in these counties, which included Allegheny, Cameron, Carbon, Delaware, Elk, Forest, Greene, Monroe, Philadelphia, Pike, and Venango. Of these, only Greene

and Elk Counties experienced much Marcellus gas development through the end of 2010, with 189 wells in Greene County and 21 wells in Elk County (Allegheny had only 4 wells, Cameron had 5 wells, and Forest had 7 wells in this time period).

### Drilling

Marcellus shale drilling in Pennsylvania began in earnest in 2007 and has rapidly increased since then. According to the Pennsylvania Department of Environmental Protection, 60 Marcellus wells were drilled statewide in 2007, which increased to 1,454 wells drilled statewide in 2010. Marcellus wells were drilled in 33 different Pennsylvania counties during that time period, including six counties with 150 or more Marcellus wells, 13 counties with between ten and 149 Marcellus wells, and another 14 counties with between one and nine wells (see the appendix for counts per county). This large variation in drilling activity among counties provides the opportunity to compare what has been occurring within those counties.

### Number of Dairy Cows

NASS data indicate that milk cow numbers decreased slightly in the state between 2007 and the end of 2010, falling about 1.7 percent statewide. There were major differences among counties, however. Cow numbers were up in 18 counties, including a 25 percent increase in Schuylkill County and 20 percent in Northumberland County, while 35 counties saw a decline in cow numbers, including a 46 percent drop in Wyoming County and 33 percent in Montgomery County.

Changes in cow numbers seem to be associated with the size of the dairy sector in each county. Those counties with relatively small numbers of cows tended to experience a relatively larger percentage loss than did counties with more cows. Counties with fewer than 5,000 cows in 2007, for example, on average experienced a 10.7 percent loss in cow numbers between 2007 and 2010, while counties with 10,000 or more cows on average only experienced a 1.5 percent loss in cow numbers (Table 1).

Changes in dairy cow numbers also seem to be associated with the level of Marcellus shale drilling activity. Counties with 150 or more Marcellus shale wells on average experienced an 18.7 percent decrease in dairy cows, compared to only a 1.2 percent average decrease in counties with no Marcellus wells (Table 2). In contrast, the average county experienced a 6.4 percent decline in cow numbers (this average differs from the statewide change because the number of cows varies significantly across counties).

When both the number of cows in the county and drilling activity are considered, the association between drilling and declining cow numbers becomes more apparent (Table 3). Higher drilling activity in all counties was associated with larger average declines in cow numbers. For example, counties with fewer than 5,000 cows in 2007 and no Marcellus wells averaged a loss of 2.2 percent, compared to an average 19 percent decline in such counties with 150 or more wells. Counties with 10,000 or more cows in 2007 and no Marcellus wells experienced an average 2.7 percent increase in cow numbers between 2007 and 2010, compared to an average loss of 16.3 percent in such counties with 150 or more Marcellus wells.

**Table 1. Change in Number of Cows in Counties, 2007–2010.**

| <i>Number of cows in the county</i>  | <i>Percent change (number of counties)</i> |
|--------------------------------------|--------------------------------------------|
| Less than 5,000 cows                 | -10.7% (24)                                |
| 5,000–9,999 cows                     | -4.8% (15)                                 |
| 10,000 cows or more                  | -1.5% (17)                                 |
| State average change at county level | -6.4% (56*)                                |

\*Does not add to 67 counties due to missing data for some counties.

**Table 2. Change in Number of Cows by Marcellus Drilling Activity, 2007–2010.**

| <i>Drilling activity within the county</i> | <i>Percent change (number of counties)</i> |
|--------------------------------------------|--------------------------------------------|
| No Marcellus wells                         | -1.2% (28)                                 |
| 1–9 Marcellus wells                        | -8.9% (11)                                 |
| 10–149 Marcellus wells                     | -11.3% (12)                                |
| 150 or more Marcellus wells                | -18.7% (5)                                 |
| State average change at county level       | -6.4% (56*)                                |

\*Does not add to 67 counties due to missing data for some counties.

**Table 3. Change in Number of Cows by Number of Cows and Marcellus Drilling Activity, 2007–2010.**

|                                      | Number of cows in the county |                  |                        |                                  |
|--------------------------------------|------------------------------|------------------|------------------------|----------------------------------|
| Drilling activity within the county  | Less than<br>5,000 cows      | 5,000–9,999 cows | 10,000 cows<br>or more | State average<br>at county level |
| Percent change (number of counties)  |                              |                  |                        |                                  |
| No Marcellus wells                   | -2.2% (8)                    | -3.6% (11)       | 2.7% (9)               | -1.2% (28)                       |
| 1–9 Marcellus wells                  | -13.1% (7)                   | -20.3% (1)       | 4.8% (3)               | -8.9% (11)                       |
| 10–149 Marcellus wells               | -16.2% (8)                   | 2.8% (3)         | -13.8% (1)             | -11.3% (12)                      |
| 150 or more Marcellus wells          | -19.0% (1)                   | -25.4% (1)       | -16.3% (3)             | -18.7% (5)                       |
| State average change at county level | -10.7% (24)                  | -4.8% (16)       | -1.5% (16)             | -6.4% (56*)                      |

\*Does not add to 67 counties due to missing data for some counties.

## Milk Production

Milk production and number of cows are related, but they do not correspond perfectly because management and feed can significantly affect productivity per cow. NASS data indicate that milk production in Pennsylvania increased very slightly from 2007 to 2010, rising by just 0.6 percent. As with cow numbers, there were major differences among counties. Milk production was up in 21 Pennsylvania counties, including a 30 percent increase in Schuylkill County and 21 percent in Bedford County. Production dropped in 35 counties, including a 38 percent drop in Wyoming County, 37 percent in McKean County, 35 percent in Montgomery County, and 28 percent in Washington County.

As with changes in the number of dairy cows, changes in milk production seem to be associated with the size of the dairy sector in the county and the level of Marcellus shale drilling activity. Counties with 250,000,000 pounds or more of milk production in 2007 on average experienced an increase of 3 percent in milk production between 2007 and 2010, compared to an average loss of 6 percent in counties with less than 100,000,000 pounds of milk production (Table 4). Counties with 150 or more Marcellus wells on average experienced a 18.5 percent decrease in total milk production, compared to an average increase of 0.9 percent in counties with no Marcellus shale wells (Table 5).

When both milk production and Marcellus wells are considered, as with the number of cows, declines

in milk production tended to be higher in counties with Marcellus activity (Table 6). Counties with 250,000,000 pounds or more of milk production and no Marcellus wells, for example, averaged a 4.2 percent increase in milk production between 2007 and 2010, while

**Table 4. Change in Milk Production in Counties, 2007–2010.**

| <i>Milk production (thousands of pounds)</i> | <i>Percent change (number of counties)</i> |
|----------------------------------------------|--------------------------------------------|
| Less than 100,000                            | -6.0% (26)                                 |
| 100,000–249,999                              | -5.9% (19)                                 |
| 250,000 or more                              | 3.0% (11)                                  |
| State average change at county level         | -4.2% (56*)                                |

\*Does not add to 67 counties due to missing data for some counties.

**Table 5. Change in Milk Production by Marcellus Drilling Activity, 2007–2010.**

| <i>Drilling activity within the county</i> | <i>Percent change (number of counties)</i> |
|--------------------------------------------|--------------------------------------------|
| No Marcellus wells                         | 0.9% (33)                                  |
| 1–9 Marcellus wells                        | -4.4% (14)                                 |
| 10–149 Marcellus wells                     | -10.0% (13)                                |
| 150 or more Marcellus wells                | -18.5% (5)                                 |
| State average change at county level       | -4.2% (56*)                                |

\*Does not add to 67 counties due to missing data for some counties.

**Table 6. Change in Milk Production by Number of Cows and Marcellus Drilling Activity, 2007–2010.**

| <i>Drilling activity within the county</i> | <i>Milk production in the county (thousands of pounds)</i> |                        |                        |                      |
|--------------------------------------------|------------------------------------------------------------|------------------------|------------------------|----------------------|
|                                            | <i>Less than 100,000</i>                                   | <i>100,000–249,999</i> | <i>250,000 or more</i> | <i>State average</i> |
| <i>Percent change (number of counties)</i> |                                                            |                        |                        |                      |
| No Marcellus wells                         | 3.7% (10)                                                  | -3.8% (11)             | 4.2% (7)               | 0.9% (28)            |
| 1–9 Marcellus wells                        | -7.5% (7)                                                  | -17.3% (1)             | 7.2% (3)               | -4.4% (11)           |
| 10–149 Marcellus wells                     | -14.2% (8)                                                 | -1.6% (4)              | —                      | -10% (12)            |
| 150 or more Marcellus wells                | -28.0% (1)                                                 | -15.5% (3)             | -18.2% (1)             | -18.5% (5)           |
| State average change at county level       | -6.0% (26)                                                 | -5.9% (19)             | 3.0% (11)              | -4.2% (56*)          |

\*Does not add to 67 counties due to missing data for some counties.

the one county at that production level with 150 or more Marcellus wells experienced an 18.2 percent decrease in the same time period.

## Implications

Wide variation occurred in the changes among counties (see the appendix), yet only two of the 19 counties with ten or more Marcellus wells (11 percent) experienced an increase in cow numbers or milk production between 2007 and 2010 (Indiana County, with 20 wells, and Potter County, with 44 wells), compared to 15 of the 33 counties with no Marcellus wells (45 percent) that increased cow numbers or milk production.

The comparatively large average declines in cow numbers and milk production in the Marcellus counties require additional, focused attention and better understanding of the dynamics of what is occurring. The NASS and Department of Environmental Protection data suggest that increases in the number of Marcellus shale wells are associated with declines in cow numbers and milk production. Unfortunately, currently available data do not allow for determining whether these declines resulted from existing farms simply downsizing the number of cows in their herds, if some dairy farms simply ended all dairy production but shifted to other agricultural activity on their land, or if they exited entirely from farming. Many of the anecdotes about dairy farmers and Marcellus suggest that some farmers are shifting away from dairy production, not just keeping fewer cows on a farm. This dynamic is not new; prior research on the Commonwealth's Purchase of Development Rights program, for

example, which provides farmers a large lump sum payment, found that some dairy farmers were using the dollars to shift away from milking cows but were keeping the field crop component of their farm operation (Maynard et al. 1998). Some of the current anecdotes suggest the same shift may be occurring today.

Of equal importance is determining whether those farmers who are leaving agriculture due to Marcellus shale development are doing so voluntarily (i.e., they're taking the money, paying off farm debt, and choosing to do something else) or whether they are being forced out of farming against their will due to environmental or other concerns, such as negative effects on their land or water, herd health, or consumer resistance to food grown near Marcellus shale wells. In addition, for those farmers remaining in agriculture, it is important to identify if and how they may be using leasing and royalty dollars to improve their farms. Anecdotes from farmers, machinery dealers, and bankers suggest that some farmers are using proceeds from Marcellus shale to strengthen their farming activity, which has the potential of benefiting farming. Whether such changes are observable or measurable is not clear from this data.

Also unknown is whether Marcellus shale development is affecting consumer perceptions of the quality of food produced in counties with much gas drilling activity and thus is changing in consumer demand. There have been some public protests against gas drilling at farms, for example, and uncertainty about whether gas drilling will affect organic or other on-farm certifications.

The analysis of cow numbers and milk production is important, even without knowing whether the number of farms may have changed or whether such changes are voluntary or forced. Declining cow numbers mean fewer dollars spent locally by farmers to maintain their herd, and lower milk production similarly means fewer dollars coming into the local economy from milk sales. A variety of local businesses typically

depend on local farming for their success, such as farm input suppliers like feed stores, large animal veterinarians, and machinery dealers, and agricultural processors, such as dairy processors and milk haulers. Farmers similarly depend on these input suppliers and processors. Agricultural economists often discuss the importance of maintaining a critical mass of agricultural activity in a community to ensure that these local businesses are viable. If the number of farms and agricultural activity fall too low, these essential supporting businesses will leave or quit, making it difficult for remaining farmers to access needed inputs and markets and thus remain in business.

The dairy data clearly suggest that there is some association between Marcellus shale activity and dairy farming that requires further study and consideration since dairy is such a large component of Pennsylvania's agricultural economy. Furthermore, this experience in dairy raises questions about the impact of Marcellus shale on other types of farming in the Commonwealth. Many of these questions may not be able to be answered until the next U.S. Census of Agriculture is released.

### Sources

Maynard, Leigh J., Timothy W. Kelsey, Stanford M. Lembeck, and John C. Becker. Early Experience with Pennsylvania's Agricultural Conservation Easement Program. *Journal of Soil and Water Conservation* 53 (1998): 106–12.

National Agricultural Statistics Service. *Census of Agriculture: Pennsylvania State and County Data*. Washington, D.C.: U.S. Department of Agriculture, 2007.

National Agricultural Statistics Service. "Pennsylvania: Number of Milk Cows, Production, and Value of Production, 2009." Revised. [www.nass.usda.gov/Statistics\\_by\\_State/Pennsylvania/Publications/Annual\\_Statistical\\_Bulletin/2010\\_2011/Milkcow\\_coes-2009.pdf](http://www.nass.usda.gov/Statistics_by_State/Pennsylvania/Publications/Annual_Statistical_Bulletin/2010_2011/Milkcow_coes-2009.pdf).

Pennsylvania Department of Environmental Protection (2007–2010). "2010 Wells Drilled By County as of 02/11/2011." [www.dep.state.pa.us/dep/deputate/minres/oil-gas/2010%20Wells%20Drilled%20by%20County.htm](http://www.dep.state.pa.us/dep/deputate/minres/oil-gas/2010%20Wells%20Drilled%20by%20County.htm).

U.S. Department of Agriculture. "Commodity Costs and Returns: U.S. Regional Cost and Return Data, 2005–2010." [www.ers.usda.gov/Data/CostsAndReturns/Test-Pick.htm#milkproduction](http://www.ers.usda.gov/Data/CostsAndReturns/Test-Pick.htm#milkproduction).

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**Appendix: Changes in Cow Numbers, Milk Production, and Number of Marcellus Wells by County, 2007–2010.**

|                | <i>Cow numbers</i> | <i>Milk production</i> | <i>Number of wells</i> |
|----------------|--------------------|------------------------|------------------------|
| Adams          | 11.1%              | 2.2%                   | 0                      |
| Allegheny*     |                    |                        | 4                      |
| Armstrong      | 6.1%               | 2.0%                   | 48                     |
| Beaver         | -10.0%             | -9.2%                  | 1                      |
| Bedford        | 13.8%              | 20.7%                  | 1                      |
| Berks          | 10.6%              | 6.5%                   | 0                      |
| Blair          | 7.9%               | 4.0%                   | 5                      |
| Bradford       | -18.8%             | -18.2%                 | 515                    |
| Bucks          | -4.5%              | -2.5%                  | 0                      |
| Butler         | -5.6%              | -9.2%                  | 64                     |
| Cambria        | -16.7%             | -9.2%                  | 3                      |
| Cameron*       |                    |                        | 5                      |
| Carbon*        |                    |                        | 0                      |
| Centre         | -13.8%             | -9.7%                  | 51                     |
| Chester        | 7.4%               | 9.3%                   | 0                      |
| Clarion        | -30.0%             | -24.1%                 | 6                      |
| Clearfield     | -26.3%             | -24.8%                 | 70                     |
| Clinton        | -3.4%              | -7.2%                  | 50                     |
| Columbia       | -14.3%             | -12.8%                 | 1                      |
| Crawford       | 0.0%               | -3.0%                  | 0                      |
| Cumberland     | -1.8%              | 1.0%                   | 0                      |
| Dauphin        | -3.3%              | -5.8%                  | 0                      |
| Delaware*      |                    |                        | 0                      |
| Elk*           |                    |                        | 21                     |
| Erie           | -31.5%             | -25.9%                 | 0                      |
| Fayette        | -18.4%             | -12.1%                 | 92                     |
| Forest*        |                    |                        | 7                      |
| Franklin       | -2.1%              | -3.4%                  | 0                      |
| Fulton         | -11.9%             | -3.5%                  | 0                      |
| Greene*        |                    |                        | 189                    |
| Huntingdon     | -6.5%              | -7.0%                  | 0                      |
| Indiana        | 11.8%              | 12.2%                  | 20                     |
| Jefferson      | -8.3%              | -0.2%                  | 9                      |
| Juniata        | 5.4%               | 7.6%                   | 0                      |
| Lackawanna     | 9.1%               | 16.7%                  | 1                      |
| Lancaster      | 9.5%               | 13.1%                  | 0                      |
| Lawrence       | 7.4%               | 18.4%                  | 0                      |
| Lebanon        | 15.0%              | 6.0%                   | 0                      |
| Lehigh         | 0.0%               | 14.8%                  | 0                      |
| Luzerne        | -21.4%             | -13.9%                 | 2                      |
| Lycoming       | -25.4%             | -22.6%                 | 150                    |
| McKean         | -38.5%             | -37.4%                 | 28                     |
| Mercer         | -8.4%              | -6.7%                  | 0                      |
| Mifflin        | -7.8%              | -4.3%                  | 0                      |
| Monroe*        |                    |                        | 0                      |
| Montgomery     | -33.3%             | -34.7%                 | 0                      |
| Montour        | 5.3%               | 12.5%                  | 0                      |
| Northampton    | -16.7%             | -6.8%                  | 0                      |
| Northumberland | 20.0%              | 20.4%                  | 0                      |
| Perry          | 13.0%              | 7.8%                   | 0                      |
| Philadelphia*  |                    |                        | 0                      |
| Pike*          |                    |                        | 0                      |
| Potter         | 8.3%               | 8.4%                   | 44                     |
| Schuylkill     | 25.0%              | 30.3%                  | 0                      |
| Snyder         | -24.7%             | -15.3%                 | 0                      |
| Somerset       | -7.2%              | -3.1%                  | 7                      |
| Sullivan       | -9.5%              | -2.5%                  | 23                     |
| Susquehanna    | -20.0%             | -14.1%                 | 186                    |
| Tioga          | -10.3%             | -9.9%                  | 388                    |
| Union          | -4.6%              | 1.4%                   | 0                      |
| Venango*       |                    |                        | 0                      |
| Warren         | -13.0%             | -11.9%                 | 0                      |
| Washington     | -18.9%             | -28.0%                 | 309                    |
| Wayne          | -20.3%             | -17.3%                 | 4                      |
| Westmoreland   | 0.0%               | -1.9%                  | 111                    |
| Wyoming        | -45.7%             | -37.8%                 | 16                     |
| York           | 7.5%               | 4.5%                   | 0                      |

\*The National Agricultural Statistics Service data do not provide dairy numbers for these counties.

Source: National Agricultural Statistics Service and the Pennsylvania Department of Environmental Protection.

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