CHAPTER 3
AGRICULTURE-RELATED ENVIRONMENTAL INDICATORS

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OVERVIEW

Finding trend data describing how agriculture impacts the environment in Missoula County was very challenging because few comprehensive reports exist for straightforward data on water pollution, water use, and agricultural chemical use in the county. Although we did not find precise figures for nitrate pollution in surface and groundwater, it has been an issue of local concern. This chapter also presents data on use of irrigation in the county. In addition, the trends suggest that the cost of fuel, fertilizer, and chemicals for farmers is growing. These items account for a greater percentage of total farm expenditures than they did in the past, which may reflect a greater reliance by the agricultural community on these inputs.

Nationwide, water pollution is probably the most damaging and widespread effect of agricultural production.[1] In order to contribute to a healthy food system, it is important that agricultural activities do not have an adverse impact on the environment through pollution or excessive water use. As the cost of farming increases in Missoula County, it is also important to come up with alternatives that help farmers cut their costs on synthetic inputs (fertilizers, chemicals and petroleum) so that farmers can improve their profits and remain viable.

GROUNDWATER AND SURFACE WATER POLLUTION FROM NITRATES

While nitrates occur naturally and are essential to all forms of life, excess nitrates resulting from human activities such as fertilizer use, and animal and human waste can cause soil and water pollution. Scientists generally agree that because gradual increases in nitrate pollution may result from nitrates that were released in the past, current trends in nitrate pollution may reflect historical activity. This suggests that even if current nitrate pollution activities were to stop, it may take decades for the ecosystem to recover.[2]

According to John Harvala, the Environmental Health Specialist with the Missoula Valley Water Quality District, there are about 150 public drinking water wells in Missoula County that provide for more than twenty five people for more than eight hours a day.[3] These wells are tested on an annual basis in Missoula County and the analyses have not detected any significantly high nitrate levels on the whole (i.e., none have exceeded the EPA standard of 10 parts per million). While there is some pollution caused by nitrates that are primarily the result of residential septic systems, Harvala believes most well water nitrate detections have little connection to the agriculture system in Missoula County. This statement was also supported by Dr. Vicki Watson, a professor who specializes in water quality issues at the University of Montana.

Nevertheless, the majority of irrigation for agriculture in Missoula is surface water irrigation from ditches that drain directly or indirectly from and into the Clark Fork River, where nitrate levels and their associated algal blooms have been documented in the past. Between 1988 and 1991, an intensive monitoring program was conducted by the Clark Fork Voluntary Nutrient Reduction Program to identify the major point and non-point sources of nitrogen along the Clark Fork. The program determined that about three-fourths of the soluble nitrogen loading in the study came from tributaries, while the remaining quarter came from wastewater. In addition, research conducted by the city of Missoula's facility planning found a significant link between groundwater and surface water in the Missoula area.[4] Nitrogen levels have contributed to dense mats of filamentous algae in the river above Missoula and heavy growths of diatom algae below Missoula. Decaying algae has been held responsible for the reduction of oxygen, water clarity, and visual appeal of the Clark Fork River.[5]

According to Will McDowell, the coordinator for the Clark Fork Voluntary Nutrient Reduction Program, agricultural inputs to nitrogen budgets in Missoula County have not yet been a priority for the VNRP. McDowell explained, "Animal production facilities such as dairies and feedlots are usually the focus for nutrient management (rather than fertilizer) in an area like Missoula County which has little row crop agriculture. Because there are few major feedlots and dairies in Missoula County, it has not yet been an area of focus for the Voluntary Nutrient Reduction Program."[6] The lack of attention towards agricultural inputs reveals that there are data gaps in the existing monitoring program that may be significant.

Why is this important?

Any excess nitrogen that is not used by plants may pollute soil or water and require costly treatment. When a surface water body becomes overloaded with nitrates from agriculture it can lead to excessive algal growth and can deplete the dissolved oxygen supply that is needed by native fish and other aquatic organisms.[7] In addition, nitrate pollution in surface water can impact various other water uses including recreation and agriculture. Nationwide, the largest health concern surrounding nitrate pollution of water used for drinking is "blue baby syndrome," a condition experienced by bottle fed infants, which interferes with the oxygen processing of red blood cells.

TOTAL SUPPLEMENTAL WATER USE BY AGRICULTURE

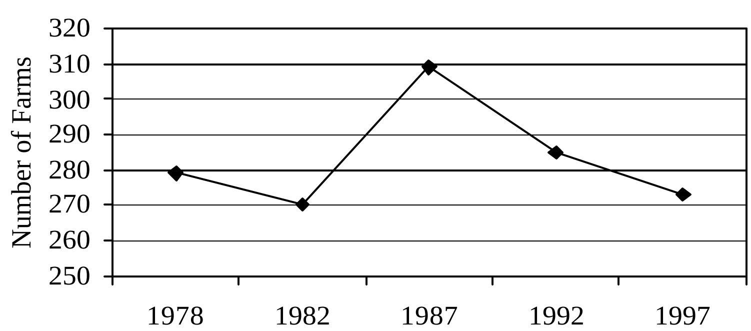
According to Mark Phares an attorney at the Department of Natural Resources, there are no subsidized water projects in Missoula County.[8] Unlike the water system that provides irrigation to large scale agriculture in California relying on extensive pipelines that carry water over a long distance, farmers in Missoula rely on water from local sources. Most of the irrigation systems in Missoula County were created in the 1800's by local government entities, according to Bill Schultz, the resource manager at the Missoula Water Resources Regional Office.[9] Today they are run by local irrigation districts that local farmers pay to maintain the irrigation ditches.

The trends.

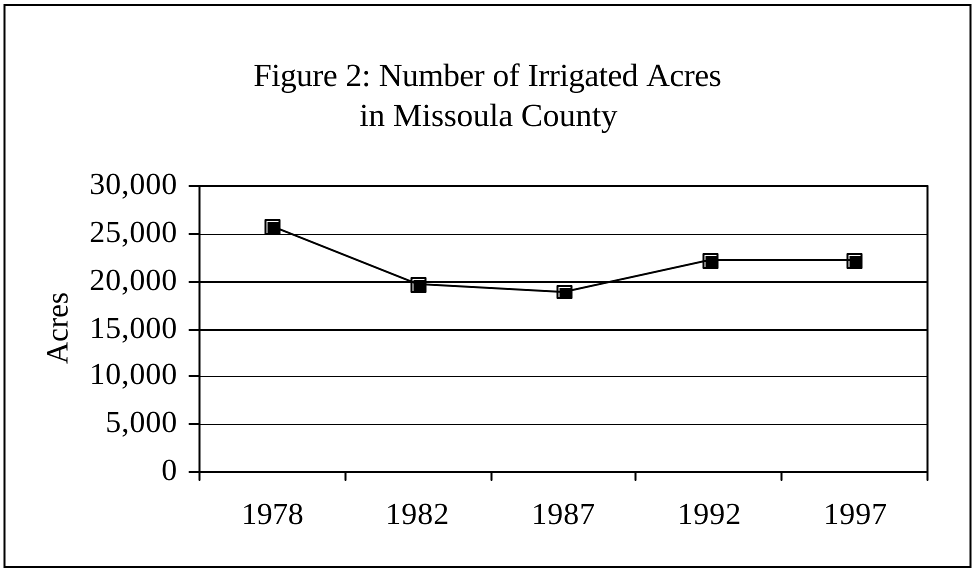
Irrigation data for Missoula County was easily found in the Agricultural Census Surveys, which are conducted every five years. "Irrigated Land" is defined in the Agricultural Census as "land watered for agricultural purposes by artificial means." The total acreage of irrigated land includes not only irrigated cropland but also any other land on a farm that was irrigated, such as pastureland.[10]

The number of irrigated farms in Missoula County has varied over the last decade (see Figure 1). Between 1982 and 1987 the number of irrigated farms grew by 14 percent, from 270 farms to 309 farms, subsequently dropping back to 1982 levels by 1997.

Figure 1: Number of Irrigated Farms in Missoula County



The number of irrigated acres in Missoula County dropped between 1978 and 1987, and then increased between 1987 and 1997 (see Figure 2). Note, however, that the Agricultural Census data are not necessarily comprehensive because they may underestimate the amount of water used by small-scale producers in the food system that the census might miss.



Why are these trends occurring?
The number of irrigated farms has fluctuated over the last 25 years, suggesting possible changes in land ownership in the county.[11] The 14 percent rise in irrigated farms between 1982 and 1987 corresponds with the rise in the number of small farms between one and nine acres and also matches an increase in the number of large farms exceeding 1,000 acres during that period. The subsequent drop in irrigated farms between 1987 and 1997 also follows the simultaneous decline of large farm ownership.

The number of irrigated farms represents just over half of the number of farms in Missoula County. In 1997, for example, 273 out of the total number of 482 farms (57%) were irrigated. More significantly, the data show that the number of irrigated acres represents only a small portion of the total acres farmed. In 1997, the total amount of acres farmed was 262,419 while only 22,291 acres (or 8.5%) were irrigated.

According to Tom Chard,[12] a statistician with the Montana Agricultural Statistics Survey in Helena, irrigation systems can be an enormous capital expense for farmers, which may deter many farmers from irrigating their crops. For example, hay production, which consumes a large portion of the agricultural land in Missoula County can grow under varying moisture conditions, Chard explained. While watering hay crops can triple the harvest, farmers may choose to avoid the expense associated with an irrigation system and produce a smaller crop. Chard also noted that once a farmer has made a capital investment in an irrigation system, he/she is likely to rely on it each year for different crops, regardless of weather conditions.

Why is this important?

Critical for irrigating agriculture, water is a finite resource especially in the arid climate of the Northern Rockies. The average rainfall in Missoula County is just 13.4 inches a year.[13] As large quantities of water are used for irrigation, water tables may decline.[14] Irrigation in the arid west has been associated with mineralization and salinization of soils and water, as well as groundwater depletion and surface and groundwater contamination.[15] Demand for water use may intensify as the population in Missoula County continues to grow, creating potential conflict between residential and agricultural users.

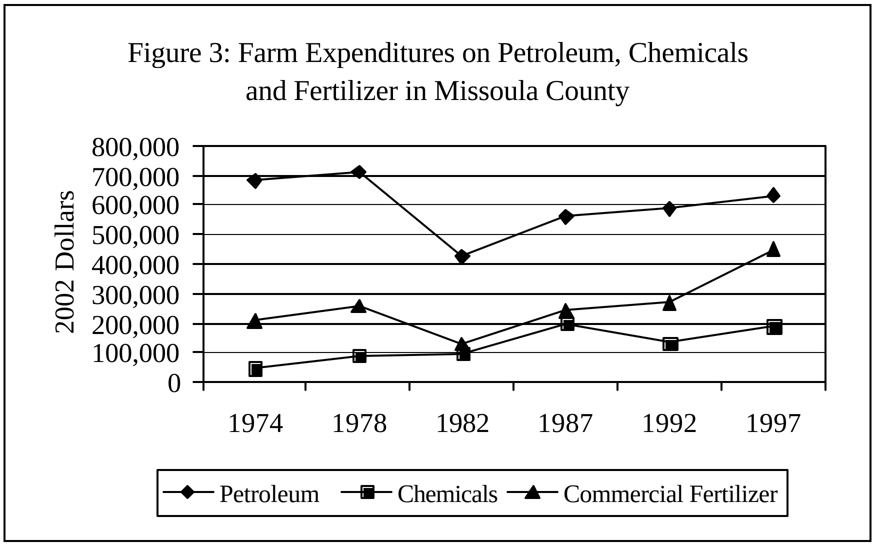
SYNTHETIC INPUT USE AND DEPENDENCE

Specific, accurate, and reliable data on the use of synthetic inputs on farms is not available for Missoula County. There are state level estimates on pesticide use, but they are not available on the county level.[16,17] Instead of looking at the total amount of *synthetic inputs applied* in the county, the portion of total farm *expenditures spent on petroleum, chemicals, and fertilizers* was analyzed to act as a rough surrogate for use of synthetic inputs. The expenditure data includes only the amount spent on items that are directly related to and used for on-farm business, excluding personal expenses, hobby farmers with sales of less than $1000, or hobby farmers with the potential to sell more than $1000.[18] Expenditure data for petroleum, chemicals and fertilizers are quite limited as a surrogate for use because changes in expenditures may also reflect changes in the prices of these products even when the dollars spent are adjusted for inflation.

According to the Census of Agriculture, changes were made to the census report in 1978 and 1982, and as a result, total farm expenditure data for those years are not available. Despite this data gap, a helpful analysis can be made from the existing expenditure trends.

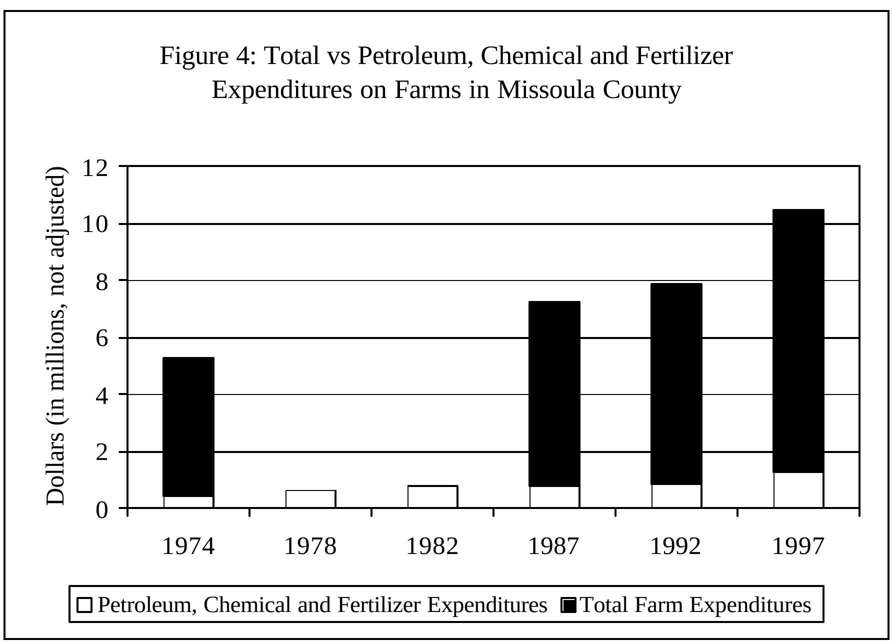
The trends.

According to the Census of Agriculture, the total amount farmers spend on production has increased over time. Figure 3 shows the amount spent on petroleum, fertilizer and chemicals adjusted into 2002 dollars.[19, 20] Notice in 1982, the trends indicate a drop in the amount spent on fertilizer and petroleum. Since then, however, the amount spent on these inputs has increased.



From 1974 to 1997, there was a 298 percent increase in the amount spent on chemicals and a 117 percent increase in amount spent on fertilizer. Over the same period of time, petroleum expenditures decreased 7.1 percent. It should be noted, however, these percentages represent the amount farmers spent on synthetic chemicals and do not take into account the changes in chemical, fertilizer, or petroleum prices over time. [21]

By comparing the amount spent on fuel, fertilizers, and chemicals with the total farm expenditures we can arrive at a percentage for the amount spent on synthetic inputs for farm production (see Figure 4). The percentage of "Total Farm Expenditures" that was spent on petroleum, fertilizers, and chemicals was 13.6 percent in 1997, while in 1974 the percent of total expenditures spent on these inputs was only 8.3 percent.[22] Thus, there has been a rise since 1974 in the proportion of farm expenditures devoted to petroleum, fertilizers and chemicals.



Why are these trends occurring?

The rise in the percentage of total farm expenditures spent on fuel, fertilizers, and chemicals may represent a greater dependence on synthetic chemicals and petroleum. The numbers may also reflect increasing prices for these inputs. For example, an increase in the amount of money farmers spent on petroleum may reflect increases in the price of fuel.

Why is this important?

One way to keep farmers on the land or in production may be to reduce their costs. Implementing more sustainable methods of farming may help to reduce the costs associated with fuel and synthetic inputs, which in turn would reduce the costs of production.

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[1] National Research Council. 1989. *Alternative Agriculture* Washington, D.C.: National Academy Press

[2] Dr. Vicki Watson, e-mail correspondence on November 19, 2003.

[3] Harvala, Jon, Environmental Specialist with the Missoula Valley Water Quality District, 523-4890, September, 2003.

[4] Tri-State Implementation Council. 1998. *Clark Fork River Voluntary Nutrient Reduction Program*. Sandpoint, ID.

[5] Tri-State Implementation Council. 1998. *Clark Fork River Voluntary Nutrient Reduction Program*. Sandpoint, ID.

[6] Will McDowell, e-mail correspondence on November 19, 2003.

[7] Tri-State Implementation Council. 1998. *Clark Fork River Voluntary Nutrient Reduction Program*. Sandpoint, ID.

[8] Mark Phares, attorney, Department of Natural Resources, Missoula office 542-4200, September, 2003

[9] Bill Schultz, Resource Manager, Missoula Water Resources Regional Office, 721-4284, September 2003.

[10] Census of Agriculture, Montana State and County Data 1978-1997, Volume 1, part 26; U.S. Department of Commerce.

[11] Census of Agriculture, Montana State and County Data 1978-1997, Volume 1, part 26; U.S. Department of Commerce

[12] Chard, Tom Agricultural Statistician with Montana Agricultural Statistics in Helena, (406) 441-1240, September-October, 2003

[13] National Weather Service, Western Region Headquarters.
http://www.wrh.noaa.gov/wrhq/PROFILE/missoula.html (Date accessed: November 20, 2003).

[14] National Research Council. 1989. *Alternative Agriculture* Washington, D.C.: National Academy Press.

[15] National Research Council. 1989. *Alternative Agriculture* Washington, D.C.: National Academy Press.

[16] USDA Economics and Statistics System. "Agricultural Chemical Usage." Ithica N.Y: Cornell University, United States Department of Agriculture, Economics and Statistics System. http://usda.mannlib.cornell.edu/reports/nassr/other/pcu-bb/ (Date accessed: 29 Sept 2003).

[17] National Pesticide Use Data Base. 2003. "State Data by Active Ingredient and Crop." Washington, DC: National Center for Food and Agricultural Policy. http://www.ncfap.org/database/default.htm (Date accessed: 29 Sept 2003).

[18] Census of Agriculture, Montana State and County Data 1974-1997, Volume 1, part 26; U.S. Department of Commerce.

[19] USDA National Agricultural Statistics Service. "Farm Production: Expenses for Missoula Montana." Oregon State University Libraries – GovStats - 1997 Census of Agriculture.
http://www.nass.usda.gov/census/census97/volume1 (Date accessed: 14 Sept 2003).

[20] Census of Agriculture, Montana State and County Data 1974-1997, Volume 1, part 26; U.S. Department of Commerce.

[21] Agricultural chemicals, fertilizer materials and crude petroleum are item names as listed in the Producer Price Index (PPI). The value given under the item name listed in the PPI was used as a multiplier to adjust the expenditure data for inflation into 2002 dollars.
[22] Census of Agriculture, Montana State and County Data 1974-1997, Volume 1, part 26; U.S. Department of Commerce.