# 2014 Year in Review

Discovery Farms Minnesota (DFM) is a farmer led water quality research and educational program. The mission of the program is to collect water quality information under real-world conditions to provide credible and practical information that supports better farm management decisions. There are currently 11 Discovery Farms located in Minnesota.

This factsheet summarizes data collected at Core Farms in water year 2014 (WY14: Oct 2013 through Sept 2014) to give a range of precipitation and runoff losses observed throughout the DFM monitoring network. Annual data is displayed in box plots which display the range of the data collected. The middle line in the box plots represents the median, a number at which half of the values are above and half of the values are below.

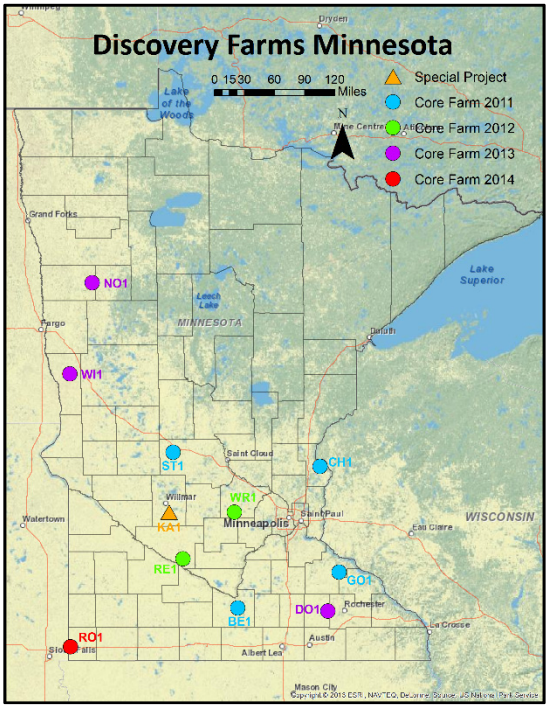


**Figure 1: DFM locations**

The data presented in this factsheet are generated from edge-of-field monitoring sites. Water quality monitoring results from edge-of-field monitoring sites are different than stream monitoring data and standards. Therefore, direct comparisons of the two types of data should not be made. The information presented is only from one year of data collection. Past DFM research has shown that runoff losses can vary greatly from year to year due to weather conditions, landscape characteristics and farm management practices. Final conclusions should not be made from this information, but rather these data should be used as a point of context for information gained in future years.

**Table 1: Description of DFM projects**

| Field ID | Farm Enterprise | Start of Project | Monitoring Setup | Soil Texture | Average Slope | 2014 Crop | Tillage | Manure History |
|---|---|---|---|---|---|---|---|---|
| KA1 | Turkey and grain (corn) | Aug-07 | Subsurface tile drainage (3 fields and bioreactor) | Loam (poorly drained) | 3.0 % | corn | Fall plow, spring field cultivator | Yes |
| GO1 | Swine farrow to wean and beef (corn-alfalfa) | Sep-10 | Surface runoff (6.3 acres) | Silt loam (well drained) | 6.7 % | corn | Spring field cultivator | Yes |
| ST1 | Dairy (corn-alfalfa) | Mar-11 | Surface runoff (28.2 acres) and subsurface tile drainage (24.2 acres) | Loam (poorly drained) | 4.1 % | alfalfa | Fall chisel, spring field cultivator | Yes |
| CH1 | Grain (corn-soybean) | Mar-11 | Surface runoff (6.1 acres) | Loam (well drained) | 3.4 % | soybean | No primary tillage | No |
| BE1 | Swine finishing and grain (corn-soybean) | Jun-11 | Surface runoff (14.3) and subsurface tile drainage (26.2 acres) | Silty clay loam (poorly drained) | 1.4 % | soybean | Fall chisel, spring field cultivator | Yes |
| WR1 | Dairy (corn-alfalfa) | Dec-11 | Surface runoff and subsurface tile drainage (23.9 acres) | Loam (poorly drained) | 4.7 % | corn | Fall chisel, spring field cultivator | Yes |
| RE1 | Grain (corn-soybean/sweet corn-peas) | Dec-11 | Subsurface tile drainage (81 acres) | Clay loam (poorly drained) | 2.0 % | corn & soybean | Fall plow or chisel, spring field cultivator | No |
| DO1 | Swine finishing and grain (corn-soybean) | Oct-12 | Surface runoff and subsurface tile drainage (13.9 acres) | Silt loam (poorly drained) | 2.9 % | soybean | Fall chisel, spring field cultivator | Yes |
| WI1 | Grain (corn-soybean) | Oct-12 | Subsurface tile drainage (160 acres) | Very fine sandy loam (poorly drained) | 1.1 % | corn | Fall chisel, spring field cultivator | No |
| NO1W | Grain (sugarbeet-corn-dry bean-soybean-wheat) | Oct-12 | Subsurface tile drainage (570.8 acres) | Fine sandy loam (poorly drained) | 1.0 % | dry bean | Fall chisel, spring field cultivator | No |
| NO1E | Grain (sugarbeet-corn-dry bean-soybean-wheat) | Oct-12 | Surface runoff (87.2 acres) and subsurface tile drainage (120.9 acres) | Silt loam (poorly drained) | 1.7 % | dry bean | Fall chisel, spring field cultivator | No |
| RO1 | Beef and grain (corn, soybean and alfalfa) | Oct-13 | Surface runoff (25.5 acres) | Silt loam (well drained) | 4.7 % | soybean | Fall disk rip, spring field cultivator | Yes |

## PRECIPITATION

Median annual precipitation for DFM sites in WY14 was 0.41 inches below normal, with a range of 2.22 inches below normal to 6.76 inches above normal. Precipitation in WY14 can be characterized by a heavy snowpack prior to spring snowmelt, a wet spring and dry summer. Most farms had near normal or above normal annual precipitation totals with significant precipitation from April to June.

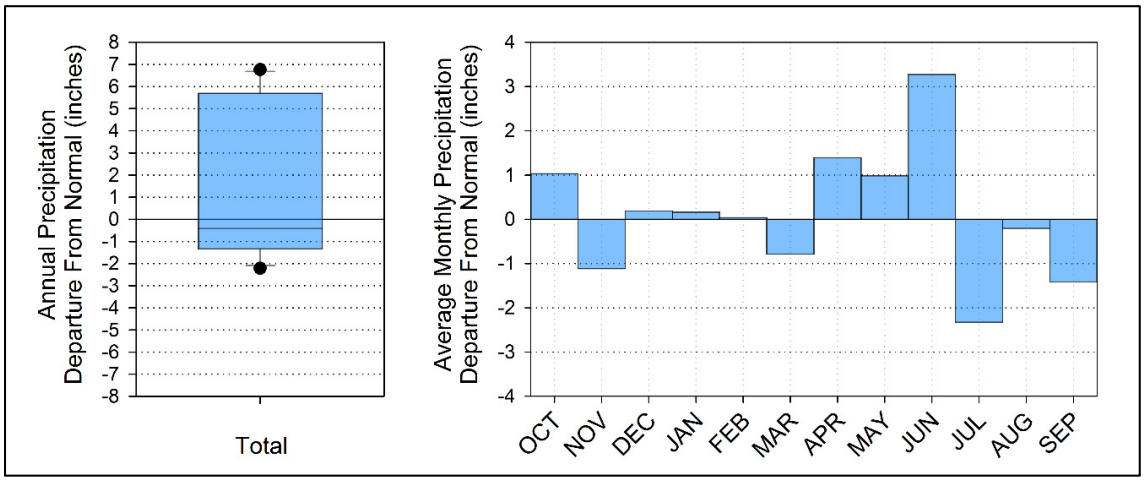


**Figure 2: Annual and average monthly precipitation departure from normal**

## RUNOFF

Median surface runoff in WY14 was 3.39 inches with a range from 0.72 to 4.61 inches. Across the DFM network, 38% of the annual surface runoff occurred during frozen soil conditions, which is lower than in past years of DFM monitoring. Even though there was a large snowpack at most sites, the gradual warm up, lack of frost and dry soils allowed much of the snowmelt to infiltrate the soil profile. Most of the surface runoff occurred from March through June. Median subsurface tile drainage was 5.77 inches with a range from 0.93 to 8.28 inches. Only 10% of the subsurface tile drainage was observed during frozen soil conditions with most of the subsurface tile drainage occurring from April to June.

On average, 9% and 15% of the annual precipitation left the monitored fields as surface runoff and subsurface tile drainage, respectively. Surface runoff was variable throughout the year with an average of 12 cumulative days of flow. Subsurface tile drainage was more constant with an average of 121 cumulative days of flow.

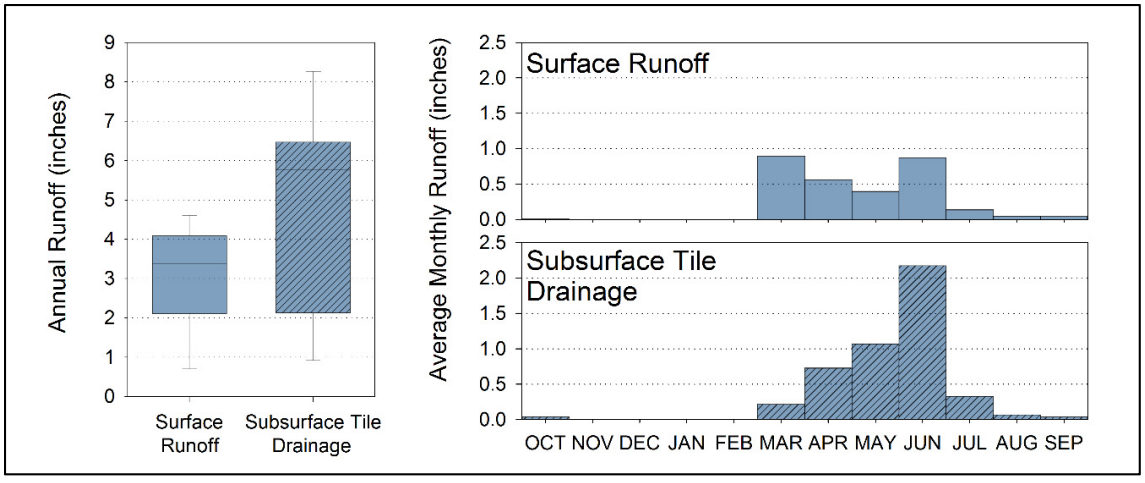


**Figure 3: Annual and average monthly surface runoff and subsurface tile drainage**

## SOIL LOSS

Soil loss is measured by total suspended solids (TSS), which are mineral and organic solids in water that can be trapped by a filter. Soil loss is driven by surface runoff during non-frozen soil periods. Soil loss was similar to past years of Discovery Farms research with the time period after planting until the crop canopy is established the most critical time for soil loss. Median TSS loss from surface runoff in WY14 was 307 lb/ac with a range from 47 to 1923 lb/ac. Almost all of the surface runoff TSS loss was observed in May and June. Median TSS loss from subsurface tile drainage was 12 lb/ac with a range from 3.1 to 145 lb/ac.

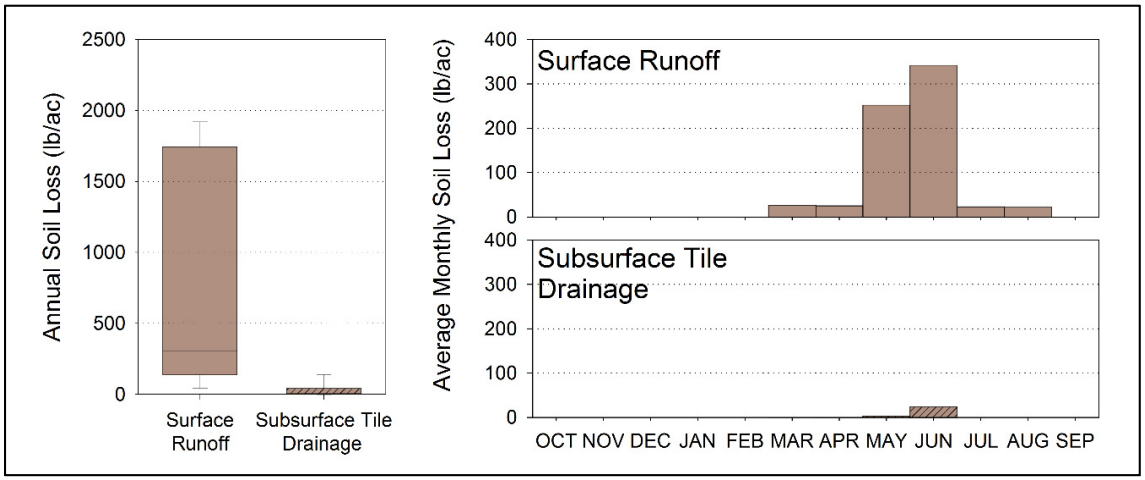


**Figure 4: Annual and average monthly soil loss**

## PHOSPHORUS LOSS

Total phosphorus (TP) refers to the combined total of particulate phosphorus, which is attached to soil particles, and dissolved phosphorus, which is not attached to soil particles. Phosphorus loss is driven by surface runoff and results from WY14 were similar to past years of DFM research. Median TP loss from surface runoff in WY14 was 0.8 lb/ac with a range from 0.4 to 3.1 lb/ac. Median TP loss from subsurface tile drainage was 0.1 lb/ac with a range from 0.0 to 0.8 lb/ac. The timing of phosphorus loss mimicked the timing of surface runoff. Frozen soils in March contributed 18% of the annual TP loss and during this month, most of the TP loss was in the dissolved form. Two-thirds of the annual TP loss occurred in May and June and during these months most of the TP loss was in the particulate form.

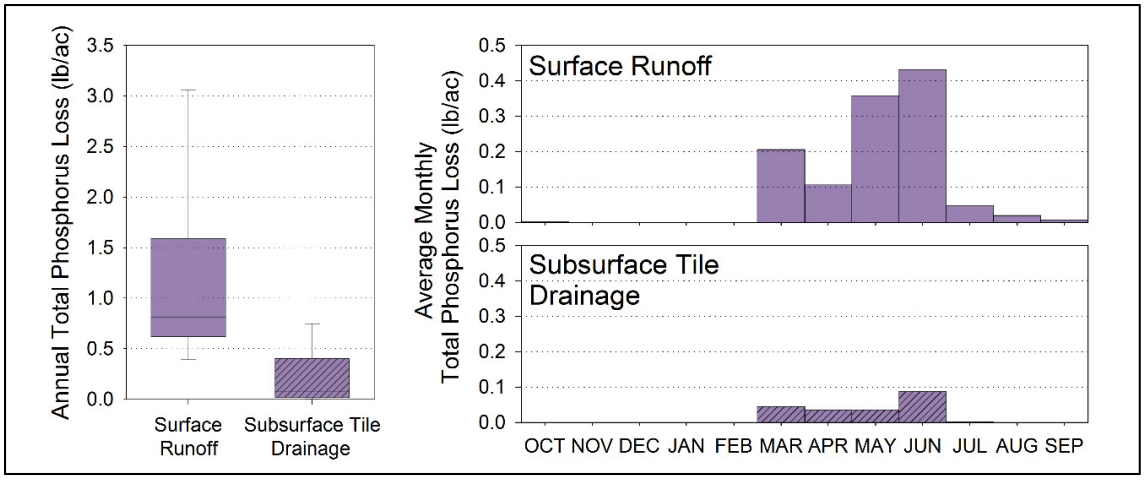


**Figure 5: Annual and average monthly total phosphorus loss**

## NITROGEN LOSS

Total nitrogen (TN) refers to the combined total of nitrate nitrogen, ammonia nitrogen and organic nitrogen. Nitrogen loss is primarily driven by subsurface tile drainage. Median TN loss from surface runoff in WY14 was 4.2 lb/ac with a range from 1.8 to 23 lb/ac. Surface runoff TN loss was mostly in the organic nitrogen form. Median TN loss from subsurface tile drainage was 24 lb/ac with a range from 2.4 to 59 lb/ac. Almost all of the subsurface tile drainage TN loss was in the nitrate nitrogen form. The timing of subsurface tile drainage paralleled the timing of TN loss, with April through June being the most active. Total nitrogen concentrations in WY14 were similar to past years of DFM research, however, TN losses from WY14 were higher than past years of DFM research because of increased amount of subsurface tile drainage.

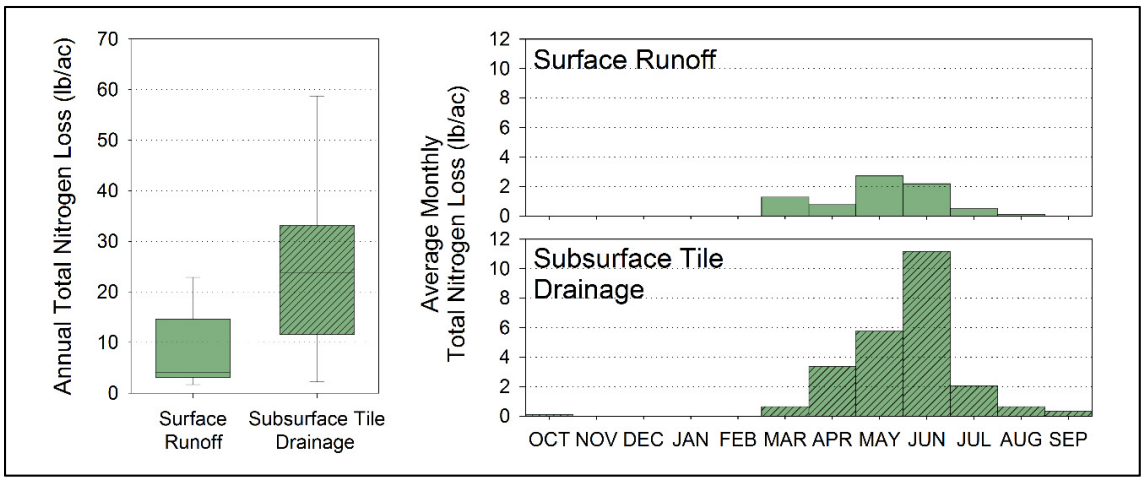


**Figure 6: Annual and average monthly total nitrogen loss**

## CONCLUSION

The data collected by the Discovery Farms program is building an understanding of actual surface runoff, subsurface tile drainage, sediment loss and nutrient loss at the edge of field on representative farms across the state. While there are opportunities to improve soil and nutrient losses throughout the DFM network, many of the locations are doing an excellent job protecting water resources. Soil and phosphorus losses, which are surface runoff concerns, and nitrogen losses, which are a subsurface tile drainage concern, are relatively low throughout the DFM monitoring network except for a few locations. The program will be working to implement management practices to reduce soil, phosphorus, and nitrogen losses at those locations. The DFM program will continue to document the good practices that protect water quality while also helping identify areas for potential improvement.

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