

DISCOVERY FARMS

Trained Local Sampler Program Bragger Farm

Program Overview 2003-2004

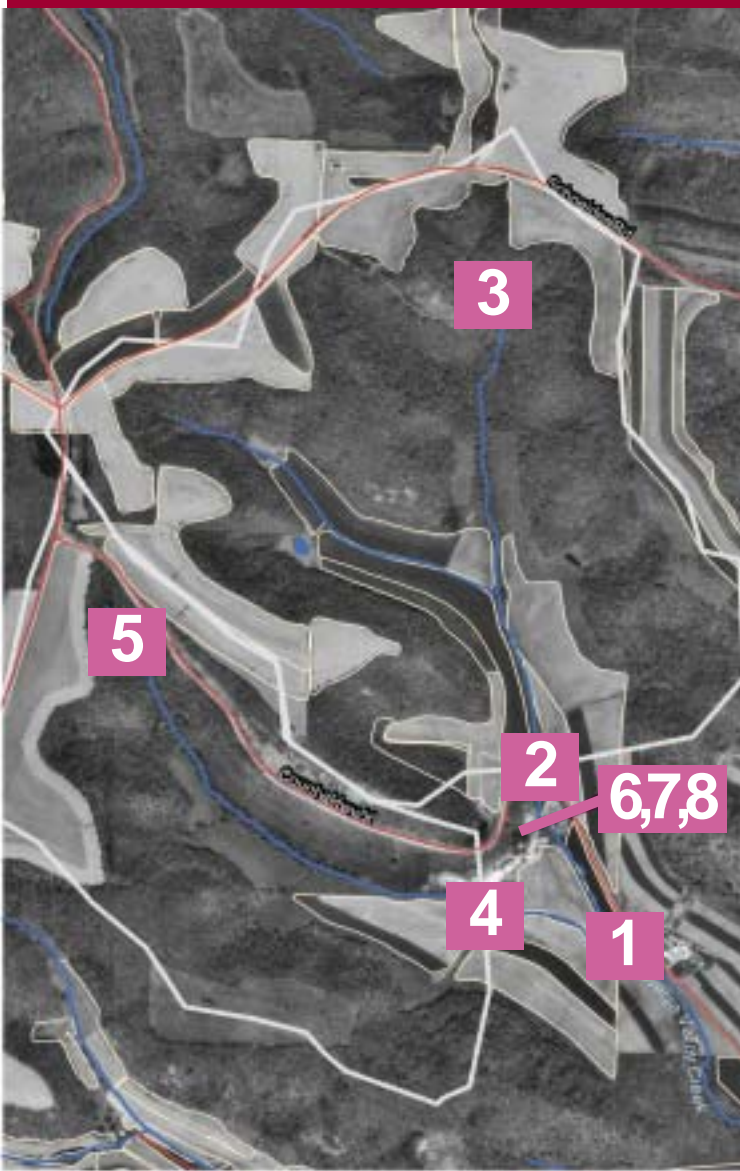
The Trained Local Sampler (TLS) program of the Discovery Farms was initiated in the fall of 2002. The TLS program's three main objectives are to:

1. Obtain high quality data to evaluate surface water quality trends on the Farms;
2. Help farmers and area citizens to learn about the role of agriculture within ecosystems;
3. Bring farmer and other community interests together by using study results for education.

At the Bragger Farm in Independence, WI, Brad Sirianni, agriculture teacher at Independence High School, and Dale Miemietz, one of Brad's Future Farmers of America (FFA) students, were selected as the Trained Local Samplers. Since January 2003, they have monitored regularly at the farm, collecting surface water samples on 13 different days from 5 stream locations and occasionally collecting samples at 3 locations within the farm's fish ponds. Seasonally, grab samples were collected from Sites 1-5 and analyzed for a variety of nutrients and total suspended solids at UW-Stevens Point's Water and Environmental Analysis Laboratory (WEAL).

Data collected on the farm are entered into an online database:<http://www1.uwex.edu/ces/erc/discovery>.

For his work on this project, Dale was awarded the State Environmental Science Proficiency Award for FFA in 2004. In addition, he received a gold rating at the national FFA for his efforts.



Bragger Farm Sampling locations
(adapted from original map created by Larry Cutforth)

Prepared by
Kris Stepenuck
October 2004

Monitoring Results 2003-4

Sites

During summer 2002, Discovery Farms staff and the Bragger Family identified 8 surface water monitoring locations on the farm. These are shown on the map on page 1. Descriptions of the sites follow:

- Site 1: Traverse Valley Creek, on Bragger Farm down from confluence of the North and South tributaries
- Site 2: Traverse Valley Creek, North tributary at flume
- Site 3: Traverse Valley Creek, North trib. at headwaters
- Site 4: Traverse Valley Creek, South tributary at flume
- Site 5: Traverse Valley Creek, South trib. at headwaters
- Site 6: Bragger Farm, outlet of hatchery pond to North tributary of Traverse Valley Creek
- Site 7: Bragger Farm, between hatchery pools
- Site 8: Bragger Farm, spring inflow to hatchery

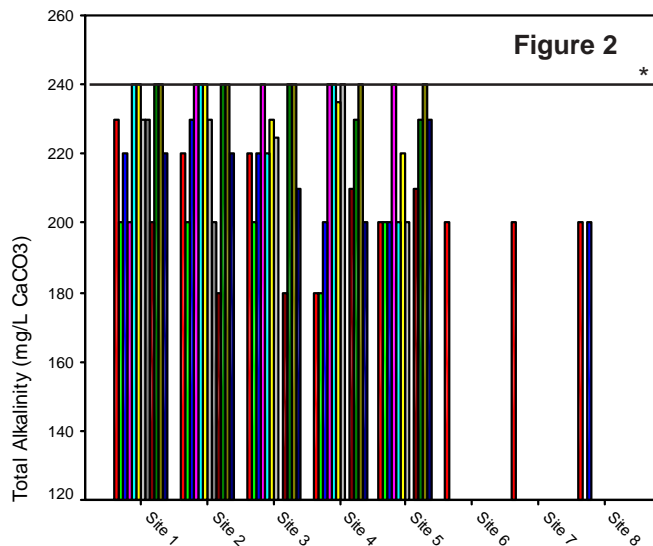
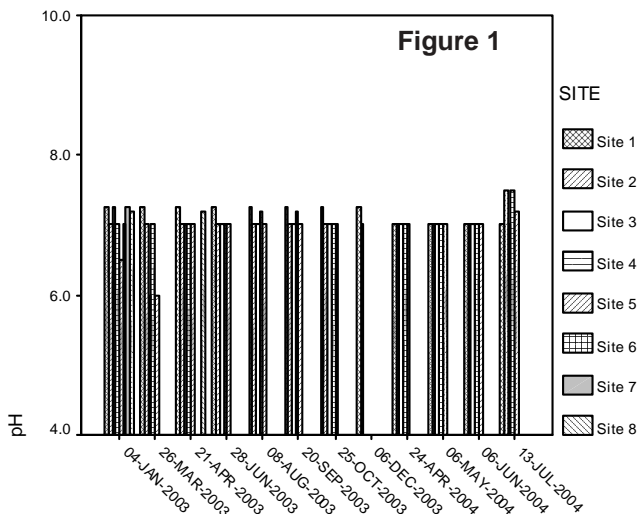


Dale collects a water sample at Site 2.

Alkalinity

pH

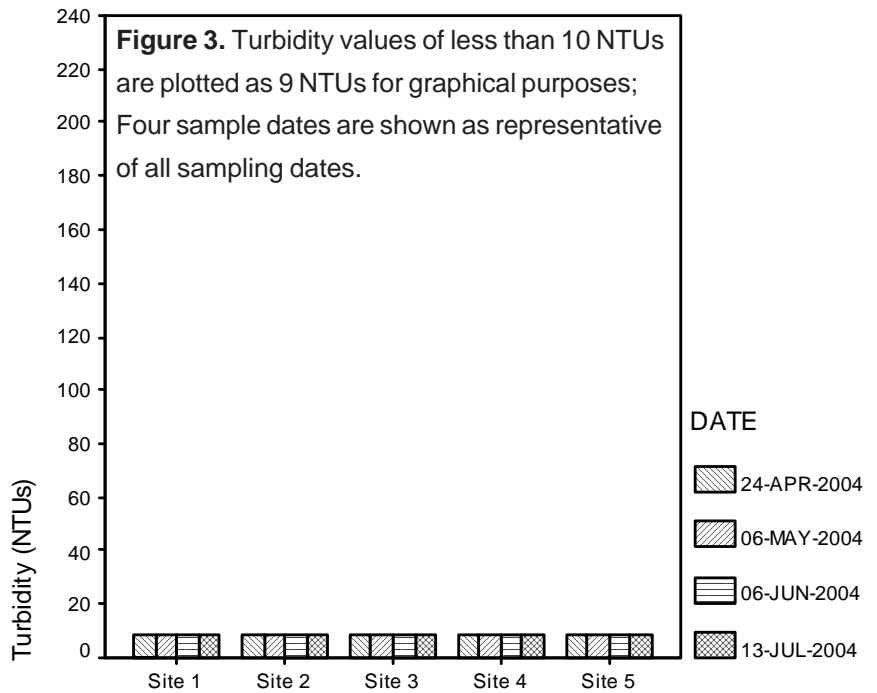
pH was expected to range between 7 and 8 pH units, based on local soil types and their ability to buffer acidic inputs. pH was quite consistent at all sites on all sampling dates (Figure 1). It ranged between 7.0 and 7.5 except at the two headwaters sites on March 26, 2003, when it was 6.0, and at Site 5, when it was 6.5 on January 4, 2003. USGS-determined mean streamflow for the North tributary is 0.21 cfs and for the South tributary is 0.056 cfs. On March 26, 2003, stream flow was 0.143 cfs and 0.036 cfs at the North and South tributary flumes respectively, suggesting high flows/snowmelt were not affecting pH values.



Alkalinity is a measure of how much acid it takes to lower the pH of water. The higher the alkalinity, the less pH fluctuates and the more potential there is for nutrient availability for plant/animal growth. At the Bragger Farm, alkalinity ranged from 180 to 240 mg/L at the sampling sites during the monitoring period. It was most often 200 (28% of the samples) or 240 mg/L (30% of the samples; Figure 2). *However, because the range of the test strips used was 0-240 mg/L, each reading of 240 mg/L suggested only that the true value was higher than 240 mg/L. Therefore, during future sampling a test method with greater precision and range should be used for testing total alkalinity.

Turbidity

Turbidity readings were excellent over the year, with consistent readings of <10 NTUs at all sites on all sample dates (Figure 3). These levels suggest that aquatic organisms within the creek are not negatively affected by poor water clarity conditions. One caution in this assessment is that results may not be as consistent following storm events. A suggestion for future sampling is to monitor turbidity within a day of a storm event to see the effect of runoff on this measure of water clarity.



B.I.

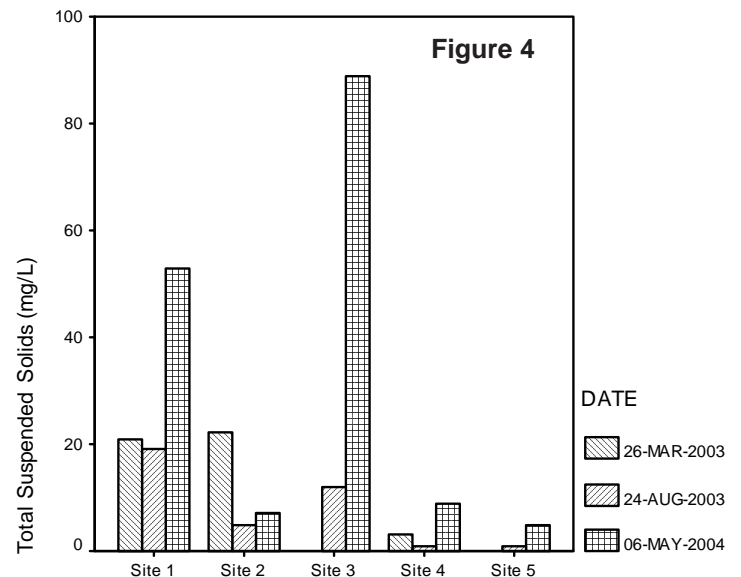
Biotic Index (B.I.) scores are based on macroinvertebrates' tolerance to oxygen levels in the water, with oxygen levels controlled by pollution inputs to the water. A stream is assigned a water quality rating of excellent, good, fair, or poor based on its score. The

B.I. scores at Bragger Farm sites ranged from 2.0 to 3.0. Headwaters sites scored highest, with a 3.0 at the headwaters of the South tributary of Traverse Valley Creek and 2.6 at the headwaters of the North tributary. Both scores indicate good water quality. Scores at both flume sites were lower, with a 2.2 at Site 2 and a 2.0 at Site 4, indicating fair and poor water quality respectively. At Site 1, the B.I. score was 2.2, indicating fair water quality. An important point in determining the B.I. scores for the headwaters sites was that neither site had very many individual macroinvertebrates present, but both sites had stoneflies present, which require very clean water for survival. Stoneflies were not present at the downstream sites (1, 2 or 4).

- 1.0-2.0: Poor**
- 2.1-2.5: Fair**
- 2.6-3.5: Good**
- 3.6 and up: Excellent**

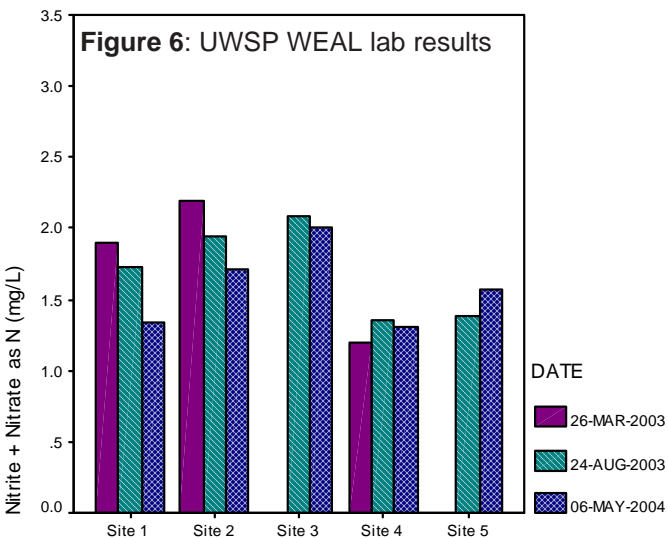
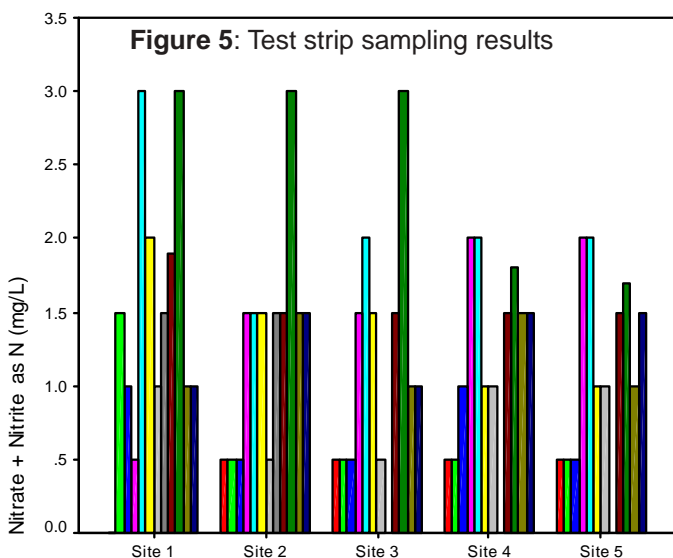
T.S.S.

Total suspended solids were assessed seasonally. In general the South tributary sites had the lowest TSS scores. The headwaters of the North tributary (Site 3) and the most downstream site (Site 1) had higher levels of TSS on May 6, 2004, than on other sampling dates (Figure 4). However, because Site 2 (flume site on North tributary) did not show an elevated TSS level on that date, it suggests that sources of solids to these sites is locally driven, and they are not carried downstream with a cumulative effect.

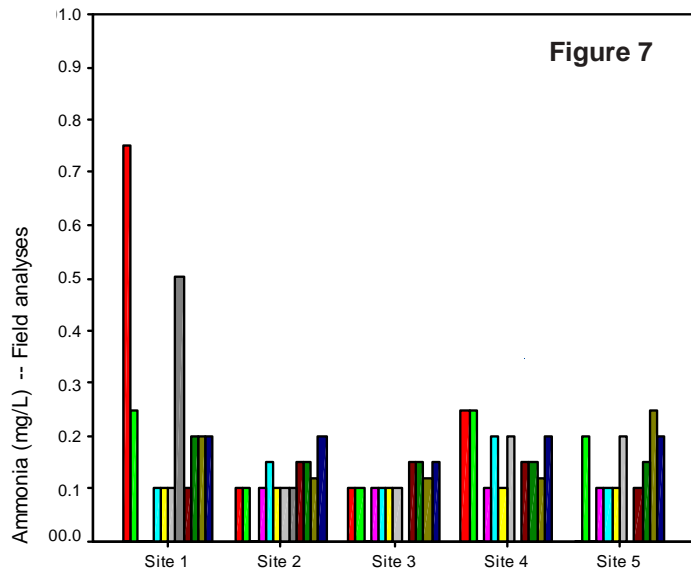


Nitrate - Nitrogen

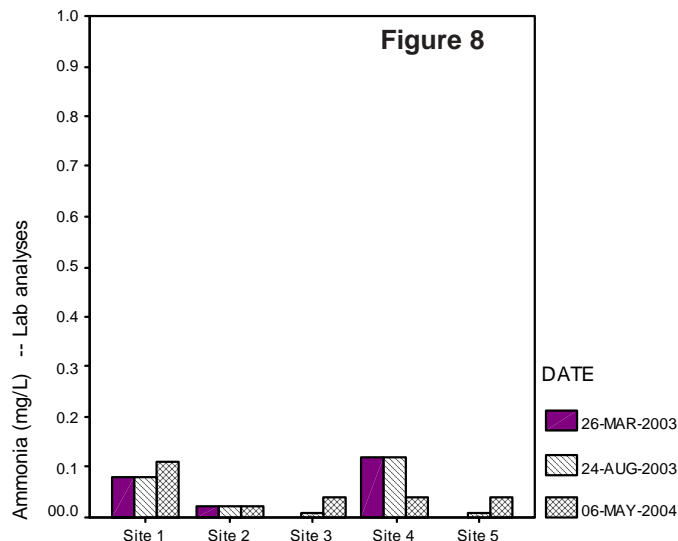
Nitrate was assessed both seasonally through lab analyses at WEAL and regularly in the field using test strips. Field analyses revealed that nitrate ranged from 0 to 3 mg/L with a median of 1.0 mg/L (n=11 or 12), while lab results revealed that nitrate ranged from 1.2 to 2.2 mg/L with a median of 1.7 mg/L (n=2 or 3; Figures 5 and 6). When nitrate levels (as nitrate-nitrogen or nitrite+nitrate-nitrogen) reach 10 mg/L in drinking water, a human health concern exists (WEAL). The Ohio EPA reported that wadeable streams are able to support a warm water fishery with median nitrate-nitrogen levels of 1.6 mg/L (Tippecanoe Environmental Lakes and Watershed Foundation).



Ammonia - Nitrogen



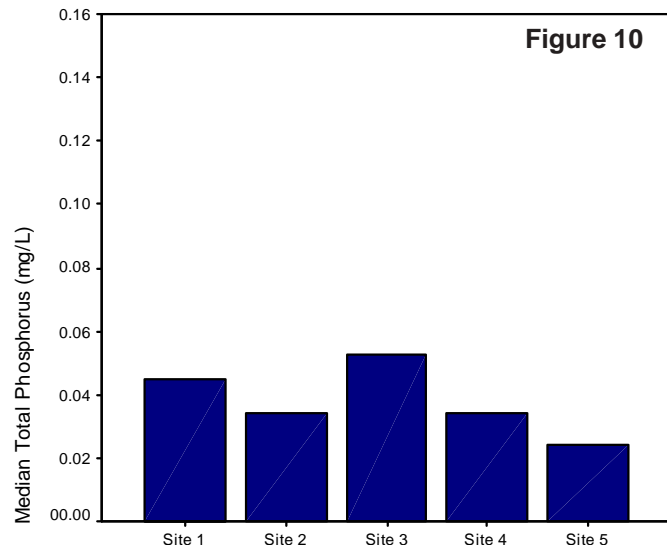
Like nitrate, ammonia was monitored regularly with test strips in the field and seasonally through lab analyses. It was expected that ammonia concentrations would be found to be 0 mg/L when using the test strips. This expectation was due in part to the precision of the test strips, which ranged from 0 to 6 mg/L in six increments. It was also expected because ammonia should not be present in a stream unless a source (such as cattle urinating into the stream or manure runoff) was present at or nearby the site as the sample was collected (since ammonia readily converts to other forms of nitrogen). Median ammonia levels determined using both field (n=11 or 12) and lab (n=2 or 3) procedures were less than 0.25 mg/L (Figures 7 and 8). Results obtained using field test kits were consistently higher than those obtained through lab analyses (Figures 7 and 8).



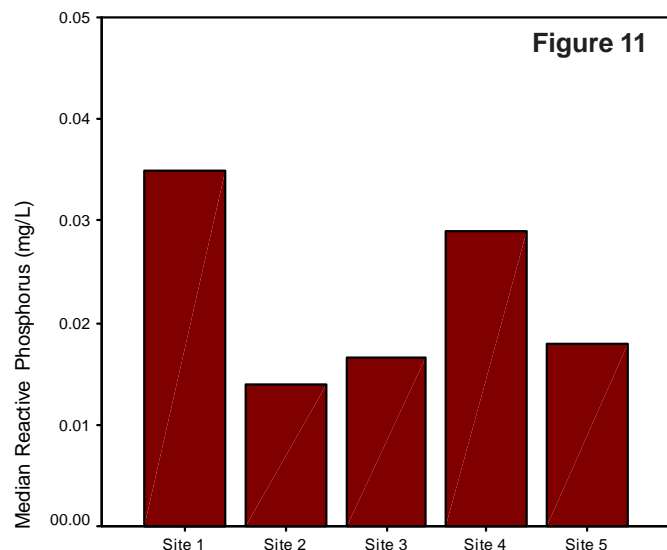
However, ammonia concentrations less than 0.25 mg/L obtained with test strips had to be estimated. Thus, we can only definitively say that ammonia was less than 0.25 mg/L when using the test strips. Ammonia concentrations were able to be better pinpointed through lab analyses (Figure 8).

In a USGS National Water-Quality Assessment Program study, a portion of which was conducted in Wisconsin, ammonia tended to be less than 0.1 mg/L in minimally impacted watersheds. This held true at all Bragger sites according to lab analyses (Figure 7).

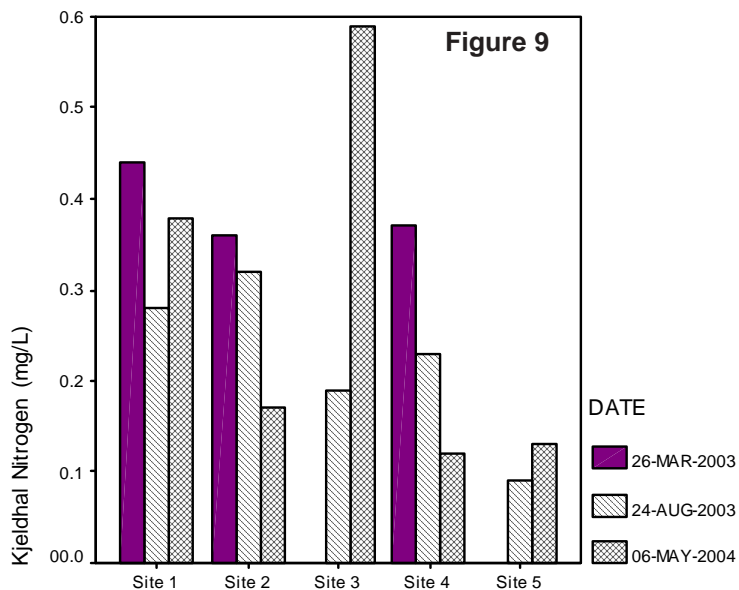
Phosphorus



Phosphorus is commonly the limiting nutrient for plant growth in freshwaters. Therefore, when present in sufficient concentrations phosphorus will support plant growth that may otherwise have not been able to occur. Total phosphorus of 0.03 mg/L in lakes is considered eutrophic (Tippecanoe Environmental Lake and Watershed Foundation). At the Bragger Farm sites median total phosphorus (n=2 or 3) ranged from 0.02 to 0.05 mg/L (Figure 10). Median reactive phosphorus (n=2 or 3) ranged from 0.015 to 0.035 mg/L (Figure 11). Reactive phosphorus is used by organisms for growth, while total phosphorus includes other forms of phosphorus that are not as readily available.



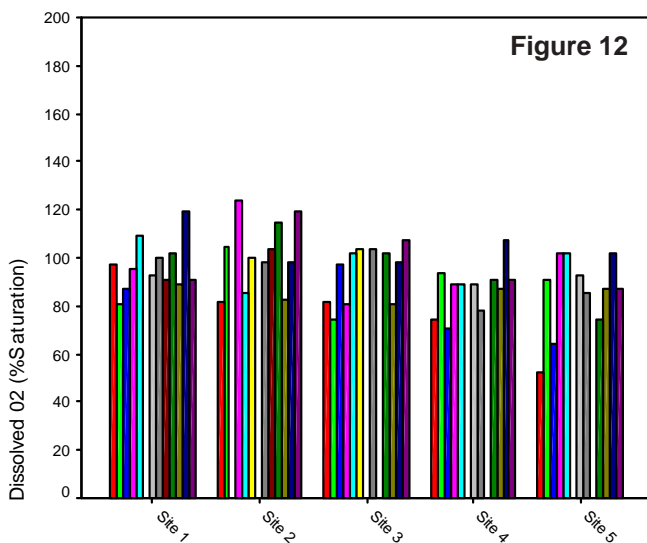
Total Kjeldahl Nitrogen



Kjeldahl Nitrogen (KN) measures the organic form of nitrogen. It is not immediately available for plant growth. The other two forms of nitrogen that were monitored, nitrate and ammonia, are the forms that are available for plant growth. Kjeldahl nitrogen at Site 1, located downstream of the junction of the North and South tributaries of Traverse Valley Creek, ranged between 0.28 and 0.44 mg/L, with a median of 0.38 mg/L. Site 3 (headwaters of North tributary) had the highest median concentration of KN 0.39 mg/L and a range of 0.19 to 0.59 mg/L (Figure 9). The South tributary headwaters site (5) had the lowest median KN concentration (0.11 mg/L) with a range of 0.09 to 0.13 mg/L. Measuring this form of nitrogen is important because organic nitrogen decomposes over time to ammonia and nitrate and becomes available for plant growth.

Dissolved Oxygen

The saturation of dissolved oxygen is the amount of oxygen that can be dissolved in the water at a given temperature and pressure. The percent saturation of dissolved oxygen (D.O.) is affected by biological and chemical processes occurring in the water. D.O. fluctuates daily, with lowest levels expected just before sunrise. Water at higher temperatures can hold less oxygen than cooler waters. Waters that have between 80 and 120% saturation are considered to be good quality for aquatic organisms. At the Bragger Farm sites, D.O. % saturation fluctuated, though there is not a clear pattern to the fluctuations (e.g., time of day sampling was done, season, turbidity, etc.; Figure 12). D.O. % saturation remained between 80 and 120% except for during Jan. and April 2003 at the South tributary sites (4 and 5).

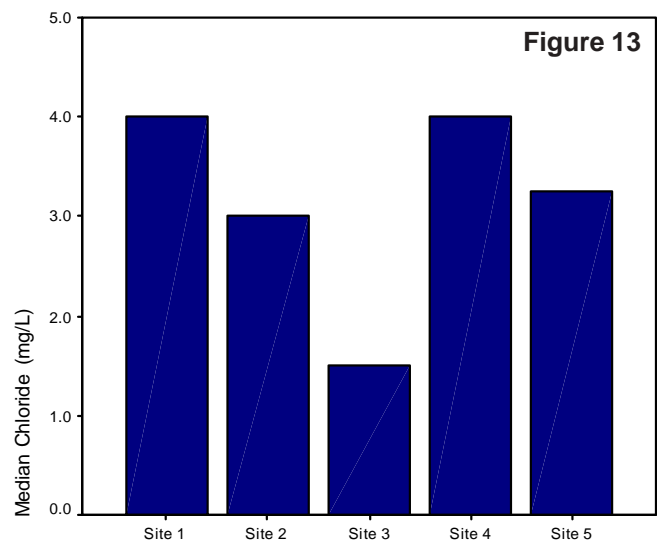


Conductivity

Conductivity measures how well water conducts an electrical current. It relates to the amount of dissolved material in the water and is affected by temperature of the water. Median conductivity (n = 11 or 12) ranged from 485 to 580 microS/cm across the sites. Water temperatures were between 2 and 12 degrees Celcius. In order to compare conductivity readings between sites, conductivity must be calibrated to 25 degrees Celcius. Extreme changes to conductivity may suggest pollution inputs to the stream (USEPA).

Chloride

Both headwaters sites (3 and 5) had lower chloride levels than the flume sites (2 and 4), but levels were consistently higher at the North tributary (2 and 3) than the South tributary (4 and 5) of Traverse Valley Creek (Figure 13). Pollutants such as road salt and human/animal wastes can affect chloride levels. According to the Student Watershed Research Project, clean rivers can normally have chloride levels of 20-50 mg/L. Chloride concentrations noted at the Bragger Farm sites fall far below this range.



Resources:

Mississippi State University Extension Service, Info.Sheet 1334, MW Brunson. <http://msucares.com/pubs/infosheets/s1334.htm>

Student Watershed Research Project manual. 3rd Ed. 1996. Published by Saturday Academy.

Tippecanoe Environmental Lakes and Watershed Commission. 2004. <http://www.telwf.org/watertesting/nitrate.htm>

USEPA New England Wadeable Streams. <http://www.epa.gov/region1/lab/reportsdocuments/wadeable/equipment/sondes.html>

USGS. Nutrients in the Nation's Waters--Too Much of a Good Thing? <http://water.usgs.gov/nawqcirc1136h8.html>
Water and Environmental Analysis Lab (WEAL).

Interpreting your drinking water quality test results: Identifying problems and solutions. <http://www.uwsp.edu/cnr/etf/rpre.htm#jump7>