IOWA'S WATER

Ambient Monitoring Program

# Nutrient Monitoring in the Cedar River Watershed

## Introduction

Considerable national and local interest continues to be focused on Eastern Iowa surface water quality. A recent study by the U.S. Geological Survey of Mississippi River watersheds ranks the Iowa River and Cedar River 2nd and 3rd highest out of 42 river systems, respectively, in average nitrate-N (nitrate plus nitrite expressed as nitrogen) concentrations from 1980-1996[1]. Additionally, the Cedar River is listed by the state as an impaired water due to high levels of nitrate and coliform bacteria[2].

*McLoud Run, a cold-water trout stream, flows through Cedar Rapids.*

Understanding the origins of these problems requires study of the watershed at a number of different spatial scales. During the past four summers, researchers at Coe College in Cedar Rapids have been investigating nitrate levels in a number of small (25,000-65,000 acres) watersheds, which are tributaries to the Cedar River north of Cedar Rapids (Figure 1). The purpose of this work is to better understand factors affecting nutrient levels in these watersheds, as well as gaining some knowledge regarding the fate of these nutrients in the environment.

## Methods

Grab samples were collected from accessible sites near the point where the selected tributaries entered the Cedar River. Dissolved oxygen, pH, conductivity, temperature, and turbidity were measured on site. Nutrient samples were taken back to the Coe College chemistry lab and analyzed within 24 hours by standard methods (ion chromatography).

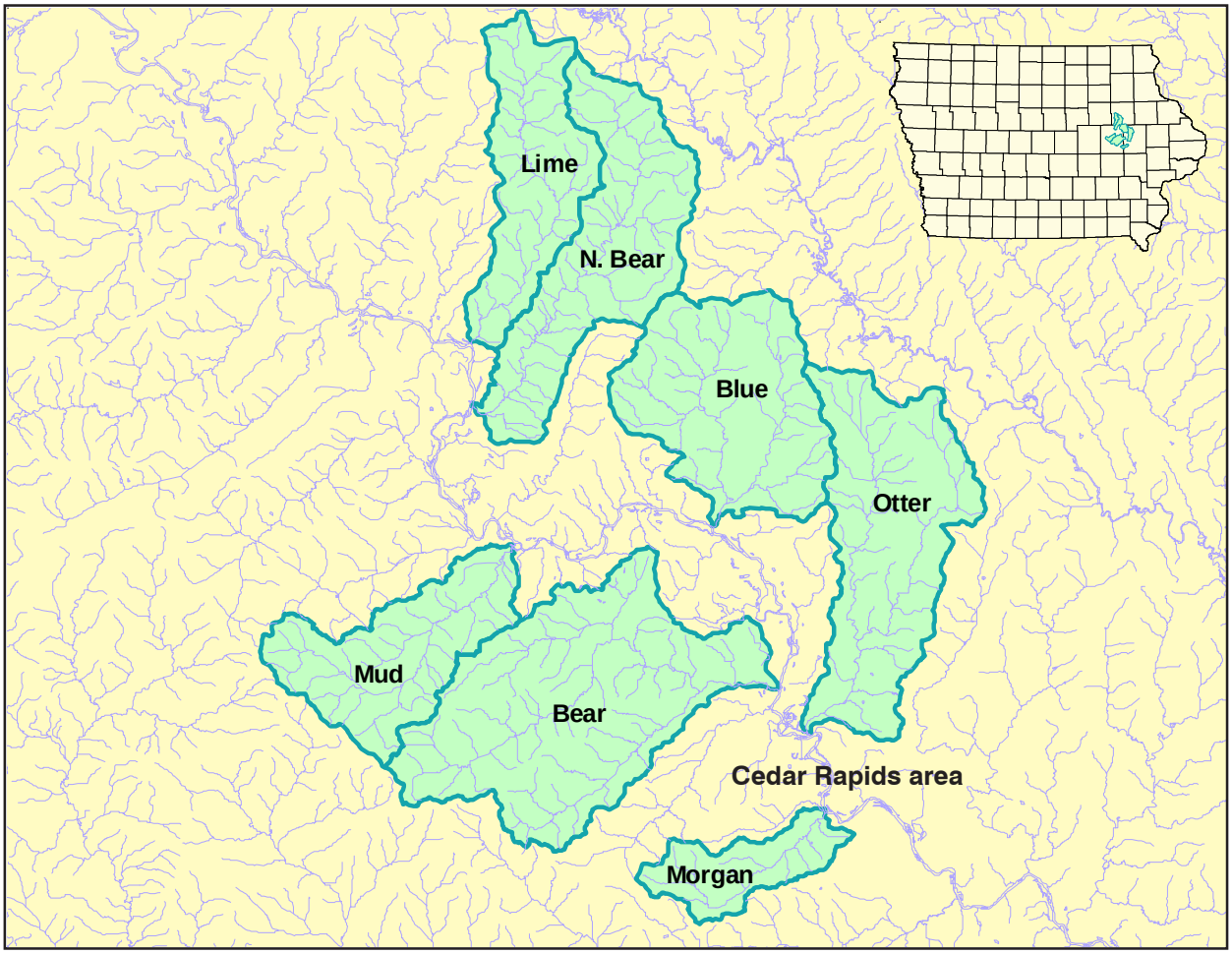


***Figure 1***. *Seven Cedar River sub-watersheds sampled by Coe College during 2000-2003.*

## Results

Seven of the Cedar River sub-watersheds (Lime, North Bear, Blue, Otter, Mud, Bear, and Morgan) have been studied each summer from 2000-2003. As can be seen from Table 1, mean nitrate-N concentrations vary from summer to summer, but the relative order of the watersheds with respect to average nitrate concentration remains fairly stable. The ordering is consistent with the percentage of the watershed in row crop. A line through the data (% land in row crop versus average nitrate concentration) shows a strong relationship. Other factors, including other land uses, average landscape slope, soil types, and watershed area were also examined, but none of these showed a discernible correlation with the nitrate concentrations.

Further study of the Indian Creek watershed was carried out in the summers of 2002 and

| Stream | % Row Crop | 2000 Ave Nitrate-N | 2001 Ave Nitrate-N | 2002 Ave Nitrate-N | 2003 Ave Nitrate-N |
|---|---|---|---|---|---|
| Bear | 74 | 9.1 | 11.1 | 9.5 | 6.2 |
| Blue | 61 | 8.9 | 8.9 | 7.7 | 5.7 |
| Lime | 80 | 13.1 | 14.6 | 12.0 | 11.1 |
| Morgan | 67 | 8.9 | 9.5 | 8.9 | 7.7 |
| Mud | 79 | 11.4 | 13.5 | 11.4 | 8.9 |
| N. Bear | 79 | 12.7 | 13.8 | 11.7 | 12.2 |
| Otter | 66 | 9.5 | 10.1 | 9.4 | 5.5 |

***Table 1.*** *Average nitrate concentrations for seven Cedar River tributaries during 2000-2003.*

2003 to better understand the changes in water quality as a stream flows from a rural to urban landscape. During the summer of 2002, samples were collected and analyzed on a daily basis from two sites on Indian Creek. The northern site was located near Linn-Mar high school at the northern edge of the Cedar Rapids-Marion urban area. At this point, the stream can be assumed to primarily contain water draining from agricultural lands. The southern monitoring point, near the Cedar River, runs through a significant amount of urban and suburban areas, including two golf courses.

Comparison of nitrate concentrations of the northern monitoring station (N) to the southern monitoring station (S) on a daily basis yields a ratio (N/S) of 1.62, indicating that the nitrate concentration dropped significantly as Indian Creek flowed through Marion and Cedar Rapids. In contrast, chloride, sulfate, and conductivity had N/S ratios near 1.0, indicating little change in these parameters as a result of changing land use. These results indicate that the urban stretch of Indian Creek yields a net uptake of nitrate-nitrogen, possibly through uptake by plants or through denitrification. A more detailed spatial study during the summer of 2003 showed that nitrate concentrations increased substantially as sampling points moved from south to north, with the highest concentrations measured being at the northernmost point sampled.

## Conclusions and Future Studies

This monitoring work is consistent with earlier research indicating that nitrate concentrations are strongly related to land use in Eastern Iowa. Studies on Indian Creek indicate that rather than contributing to the nitrate concentrations, urban/suburban streams can show a net uptake of nitrate. Future work will include similarly detailed studies of phosphorus concentrations and incorporate flow measurements to better understand the changes through seasons.

*Indian Creek, east of Cedar Rapids, flooded in June of 2002 after a heavy rainfall.*

## References


[1] "Flux and Sources of Nutrients in the Mississippi-Atchafalaya River Basin: Topic 3 Report for the Integrated Assessment on Hypoxia in the Gulf of Mexico" Goolsby, D.A., Battaglin, W. A., Lawrence, G.B., Artz, R.S., Aulenbach, B.T., Hooper, R.P., Keeney, D.R., Stensland, G. J. May, 1999, U.S. Department of Commerce, National Oceanic and Atmospheric Administration.

[2] Cedar River Assessment Survey Project, Iowa Department of Natural Resources, Water Resources Section, June 2001.



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Water Monitoring Program Web Site – wqm.igsb.uiowa.edu


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