

Pesticides and Nutrients in Surface Waters Associated with Golf Courses and Their Effects on Benthic Macroinvertebrates

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Objectives:

1. To determine if surface waters and their sediments associated with golf courses are contaminated by pesticides and/or fertilizers.
2. To develop the use of stream macroinvertebrates and their communities as long-term indicators of water quality.

Start Date: 1998

Project Duration: 2 years

Total Funding: \$54,896

Golf courses intensive management necessitates the use of pesticides and fertilizers, thus provoking concerns of environmental damage. One of the overall goals of this project is to determine if surface waters and their sediments associated with golf courses are contaminated by pesticides and/or fertilizers.

Contamination is especially expected to occur in association with high runoff events such as storms. A second overall goal is to develop the use of stream macroinvertebrates and their communities as long-term indicators of water quality.

Water samples for nutrient level measurement have been collected and analyzed once or twice every month since March 1998. Water and sediment samples for pesticide analysis have also been collected five times following run-off events.

On the basis of this data, it does appear as though pesticides and fertilizers used on golf courses are moving in streams associated with golf courses, especially in association with run-off events of a large magnitude such as those on July 31, 1998 and October 8, 1998, in higher concen-



Macro-invertebrates found in streams along golf course fairways were not affected by golf course maintenance practices.

trations at the downstream locations. However, routine sampling for nutrient levels indicated that golf courses do not cause nutrient enrichment of streams.

Macroinvertebrates associated with natural leaf packs are collected using artificial leaf pack samplers. Community comparisons, using taxonomic diversity and invertebrate density, have been performed by calculating various community statistics for each golf course and site.

During 1997 and 1998, invertebrates were collected five times. These samples yielded 42,557 individuals representing 79 families of invertebrates. The most abundant types of invertebrates collected were members of the families Chironomidae (midge flies), Simuliidae (black flies), Hydropsychidae (net-spinning caddisflies), Elmidae (riffle beetles), and Capniidae (winter stoneflies).

The overall analysis for taxa richness showed a significant increase in the number of taxa at sites downstream of the course. However, the analysis did not indicate a significant difference in taxa richness at upstream and downstream locations for any of the courses when the analysis by course was completed. In addition, analysis of the data showed a significant increase in abundance of invertebrates at the downstream location for two of the courses.

Total abundance of invertebrates can either increase or decrease in the presence of pollution, depending, on the type of pollution. However, pesticide presence (at least at toxic levels) would be expected to be correlated with a decrease in total abundance.

The pesticides concentrations, even at



Dr. Amy Soli explains to Stan Zontek how benthic macro-invertebrates from streams on golf courses were sampled and catalogued.

their highest, at sites downstream of the courses are not close to toxic levels for fish and aquatic invertebrates. In addition, when the pesticide levels are high in the water columns from sites downstream of the course, the EPT richness and taxa richness of benthic macroinvertebrates from the same sites are higher than they are at the upstream sites.

Also, the nitrate and phosphorus concentrations at sites downstream of the course are less than (in the case of nitrate) or equal to (in the case of phosphate) the concentrations at sites upstream of the course.

Summary Points

- The most abundant types of invertebrates collected were members of the families Chironomidae (midge flies), Simuliidae (black flies), Hydropsychidae (net-spinning caddisflies), Elmidae (riffle beetles), and Capniidae (winter stoneflies).
- The overall analysis for taxa richness showed a significant increase in the number of taxa at sites downstream of the course.
- At downstream sites, nitrate concentrations were lower and phosphorus concentrations were the same as upstream sites.