Stream Ecology of Leatherstocking Creek
Immediately Following Planting of Riparian Vegetation (Year-0)

James P. Hakala*

ABSTRACT

In 1993 trees and shrubs were planted along a study area of Leatherstocking Creek (Otsego County, N.Y.) previously devoid of riparian vegetation. A baseline study was initiated to determine the effects of improved riparian vegetation on water quality, invertebrate and fish composition and biomass.

INTRODUCTION

Significant mortality of brook trout occurred in the upper reaches of Leatherstocking Creek during the summers of 1988 and 1991. Preliminary investigations by Hayes (1989, and 1990) and others (Foster et al, 1991) indicated that high water temperature due to the absence of riparian vegetation was the likely cause. To test this hypothesis a field study was initiated along Leatherstocking creek on the property of Louis Hager.

Prior to 1993, the upper section of Leatherstocking creek was lacking sufficient riparian cover to maintain cool water temperatures for supporting trout. In 1993 stream corridor improvements were undertaken to increase the quantity and diversity of riparian vegetation (Figure 1).

This study was the first year of a 5-year monitoring program to document the impact of improved riparian vegetation on stream ecology. The impact of stream improvements on the biotic and abiotic environment were determined by sampling water quality, fish and invertebrate populations.

MATERIALS AND METHOD

Water Quality

On 24 June and 28 July 1993 water quality measurements were taken at five sample sites utilized in the "Baseline Study of Leatherstocking Creek at Louis Hager's Property" (Stanton 1992). Using a Hydrolab, (model SVR2-SU) measurements

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FIGURE 1
LOCATION OF BOTH NATURAL AND PLANTED TREES ALONG LEATHERSTOCKING CREEK ON LOUIS HAGER'S PROPERTY

RM...RED MAPLE
H.....HEMLOCK
A.....APPLE TREE
SM...SUGAR MAPLE
SD...SILKY DOGWOOD
MA...MOUNTAIN ASH
WW.....TEEPING WILLOW
JB...JUNE BUSH
RO...RED OIGER
SW.....SHRUB WILLOW

JAMES HAKALA

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of dissolved oxygen, pH, temperature, and conductivity were obtained at each sample site (Figure 2). Sample sites were marked with identifying stakes. All samples were taken in pools.

Since cold water ecosystems are most likely to be stressed on hot days, two of the hottest days of the summer were chosen for sampling. Ambient air temperature was 30 - 40°C when water quality data were collected.

Invertebrate Populations

A surber sampler was used to collect eight invertebrate samples on 10 June 1993 (Table 2). Each sample site was marked with an identifying stake for future reference.

Invertebrate samples were collected from the riffles sections of the stream to a depth of 15 cm. The stream invertebrates were then removed from the sampler and placed into labelled jars containing a solution of Rose Bengal and 70% ethanol. The invertebrates were sorted by sample sites and identified to family using Lehmkühl (1979).

Biomass for each taxa was determined for each sample site. Invertebrate samples were blotted dry on paper toweling and weighed on an electronic balance.

Fish Populations

Fish populations were sampled with a Smith-Roote back-pack electrofisher. Electrofishing surveys were conducted in a pool and a riffle in the lower, middle, and upper section of the stream (Figure 2). The sites were marked with stakes and a series of length, depth and width measurements were made to determine the area and volume sampled.

Blocking nets were set up at both ends of the sample sites. Repeated sweeps were made with the backpack shocker until all fish were removed from the sample sites. The fish were identified in the field and length measurements were taken for use in biomass calculations.

A sample group of varying lengths from each species collected was taken back to the field station to be weighed. The weight and corresponding lengths were plotted on exponential graphs (Figures 3, 4, 5). These graphs were utilized to determine weight from length data.

RESULTS & DISCUSSION

Invertebrate Populations

Biomass

Insect biomass reveals a substantial amount about water quality and temperature thus indicating suitability for trout (Hunter 1991). Five of the eight sites surveyed had more than one gram of invertebrates per square foot of stream (Table 1). One to two grams of invertebrate biomass per square foot is considered average. Less than one gram is considered poor and over two grams is excellent (Lagler 1956).
Sample locations for fish, invertebrates and water quality.
FIGURE 3 LENGTH VS. WEIGHT RELATIONSHIP FOR BLACKNOSE DACE
FIGURE 4  LENGTH VS. WEIGHT RELATIONSHIP FOR COMMON SHINERS
FIGURE 5  LENGTH VS. WEIGHT RELATIONSHIP
FOR CREEK CHUBS
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<th>SITE:3</th>
<th>SITE:4</th>
<th>SITE:5</th>
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<td><strong>WATER PENNY</strong></td>
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<td><strong>RIPPLE BEETLES</strong></td>
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<td><strong>STONEFLIES</strong></td>
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<tr>
<td><strong>DECAPODA</strong></td>
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<td><strong>CRAYFISH</strong></td>
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</table>

**TOTAL**            | 0.3186 | 0.8741 | 1.2411 | 2.1387 | 0.8686 | 3.7248 | 1.2402 | 6.5932 | 16.9993
The average biomass for all of the sites was 2.1 grams. However, the presence of crayfish in some of the samples added significantly to the weight. Thus, the invertebrate biomass for the stream section would be considered average.

Diversity

Invertebrate diversity also provides a good indication of water quality parameters and stream productivity (Lagler 1956). Streams with a high diversity of invertebrates have high levels of fish production and have the best water quality.

There were 15 families of invertebrates present. Caddisflies, crane flies, and stoneflies made up the majority of aquatic insect biomass for the sample sites (Table 1).

Water Quality

Temperature

Temperatures for the five sample sites shows clearly the lack of sufficient cover over the stream to maintain cool water temperatures suitable for trout (Figure 3 & 4). The average temperature of the stream section for both days was 22.8°C. Sixteen degrees celsius is ideal water temperatures for trout survival. Temperatures above 25°C is lethal for trout (Hunter 1991). Several sites were over 23°C and one site was 24°C. These temperatures are as much as 4°C higher than those found in earlier studies of the stream section.

In general the stream temperature increased as you went upstream, toward the cow pastures of the Keys Farm.

pH

The pH readings at each site ranged between 6 and 7 with most readings at 7 or neutral (Figures 6 & 7). These readings were excellent for brook trout which can withstand pH as low as 4.8 and as high as 9.8 (Stoltz & Schnell, 1991).

Dissolved Oxygen

Dissolved oxygen levels for the stream section were excellent for trout. The average level of dissolved oxygen was 9.2 mg/l (Figures 6 & 7). Levels below 5mg/l are lethal for a trout population (Willers 1981). Thus oxygen was not a limiting factor to trout survival.

Conductivity

The conductivity measures dissolved ions in the water and is a crude measure of nutrient levels. Conductivity measurements were characteristic of a limestone and bedrock stream bed, and do not indicate high levels of nutrient runoff. The average conductivity readings of 235µhos/cm. were slightly below
WATER QUALITY MEASUREMENTS FOR LEATHERSTOCKING CREEK, JUNE 24, 1993

FIGURE 6

SAMPLE SITES

TEMP  pH  D.O.  COND
FIGURE 7

WATER QUALITY MEASUREMENTS FOR LEATHERSTOCKING CREEK, JULY 28, 1993

TEMPERATURE @C, pH, DISSOLVED O2 mg/L, CONDUCTIVITY umhos/cm

SAMPLE SITES

- TEMP  - pH  - D.O.  - COND(2nd Y axis)
measurements from Otsego Lake where Leaetherstocking Creek empties (Figures 6 & 7). These conductivity readings indicate adequate nutrient levels to support plant and invertebrate populations, which utilizes the trace elements dissolved in the water for metabolic activities.

**Fish Populations**

**Fish Biomass**

The total fish biomass and species specific biomass varied with sample location and habitat. Creek chubs constituted the largest percent of biomass for the stream section (Table 2).

Table 2

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>SITE 1</th>
<th>SITE 2</th>
<th>SITE 3</th>
<th>SITE 4</th>
<th>SITE 5</th>
<th>SITE 6</th>
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<tbody>
<tr>
<td>BLACKNOSE DACE</td>
<td>1.7</td>
<td>1.5</td>
<td>69.8</td>
<td>28.6</td>
<td>30.0</td>
<td>106.6</td>
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<tr>
<td>COMMON SHINER</td>
<td>3.2</td>
<td>62.9</td>
<td>2.8</td>
<td>24.2</td>
<td>3.5</td>
<td></td>
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<tr>
<td>CREEK CHUB</td>
<td>20.8</td>
<td>220.3</td>
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<tr>
<td>BROOK TROUT</td>
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<tr>
<td>TOTAL DENSITY</td>
<td>1.7</td>
<td>25.5</td>
<td>353.0</td>
<td>28.6</td>
<td>32.8</td>
<td>192.4</td>
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</table>

Data in Table 2 are based on the following sample volumes: site-1 151 m³, site-2 16.85 m³, site-3 1.57 m³, site-4 1.7 m³, site-5 1.56 m³ and site-6 0.41 m³.

**Diversity**

The electrofishing survey yielded four species of fish inhabiting the stream section: blacknose dace (Rhinichthys atratulus), common shiners (Notropis cornutus), creek chubs (Semotilus atromaculatus), and a single brook trout parr (Salvelinus fontinalis) (Table 3). The fish community includes fish associated with cool waters (common shiners and creek chubs), fish that are common in both cool and cold waters (blacknose dace), and fish that occur exclusively in coldwater (brook trout).
Table 3
Percent Composition of Fish Captured in 1993 as Compared to Fish Caught in 1992

<table>
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<tr>
<th></th>
<th>COMMON SHINER</th>
<th>CREEK CHUB</th>
<th>BLACKNOSE DACE</th>
<th>BROOK TROUT</th>
<th>PUMPKINSEED</th>
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<td>SUMMER 1992</td>
<td>5%</td>
<td>24%</td>
<td>69%</td>
<td>0%</td>
<td>1%</td>
</tr>
<tr>
<td>SUMMER 1993</td>
<td>11%</td>
<td>24%</td>
<td>69%</td>
<td>.003%</td>
<td>0%</td>
</tr>
</tbody>
</table>

The percent composition for the species caught was nearly the same for both the 1992 study by Stanton, and this year's study (Table 3).

Brook trout were not captured in last year's survey (Stanton 1992), conducted prior to planting riparian vegetation (Table 3). Pumpkinseed, a warm water fish, were absent in 1993 sampling, but were present in 1992 prior to the planting of riparian vegetation.

CONCLUSIONS

The study area is undergoing natural process of succession, changing from production agriculture back to forest. The stream bank is returning to its natural state and the stream bed is narrowing and deepening. As the stream narrows water temperatures will cool because of reduced surface area exposed to solar radiation (DEC 1985). Stream narrowing also exposes more gravel for use by trout for spawning beds.

The planting of trees along the stream corridor is believed to have accelerated the natural succession rate by 15 to 20 years (Hamburger 1993). These trees will help maintain the stream corridor and reduce stream bank erosion that leads to siltation and the destruction of brook trout spawning beds. Since Leatherstocking creek is a tributary to Lake Otsego, reducing erosion will reduce silt deposition in the lake.

The primary factor limiting trout population in the upper reaches of Leatherstocking Creek is the warm water temperatures caused by insufficient riparian cover (Foster, et al. 1990). As the newly planted trees and shrubs mature their foliage will shade the stream. Water temperatures are expected to decline in the study area over the next 5 years, to a level that will maintain trout populations.

The added tree cover will also increase terrestrial insects that fall into the water and become available to trout for food. Leaves, twigs, etc that fall into the water become food for aquatic insects (Alabaster 1985). The current,
"average" insect biomass and diversity is expected to increase, which will in turn result in increases in fish populations.

As Leatherstocking creek returns to its natural state, continuing monitoring of the study area is essential to document the full effects of corridor improvements. The improvements in riparian vegetation will accelerate natural succession and serve as an example for future stream improvements elsewhere.

LITERATURE CITED


Homburger, J. Personal Interview on July 30, 1993. SUNY Oneonta Biological Field Station, SUNY Oneonta.
ACKNOWLEDGEMENTS

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