Riparian Forests and Benthic Macroinvertebrates in the Little Miami Scenic River Watershed

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It has long been established that the health of living organisms in freshwater are dependent on terrestrial ecosystems embedded the landscape of the surrounding catchment. However, despite much study, are still many aspects of this terrestrial-aquatic relationship that are still not well understood. According to scientists at the USEPA the Little Miami River watershed (LMRW) may represent a unique opportunity to study these interactions. The Wisconsinan glacier graded the northern half of the LMRW but did not extend to the southern half. The glacial advance altered the surface topography and its retreat deposited till (Till Plain) in the upper half of the LMRW resulting in present-day land cover that is significantly different from that in the un-glaciated southern half (called a Drift Plain by geologists). Using color infrared photography of the Little Miami basin the EPA researchers have created a detailed analysis of the riparian corridor lining 35 small (headwater) streams distributed across the LMRW. The EPA researchers also conducted a multi-year study of the fish and aquatic invertebrates that lived in these same streams. The results of this study showed significant differences between both the vegetation in the riparian zone and the status of the aquatic insects between the two LMRW regions (Table 1).

Table 1. Comparison of Riparian Forest and EPT Richness in the LMRW Drift and Till Plains

	Drift Plain				Till Plain			Confidence
Catgory	Mean	±	S.D.		Mean	±	S.D.	p-value
Percent Riparian Corridor in Forest Cover	62.7	±	13.0		37.5	±	19.9	<0.001
Percent of Individuals in EPT (EPT-Richness)	33.5	±	17.3		19.4	±	15.6	0.016

The mean is the average score for all the sub-watershed in each region. The "p-value" describes the confidence these observed differences between the Drift and Till Plains are not simply due to chance. A "p < 0.001" means there is less than one chance in a 1000 that the difference seen is a random event.

The percentage of riparian corridor covered in forest for the 16 sub-watersheds in the Drift Plain was 1.7 times higher than the 19 located in the Till Plain. Likewise, when the macroinvertebrates living in the stream beds were examined and identified the scientists

found that, on average the EPT-richness of theses samples was significantly higher in the Drift Plain sub-watershed. The EPT-richness is the percentage of macroinvertebrates sample that are members (larval forms) of three taxa of aquatic insects: Empheroptera (mayflies), Plecoptera (stone flies) and Tricoptera (caddis flies). The EPT-richness metric is very useful measure because these three taxa of insects are known to be very sensitive to many kinds of stream disturbance thus are found only in higher quality stream sites. Thus, by implication the Drift Plain streams represent high quality stream conditions for these organisms.

A scatter plot of EPT-richness versus the riparian forest shows a good correlation between riparian forest and ETP-richness. More than 30% of the variation in the invertebrate metric in thee streams can be explained by considering the amount of forest along the stream bank (Figure 1).

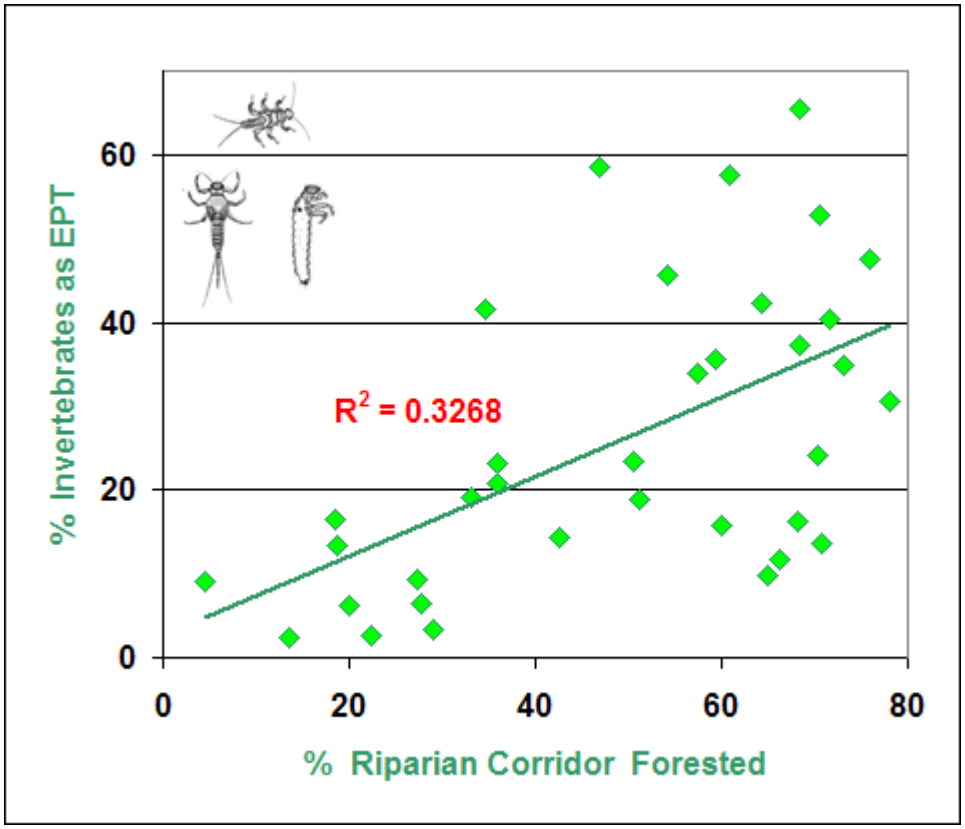

Figure 1. A scatter plot relating EPT-richness in the macroinvertebrates samples to the amount of riparian corridor that is forested for the 35 LMRW sub-watersheds.

When this information on land cover and invertebrate populations was spatially projected using a geographic information system it one can see strong correspondence between the amount of riparian forest in each of the sub-watersheds and the EPT-richness metric (Figure 2).

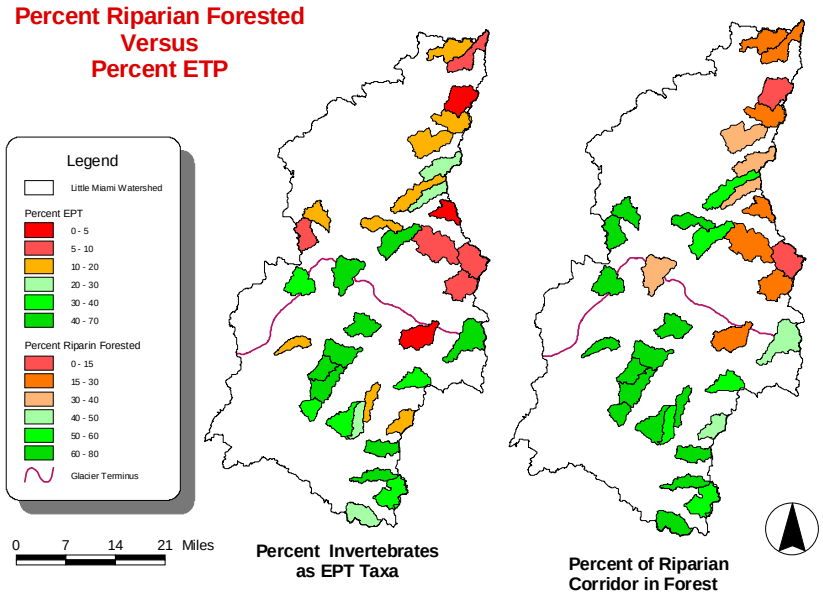

Figure 2. Maps showing the spatial distribution of the percent of riparian forest and the EPT-richness score of the 35 LMRW streams. The dark green color streams have relatively greater amounts of forested riparian corridor and also higher EPT-richness scores. The dark red-colored sites are relatively low for both measures.

Most of the more sparsely forested sub-watesheds also have lower EPT-richness scores and these are more likely to be located in the northern Till Plain. It should be noted while these results are expected in that the benefits in terms of services and protection afforded by riparian vegetation to stream biota is well established. Nonetheless, there are clearly other factors that are affecting the EPT-richness metric as at least 60% of the variation in this score in not accounted for by considering in the amount of riparian forest. In addition a few sub-watersheds with better riparian cover have poorer ETP scores (and the reverse). The EPA scientists believe that other types of land cover (e.g., grassland and row crop) as well as geological physical features (e.g., soil, ground water contributions to

flow) also play a role in the status of the invertebrate community and these factors are under study.