Relationship between flow regimes in headwater streams and Macroinvertebrate abundance in the Piedmont Region of North Carolina, USA

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Introduction

• Headwater streams, located in the uppermost regions of watersheds, drain diffuse sources of materials throughout the entire watershed (i.e. sediments, nutrients, and chemicals) which have a potential to accumulate downstream.

• Macro-invertebrate populations and their relationship to headwater streams may be used to assess water quality.

• Understanding the relationship between headwater streams and macroinvertebrates may assist land managers and decision-makers adopt better land use practices.

Objectives

• Describe the hydrologic variability of eight headwater streams within the Piedmont Region of North Carolina.

• Determine the relationship between headwater streams and macroinvertebrate abundance.

Methods

• Stream water depth measurements were recorded on a weekly basis within several stream reaches and flow regimes (pool, riffle, and run) of eight North Carolina Piedmont headwater streams (figure 1).

• Macro-invertebrate data was collected three times a year within the corresponding stream reaches and flow regimes in the spring, summer, and winter of 2003 and 2004.

• Mixed-effects models were developed to investigate the relationship between water depth measurements and macroinvertebrate abundance variables.

Results

• Water depths in streams exhibited hydrologic variability as a result of season rainfall patterns (figure 2).

• Patterns of hydrologic variability affecting macroinvertebrate abundances may be most prominent in the ephemeral and pool reaches of some streams.

• Original model indicated that water depths four weeks prior to macroinvertebrate sample date may have limited statistically significant influence on macroinvertebrate abundances (p=0.002-0.949; figure 3).

• Minimum water depth model for pool (Xp_min) and riffle samples (Xr_min) indicated that minimum water depths one week before and one week after macroinvertebrate sampling may have statistically significant influence on macroinvertebrate abundances (p=0.0001-0.8398; figures 4 and 5).

Discussion and Conclusion

• Results indicated that stream flow in headwater streams may be influenced by changes in seasonal rainfall patterns as well as other environmental and biological variables.

• Results from the statistical analysis supported that the minimum water depth model best fit the data.

• Although the minimum water depth model reported higher p-values in most seasons.

• Sample size may influence a model’s ability to detect relationships between water depths and macroinvertebrates as well as stream types.

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