Snapshot Analysis of the Abundance and Community Composition of Terrestrial Invertebrates in Three Tributaries of the Beebe River in Campton, NH

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Introduction

Funding has increased for the prioritization of stream restoration in the United States due to a variety of threats (Sweeney et al. 2004). However, these efforts focus on the restoration of physical habitat to revitalize ecological functions rather than also considering trophic deficiencies, such as food production to support fish (Humphries and Winemiller, 2009).

- Approx. 33% of brook trout diet comes from terrestrial invertebrates (Courtwright & May, 2013). Climate change and deforestation changes to food supply may be important to brook trout abundance and survival (Nislow & Lowe, 2006).
- Understanding how riparian zones influence stream food webs can strengthen future restoration practices

Hypotheses

- Abundance and types of terrestrial invertebrates will change as habitat type changes in a tributary, which we classified as zones (Fig 1)
- Zone 2 in both GR3 and GR4 will have a different composition of invertebrates than Zones 1 or 3 because it has a higher level of human disturbance
- Terrestrial food availability will be greatest in forested zones (ECR1 or Zone 3) when compared to zones with less forest or open meadow (GR3 and GR4 Zones 1 and 2)

Methods

Study Site

- 3 tributaries of Beebe River in Campton, NH with similar channel morphologies (Fig 3)
- 100m of each tributary starting at the confluence split into 3 zones relative to riparian type
- Tributaries GR3 and GR4 have a middle zone 2 that is disturbed and has been clear cut in past years to maintain powerlines that cross over
- ECR1 was our control tributary as it has little disturbance and maintains similar forested riparian characteristics throughout its zones

Terrestrial Invertebrate Collection

- 4 pitfall traps (2 each side) were placed in each zone so each tributary had 12 samples total. The meter of deployment was determined with a random number generator
- Pitfalls consisting of plastic cups were put in the ground flush with the surface and filled half way with 70% ethanol
- After 72 hours contents were collected from traps and stored until being brought back to the laboratory where organisms were identified to family using a dissecting microscope

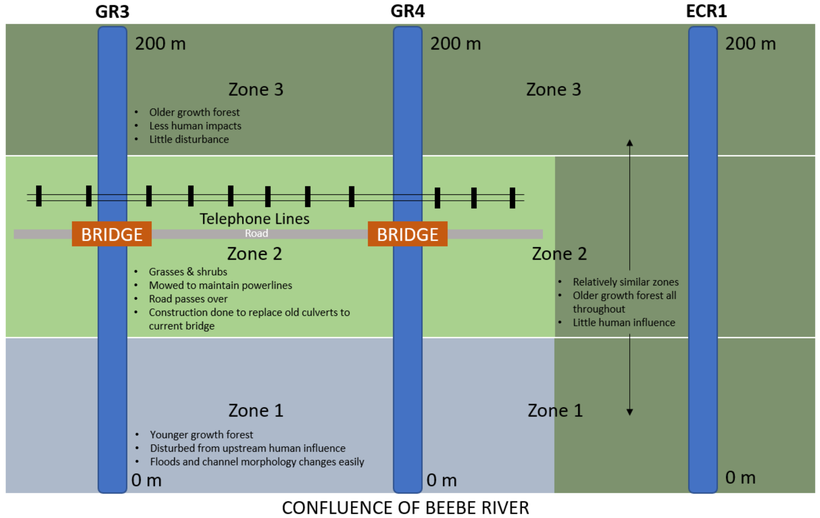


Figure 1

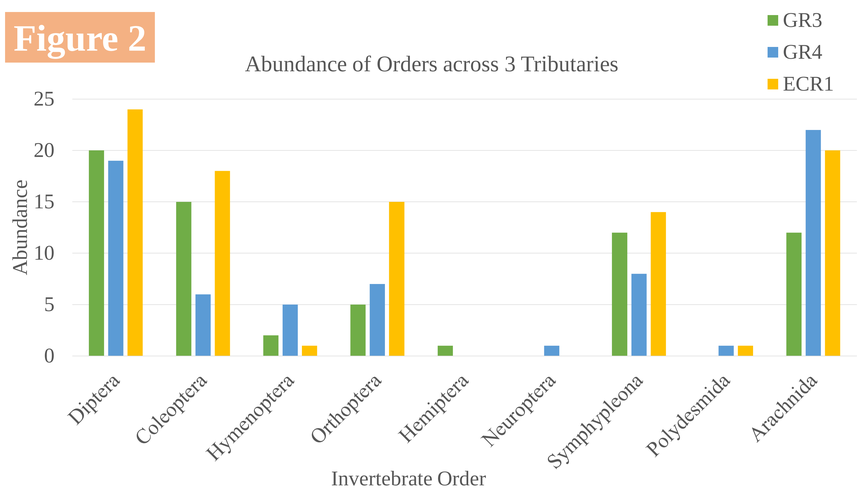
Study site schematic of the three tributaries of the Beebe River and their respective zones

Data Analysis

A. Compared orders of invertebrates across & within tributaries using single factor ANOVA

B. Compared orders of invertebrates between zones and across tributaries using a two-way ANOVA without replication

Figure 2

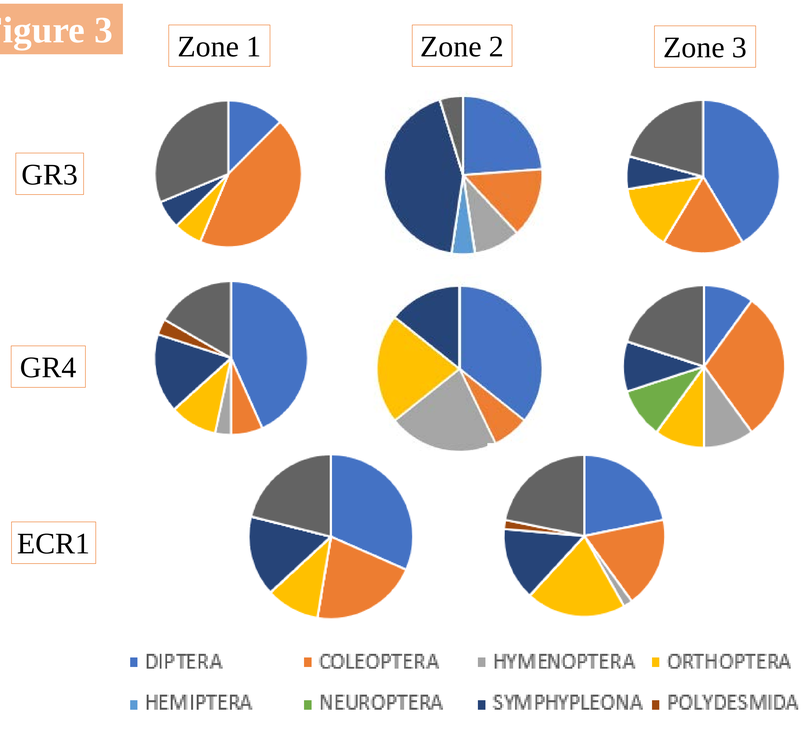


The abundances of 9 terrestrial invertebrates orders in streams GR3, GR4, and ECR1

Spatial Variation Across Tributaries

- ECR1 had the highest abundance of invertebrates (n=93) compared to GR3 (n=67) and GR4 (n=69)
- ECR1 had significantly more Orthoptera than GR3 and GR4 ($F(2,6)= 5.12$, $p < 0.05$)
- ECR1 had significantly more Coleoptera than GR3 and GR4 ($F(2,6)=18.5$, $p < 0.05$)
- No significant difference in order-level abundance between the tributaries for the orders: Symphypleona, Arachnida, Diptera, Hymenoptera, Hemiptera, Neuroptera, or Polydesmida

Figure 3



The abundances of terrestrial orders in zones 1, 2, & 3 of streams GR3, GR4, & ECR1

Within Tributary Variation

- No significant difference in order-level abundance across zones
- Observed trends such as Zone 1 and 3 in both GR3 and GR4 have similar community compositions
  - Zone 2 dissimilar with different dominant orders

Conclusion

- ECR1 (control) had a different community composition of terrestrial invertebrates when compared to GR3 and GR4
- Both GR3 and GR4 have had human induced disturbances
  - This changes the succession of riparian zones which likely affects the types and abundances or invertebrates found there
- Trends in the data suggest that a larger sample size we may see significance when comparing zones within tributaries
  - Additional replications or increasing the number of samples per zone
- Repeating this study at different times of year will allow for a more detailed snapshot of what kinds and how much of allochthonous prey items are available for brook trout
- Coupling this data with aquatic macroinvertebrate data will give more complex level of food subsidies for brook trout

Take-Homes

- The type of riparian zone has implications on the temperature, hydrology, and habitat quality of streams
- Deforestation and agriculture have potential to change riparian zones
- These effects on terrestrial invertebrates can change terrestrial and aquatic food subsidies for the temperature sensitive and threatened species of eastern brook trout

References

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