Determining environmental flow regime in the Pee Dee watershed, SC.

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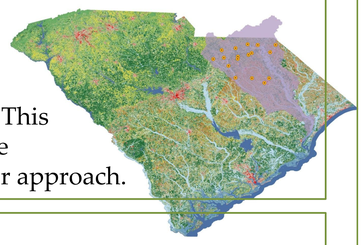
Introduction

The Pee Dee river basin drains 15, 000 km^2 from southern Virginia, North Carolina, and South Carolina. With increasing population density and intense droughts in the region, demands placed on this natural resource are fast approaching an ecological tipping point. There is a need to develop environmental flow requirements (EFRs) that preserve ecosystem integrity while meeting anthropogenic demands. While river ecosystems depend on the magnitude , frequency and duration of flow; humans depend primarily upon a relatively constant water supply. As a result of anthropogenic intervention, many streams lack the minimum flow and variation necessary to sustain natural processes. This study aims to determine statistically significant relationships between hydrological, ecological and geomorphic data collected from 17 sites in the Pee Dee watershed in order to determine EFRs for the watershed. This poster outlines the project, however data are preliminary and serve only to illuminate our approach.

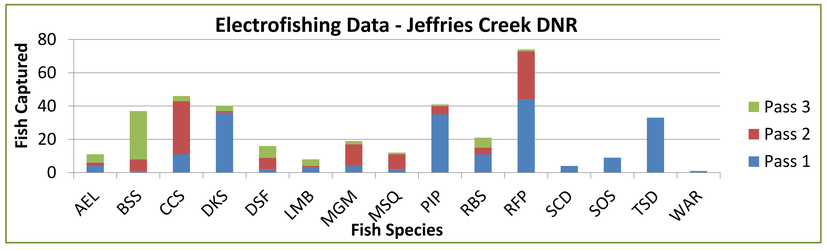


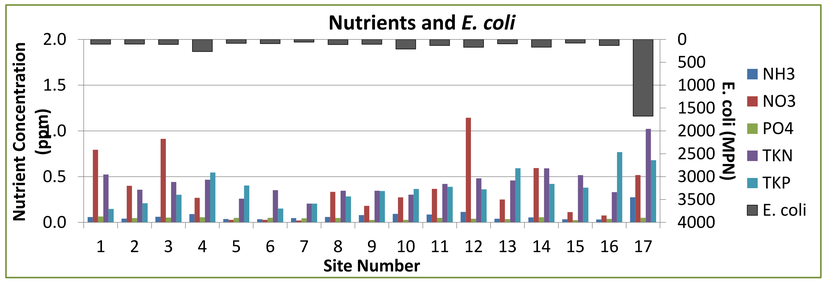
Methods

Flow and water quality measurements at 17 sites in the Lower Pee Dee River basin was initiated in fall of 2009. Monitoring includes the measurement of flow rates, physiochemical parameters, fecal coliform, nutrient concentrations, stream geomorphology, and fish species composition. Monitoring sites were chosen to represent a range of drainage basin areas in order to better represent the area of study.

Fish and water quality

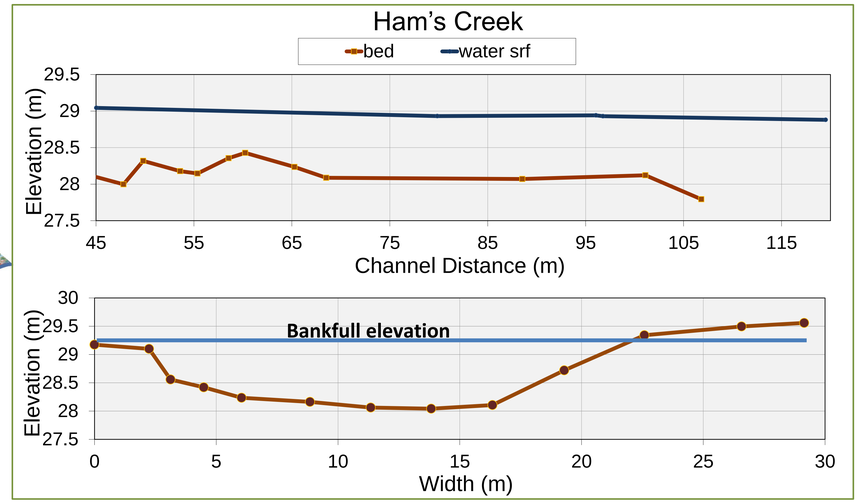
Fish make great indicators of an ecosystem's health because of their relatively high trophic level and dependence on organisms of lesser trophic levels. Indices of population composition will be calculated as possible means of analyzing species composition collected through electrofishing. Another indicator of ecological stability is water quality. Water samples from each site are taken bi-monthly and analyzed for Total Suspended Solids(TSS), Total Volatile Solids(TVS), Total Nitrogen(TN), PO_4, NH_3, NO_3, Total Kjeldahl Phosphorous(TkP), Total Kjeldahl Nitrogen(TkN), Non-Purgable Organic Carbon (NPoC),and Fecal Coliforms.

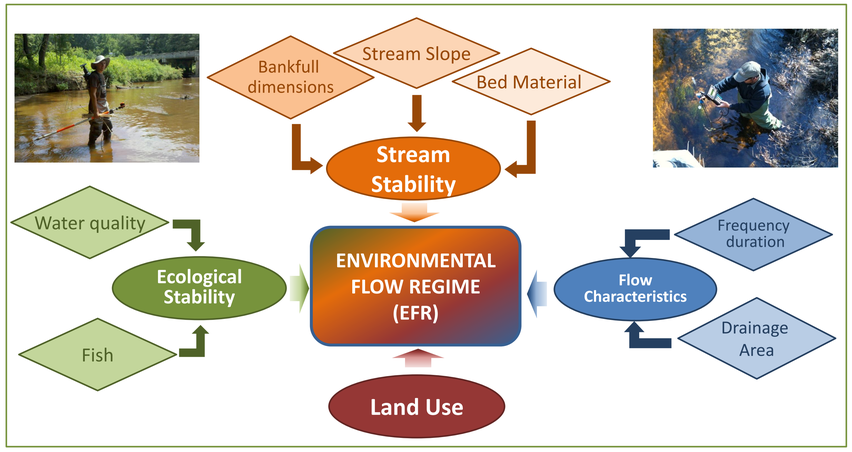




Stream geomorphology

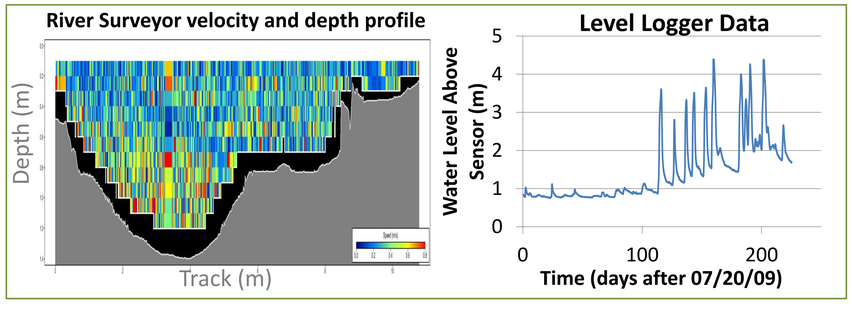
Stream geomorphology was measured per Harrelson et al., 1997. Measurements were made with a total station at wadeable sites and a depth profiler at non-wadeable sites. Bed materials were sampled and characterized at all 17 sites with sieves used to characterize coarse grains, and a particle size analyzer for fines.





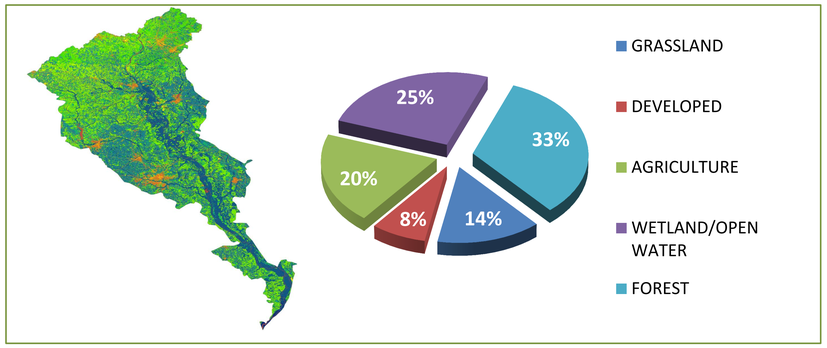
Flow characteristics

Stage data are measured using water level loggers at 11 sites. These data will be converted to flow rates using a rating curve, generated by measuring stream velocity and water surface slope at various flow stages. A current profiler and a wading flow velocity meter were used to measure velocity profiles at a cross section. The remaining 6 sites are located in the Lower Pee Dee subwatershed. and are gaged by the USGS.



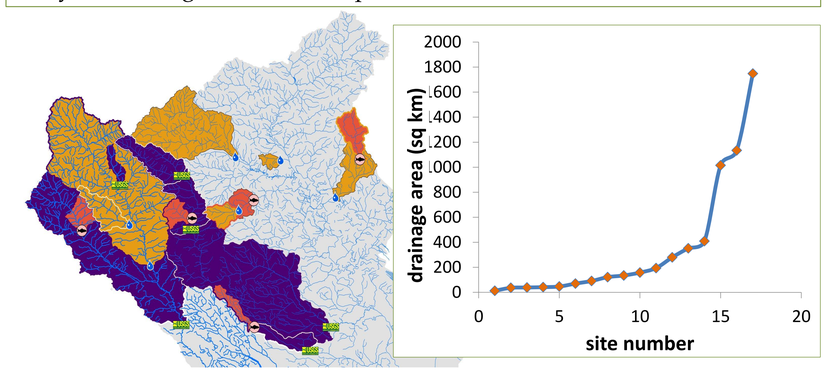
Landuse

Landuse by watershed was derived from NLCD 2001 datasets. The predominant landuse within the study watersheds was forest (33% of drainage area). The percentage of impervious land cover by watershed will also be assessed.



Statistical Methods

A multivariate approach will be performed using measurements of stream form, flow, landuse and watershed size as independent variables, and measures of fish and water quality as dependent variables. In order to determine statistically significant relationships, data reduction of environmental variables will be carried out using principal components analyses and regression techniques.



Conclusions

In order to protect the State's surface waters, regulations are expected to establish allowable withdrawal rates. By establishing EFRs in surface waters, South Carolina can reasonably legislate water withdrawal strategies that will ensure stream ecological health while ensuring that human needs are met. Ultimately, a well-informed development and implementation of a Pee Dee EFR will enhance and protect South Carolina's Pee Dee river, while setting a precedent for similar watersheds in the region.

References

Harrelson, C.C; Rawlins, C.L.; Potyondy, J.P. 1994. Stream channel reference sites: an illustrated guide to field technique. Gen. Tech. Rep. RM-245. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 61 p.

Acknowledgments

The Pee Dee Endowment Fund; Paul Conrads, USGS; Brian Williams, Leah Gregory, and Jeff Vernon, Clemson University.