

# Evaluating a Stream Classification System in the Mid-Atlantic US

## Using Discriminant and Cluster Analysis

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### Stream classification systems are useful communication tools

They are also used to make decisions regarding restoration and management. The Rosgen (1994) system has been the most widely adopted in the US, despite unanswered criticisms. These criticisms include the limited data set with which the system was developed, lack of peer-review and field testing, and application outside of the region of development (Miller and Ritter, 1996; Doyle and Harbor, 2000; Juracek and Fitzpatrick, 2003).

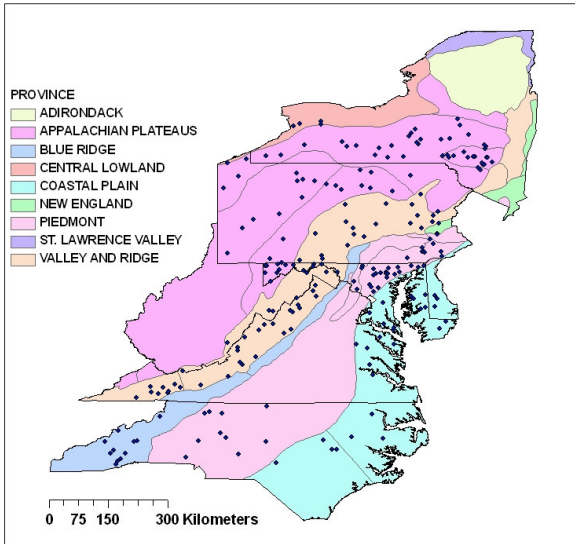


Figure 1. Map of stream gaging sites used in analysis (N = 272, 119 w/complete records).

### Discriminant analysis was conducted using data collected in the mid-Atlantic

Rosgen's three "delineative criteria" necessary to classify to Level I were used: 1-entrenchment ratio, 2-sinuosity, and 3-width:depth ratio. Sites missing any of the delineative criteria were eliminated from the analysis. Quadratic linkage was utilized because the covariances of the stream classes were unequal.

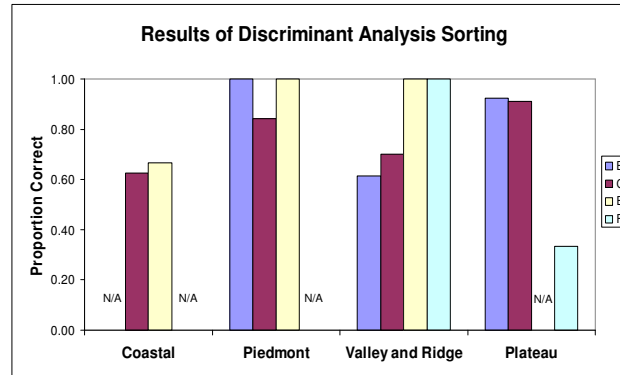


Figure 2. Proportion of streams correctly sorted into Rosgen Level I stream class (N/A: no streams of type in region).

### Correct sorting to Rosgen Level I class depended on physiographic province

Streams in the Piedmont and Appalachian Plateaus were sorted into the correct class more often than streams in the Coastal Plain or Valley and Ridge. C-type streams were sorted incorrectly more often than any other type.

### Four variables were chosen by qualitative analysis for clustering

Slope, width:depth ratio, sinuosity, and mean D50 were selected as the variables that accounted for most of the variability in stream characteristics. Correlated and categorical variables were eliminated. K-means clustering appeared to be controlled by a few dissimilar streams leading to most being sorted into two clusters. Ward linkage hierarchical clustering produced clearer clusters. The clusters were validated using discriminant analysis (N = 24).

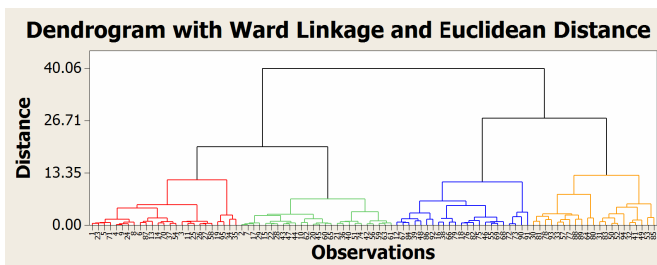


Figure 3. Hierarchical clustering scheme for eastern US streams on four variables (N = 95).

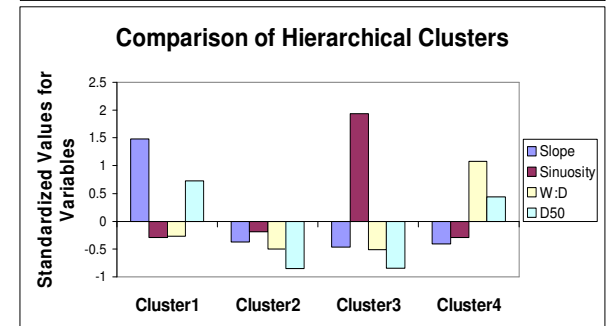
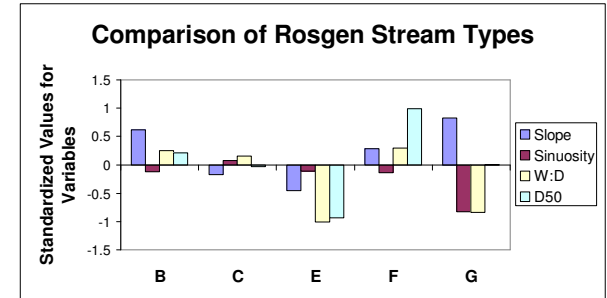


Figure 4. Standardized value of Rosgen stream types and Ward linkage hierarchical cluster centroids.

### The clustering scheme was analyzed and compared to Rosgen classes

The clusters differ from the Rosgen stream types (Fig. 4). The new clusters are characterized by the deviation of the value of one or more standardized variables from the average. Generally, the mean values of the Rosgen stream type variables are more similar to the overall average (standardized value close to zero), implying the system is not distinguishing streams well from each other.

### Summary

While more data and analyses are needed, our preliminary results suggest that the use of Rosgen's stream classification system for eastern streams may not be appropriate. Caution should be used when applying a stream classification system developed in other regions.

### References

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- Juracek, K. E., and F. A. Fitzpatrick. 2003. Limitations and implications of stream classification. *Journal of the American Water Resources Association*. 39 (3): 659-670.
- Miller, J. R., and J. B. Ritter. 1996. An examination of the Rosgen classification of natural rivers. *Catena*. 27 (3-4): 295-299.
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