

Riparian Zones and Phosphorus Concentrations of Nineteen Tributary Sites in The Lamoille River Watershed, Vermont

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Introduction

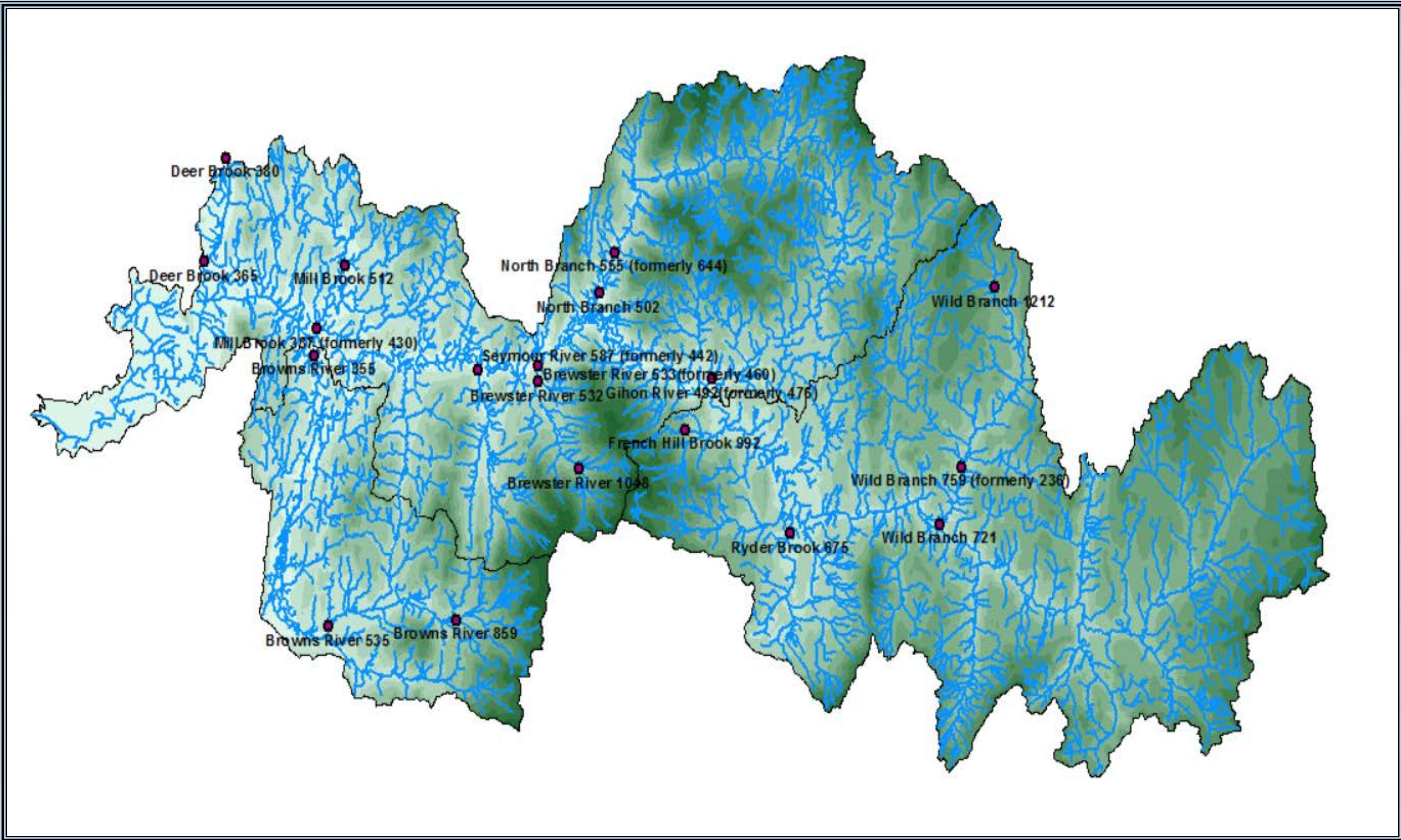
Riparian areas are vegetated areas along the banks of rivers. The riparian buffer zone includes the floodplain and wetlands alongside the river or stream. Riparian zones regulate water temperature and light, support channel and floodplain stability, enhance water quality, food supply and support natural communities. Riparian zones also support aquatic food webs, provide habitat for rare, threatened and endangered species, and aid in the removal of pollutants from runoff.

Phosphorus, is a naturally occurring essential nutrient in aquatic food webs; however, due to human influence, nutrient enrichment of this chemical often drastically alters stream health. Phosphate enrichment of rural freshwater streams is common because large amounts of phosphorus enter by agricultural runoff (mainly animal excrement used as fertilizer) and chemically engineered fertilizers spread on land ². A healthy riparian buffer zone serves to filter phosphorus before it enters a stream.

The purpose of this study was to determine if any correlation existed between riparian buffer width and total phosphorus concentrations in the nineteen tributary sites of the Lamoille River.

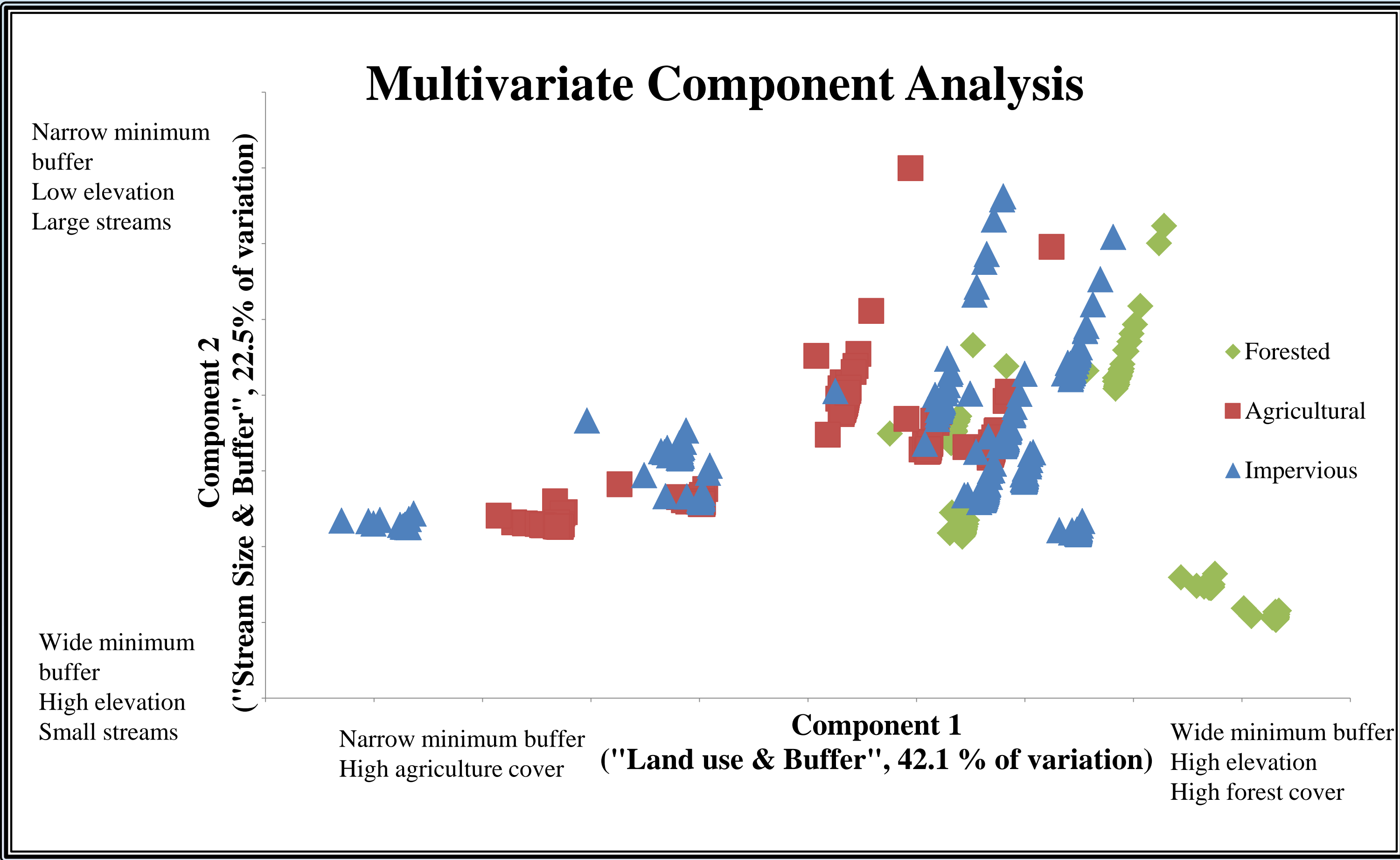
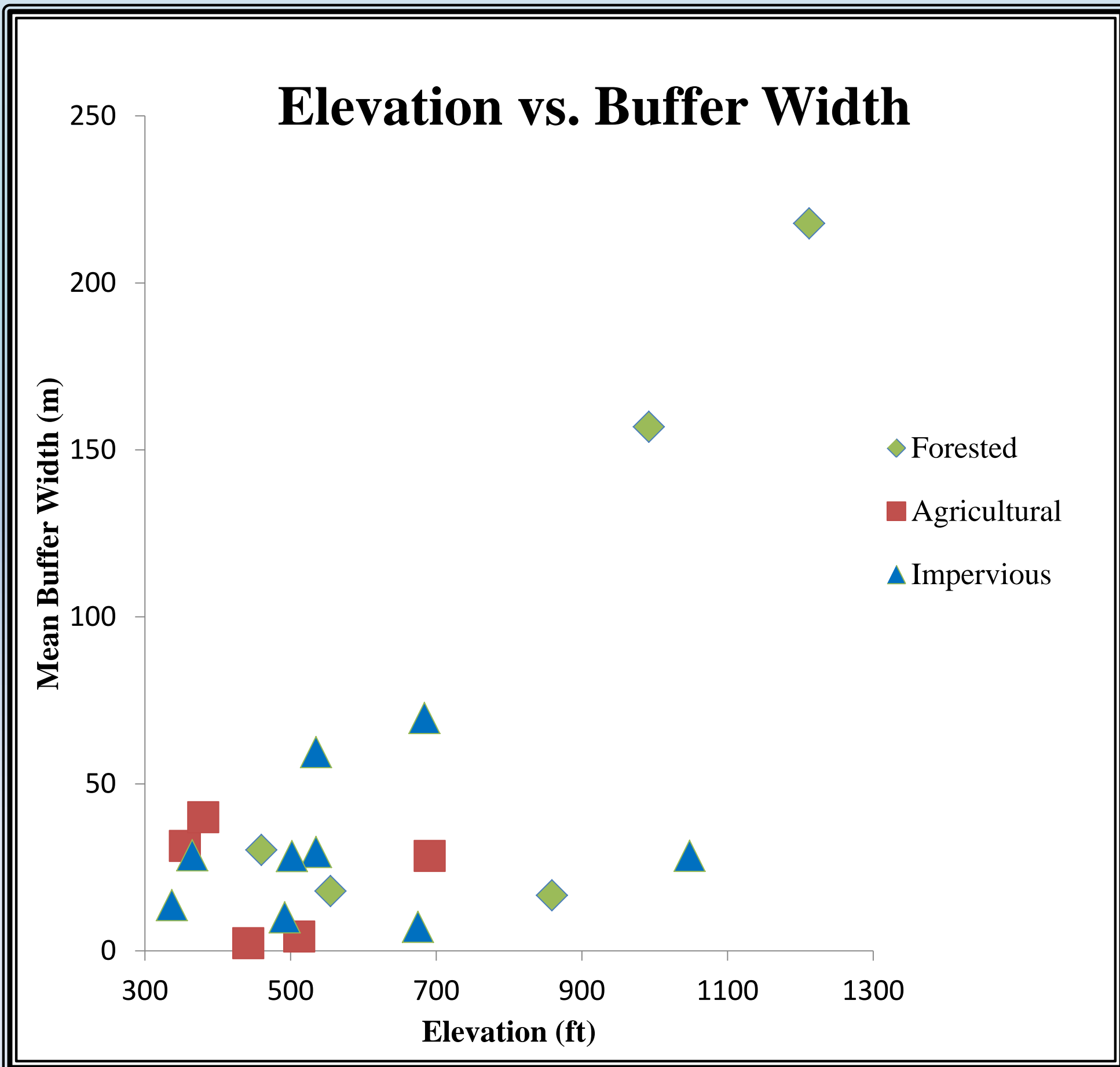
Materials and Methods

Stream water samples were collected from each site weekly during the summers of 2008-2012. The samples were processed using the ascorbic acid method with digestion to get a total phosphorus (TP, µg P/L) concentration. A FlowTracker (Sontek/YSI Inc., San Diego, CA) was used to determine stream width and discharge for each sampling period. Stream width data for each site was averaged to obtain an average width. GoogleEarth was used to determine average buffer width by averaging buffer width measurements from along the right and left bank, 100 meters upstream and downstream along right and left banks, and 200 meters upstream and downstream along right and left banks at each site location. Principle components analysis was used to simplify interpretation of multiple correlations between the variables.



Results

- Multivariate analysis indicated stream sites with wider average buffer width were correlated with being located at higher elevations and having a higher percent forested land use. These areas have significantly lower percent urban and agricultural land use.
- It was also determined that stream sites with smaller average buffer widths are correlated with being located at lower elevations and have a wider average stream width with higher discharge.
- Total Phosphorus is independent and has no correlation to any of the variables studied.



Conclusions

As much of the low-lying land in the state of Vermont has been settled or farmed, it is no surprise that areas of higher elevation tend to have more forest and are generally less disturbed (resulting in wider average buffer width). Because of our mountainous terrain, areas of higher elevation are less suited for living and even more less suited for farming which explains how higher elevations are negatively correlated with agricultural and impervious land use.

Likewise, areas of lower elevation are strongly correlated with high agricultural and impervious (urban) land use and tend to have wider streams with a greater discharge (output flow). Increased disturbance along stream banks as the result of increased agricultural and impervious land use is a probable explanation for the decreased buffer along stream banks. The lower elevation of such streams allows for more runoff to be channeled by the streams, resulting in greater stream width.

A very weak association was found between total phosphorus concentration and the width of riparian buffer zones. It may be that focusing the analysis of total phosphorus concentration in relation to other variables, such as during storm events, would provide additional insight.

Acknowledgments

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Literature Cited

- Vermont Agency of Natural Resources. 2005. Riparian Buffers and Corridors, Technical Papers, Waterbury, Vermont.
- Phosphorus: Water Monitoring and Assessment, EPA. 28 January 2013. <http://water.epa.gov/type/rs/monitoring/vms56.cfm>