

Potential effect of corn production and riparian zone on Primary Headwater Habitat in the Upper Sugarcreek Watershed, Ohio.

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INTRODUCTION

Corn production is a major component of the United States agricultural system. The nutrient and sediment runoff from corn production may cause impairment of adjacent primary headwater streams as well as hypoxia downstream. Riparian buffer zones have been effective in reducing the amount of substrate and nutrient deposition into streams resulting from crop production. The quality of these primary headwater streams are determined by their physical, chemical, and biological properties. The Ohio Environmental Protection Agency (OEPA) has developed standardized evaluation systems for classifying streams based on these three components. Using these evaluation systems, this project examines how corn production and riparian zone quality affect the substrate composition and water chemistry of primary headwater streams.



Riparian zone



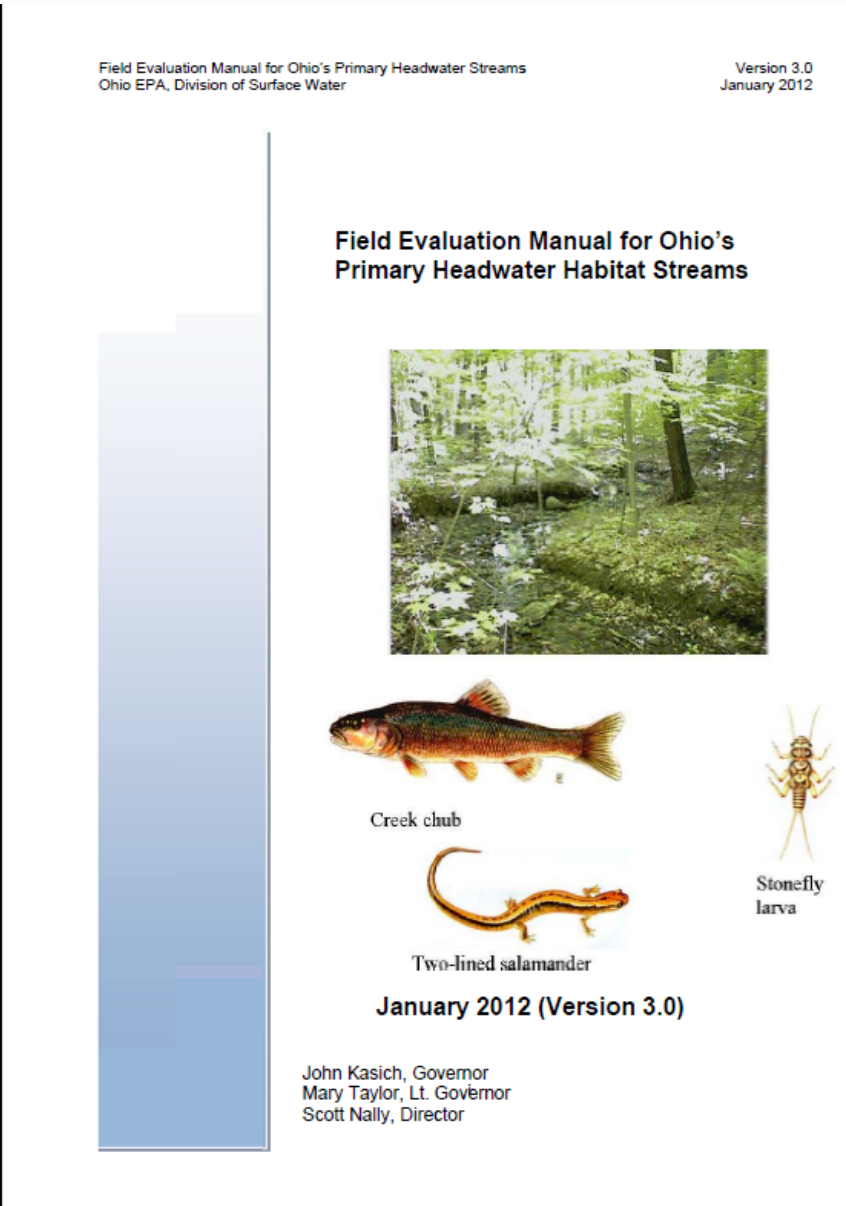
In 2008, a study was conducted in the Upper Sugarcreek Watershed of Ohio to establish a database for all the primary headwater habitats. This database includes the Headwater Habitat Evaluation Index (HHEI) and the Headwater Macroinvertebrate Field Evaluation Index (HMFEI) developed by the OEPA. The 2012 study was conducted in the same Watershed with a focus on the effect of corn production. This region is dominated by agricultural activity including crop production and dairy farms. USGS satellite images were examined to determine the proper locations of sample sites.



Two important factors that affect site selection are floodplain and riparian zone. For the selected sites, the floodplains are **mostly** composed of row crops and pasture, the riparian zones range from nonexistent to wide (0-10 meters). A total of thirty four sites meeting specified requirements were sampled during this study.

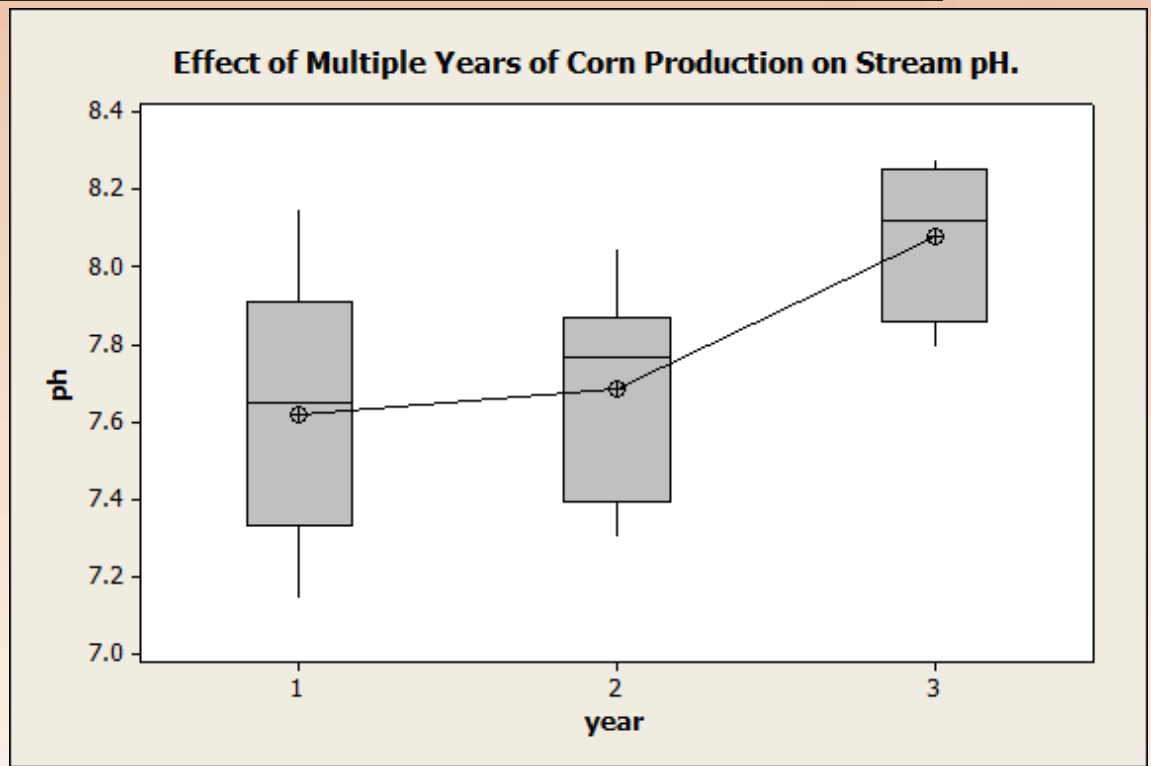
MATERIALS & METHODS

- The Headwater Habitat Evaluation Index (HHEI) was developed by OEPA in order to classify Primary Headwater Habitat (PHWH) streams. Primary Headwater streams are relatively small streams that have a drainage area of less than 1.0 mile². The health of these primary headwater streams have proved to be important in determining water quality and biology in larger streams. The HHEI measures three parameters when classifying streams: maximum pool depth, substrate composition, and bank full width. Upon classifying each stream, an average of each measurement is collected and a corresponding score is given. The better the habitat for macroinvertebrates and salamanders, the greater the HHEI score. After examining measurements and the overall score, a flow chart is used to determine the class (I, II, III) of the PHWH stream.

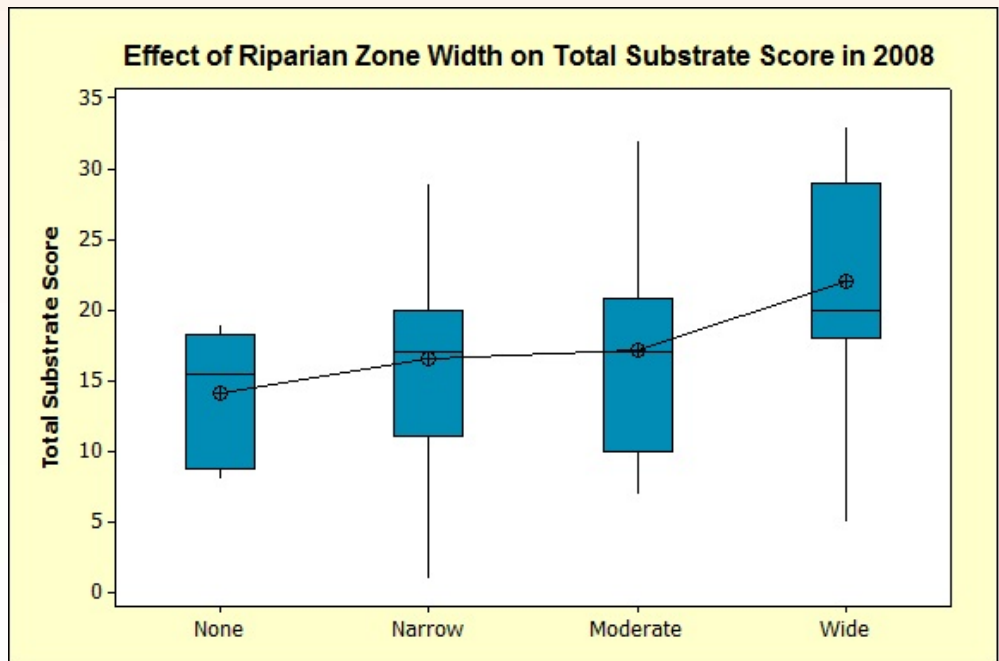


- The Headwater Macroinvertebrate Field Evaluation Index (HMFEI) is used to evaluate the benthic macroinvertebrate community of PHWH streams. The HMFEI is a rapid field level biological assessment in order to classify macroinvertebrates to a Family or Order level. Based on their taxonomy, they are assigned different scores and the total HMFEI score is used to categorize PHWH streams into three levels.
- The chemical properties of the stream are measured by using the Hydrolab Quanta Multiparameter Sonde before the field evaluation is conducted. Parameters measured include: temperature, pH, conductivity, dissolved oxygen, turbidity.

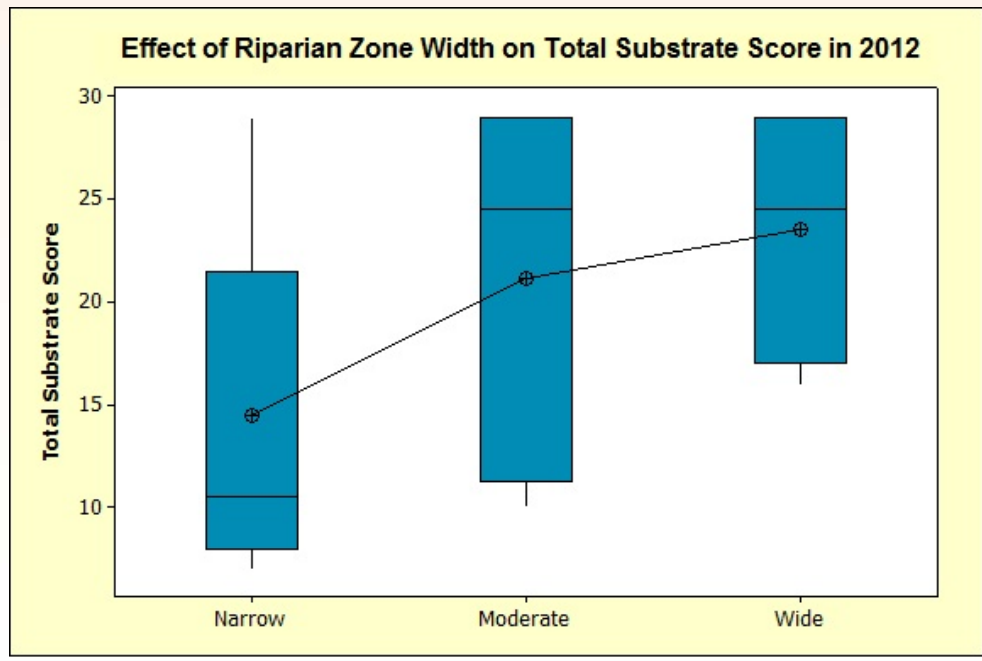
RESULTS & DISCUSSION



P = 0.041

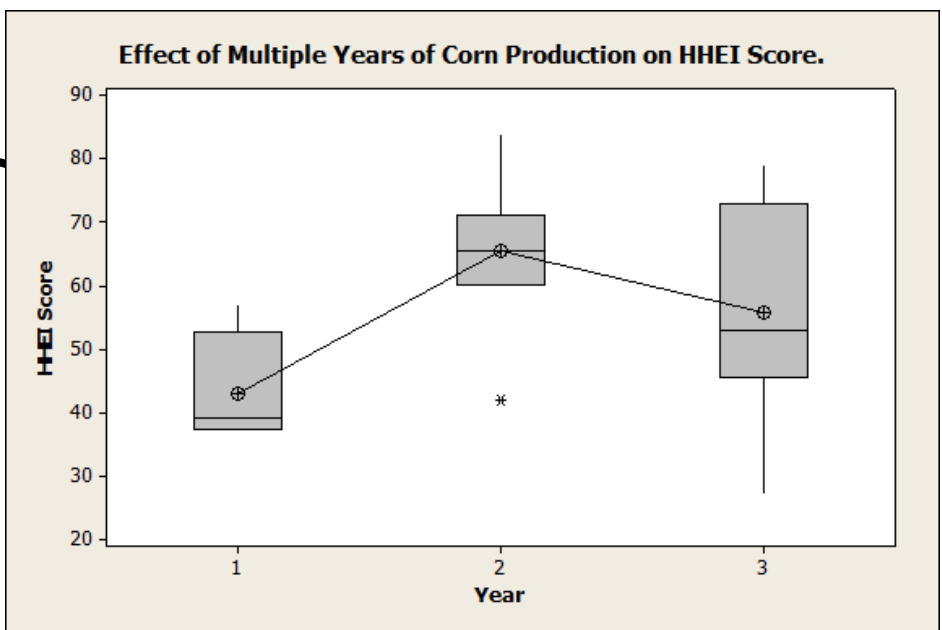


P = 0.006



P = 0.022

Year 1 in the graph on the right includes the information from fields having only one year of corn production. Year 2 includes two and three years of production. Year three has four, five, and six years of production.



P = 0.031

Discussion

Past studies show that streams with a smaller riparian zone are more subject to runoff and siltation which can have a negative effect on the overall health of the stream. The data obtained from this study supports that previous research, by proving a statistical significance between total substrate score and riparian zone width. A statistical analysis showed that corn has a definite effect upon the HHEI score, and stream pH. This effect could harm the ecosystem so further research is warranted. Our sample size was very small so a larger sample would achieve better results.

CONCLUSION

The hypothesis that streams with a wider riparian zone will have a larger total substrate score was confirmed. The hypothesis that corn production would cause the pH of the stream to decrease was rejected. The HHEI score of streams successively surrounded with corn increased at first; opposing the hypothesis that corn negatively impacted habitat. However after several corn plantings HHEI scores decreased so the hypothesis was upheld over all.

ACKNOWLEDGEMENTS

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