

ABSTRACT

Invasive European earthworm species have become prominent in a variety of Northern US forest soils, including the Driftless Area of Southeastern Minnesota. This research seeks to determine the variety of species found along the Root River located in this previously unglaciated region. Earthworms were sampled using liquid mustard extraction at three separate locations along the Root River in October of 2017. The site locations included a floodplain, a picnic area, and a heavily forested area near a bike trail that follows the river. Soil samples were collected at these three sites which were used to measure soil pH, moisture content, and calcic granules to determine the impact of invasive earthworms on the soil. The earthworms were preserved by anesthetization in alcohol and then later identified. A wide variety of species were identified from the Lumbricidae family including many juvenile earthworms, however, no native species were identified despite being an unglaciated area. All of the soil samples were slightly alkaline with a pH between 7.43-7.83 conducive to the European earthworms. To expand upon this survey sampling outside the range of human activities in the Driftless area should be done to determine if native species are present.

BACKGROUND

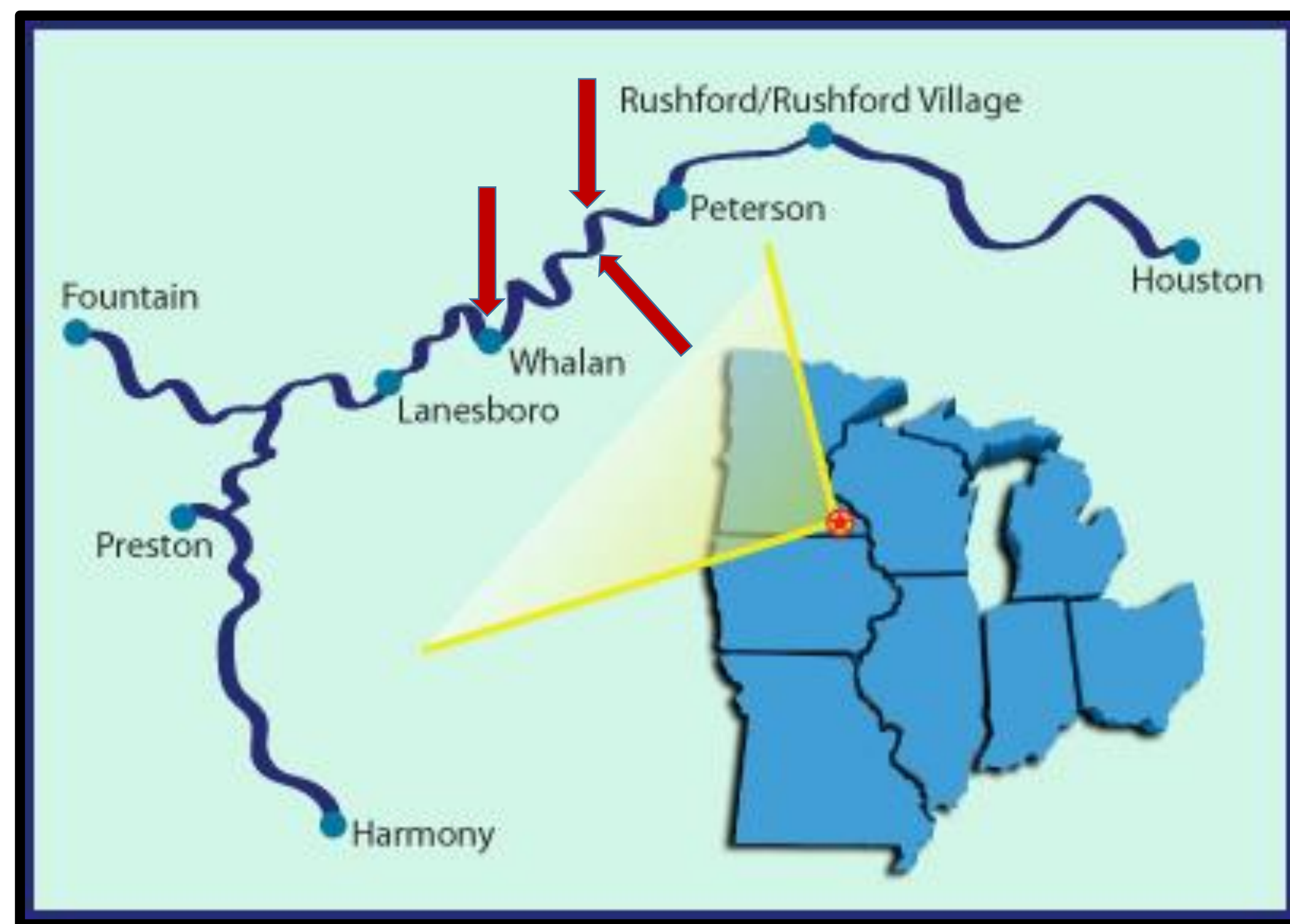
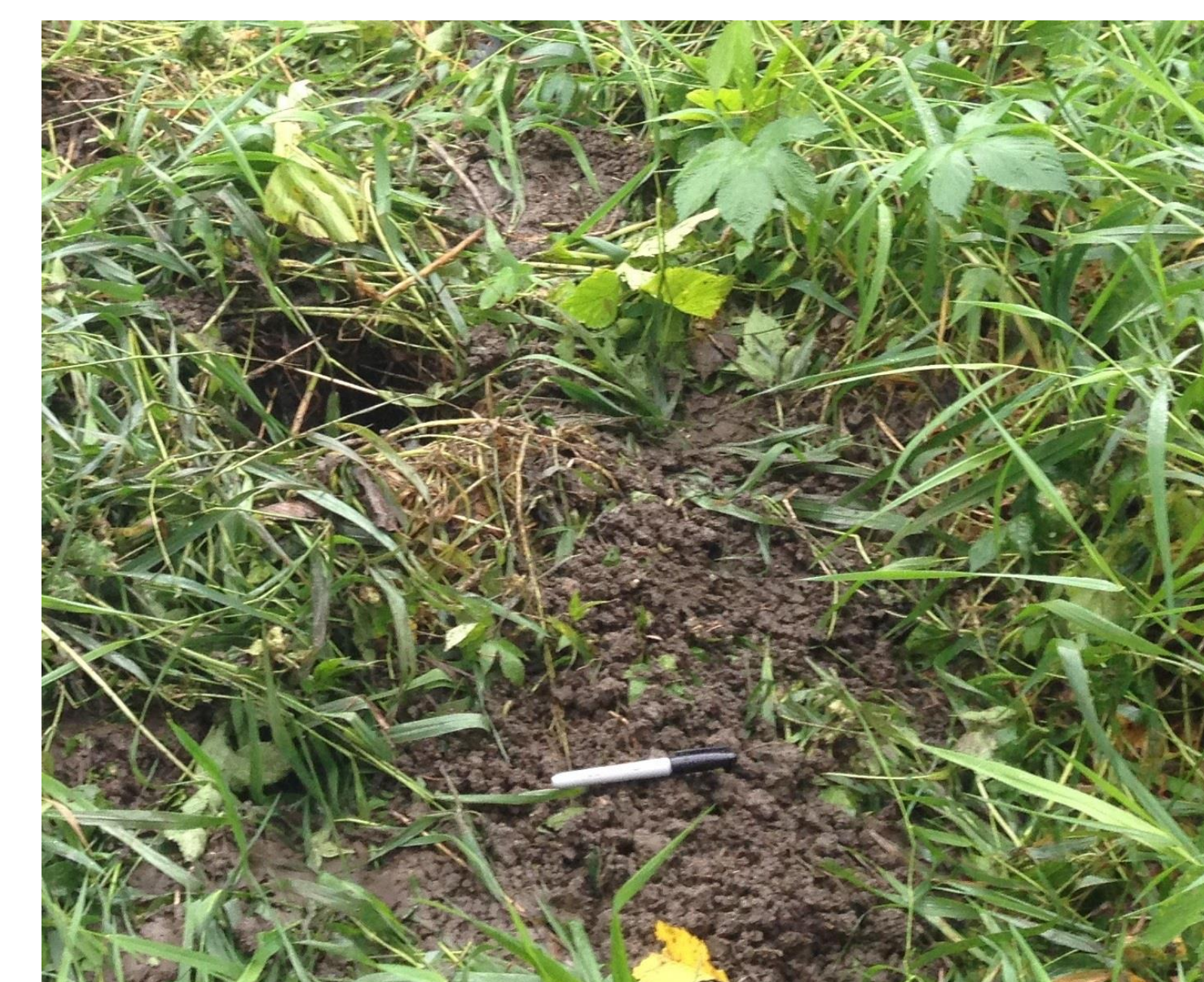


Image from Root River Trail Towns Website

The Root River is located in the Southeastern Region of Minnesota, also known as the Driftless Area, a previously unglaciated region of the Midwestern United States. During the 1700s when European settlers colonized the area they introduced non-native earthworms to the region. Within the past twenty years there has been a growing amount of research on the effects of the European earthworm invasion on ecosystems, soils, crops, and many other properties of the Great Lakes region. However, there has been little consideration about the possible presence of native earthworm species in this region of Minnesota where glaciers did not cover the land. We identified three sites along the river where the presence of earthworms were likely and collected soil and earthworm samples at each. Based off of how the soil properties were effected and what species were identified we determined whether the soil properties were characteristic of native or invasive earthworms.

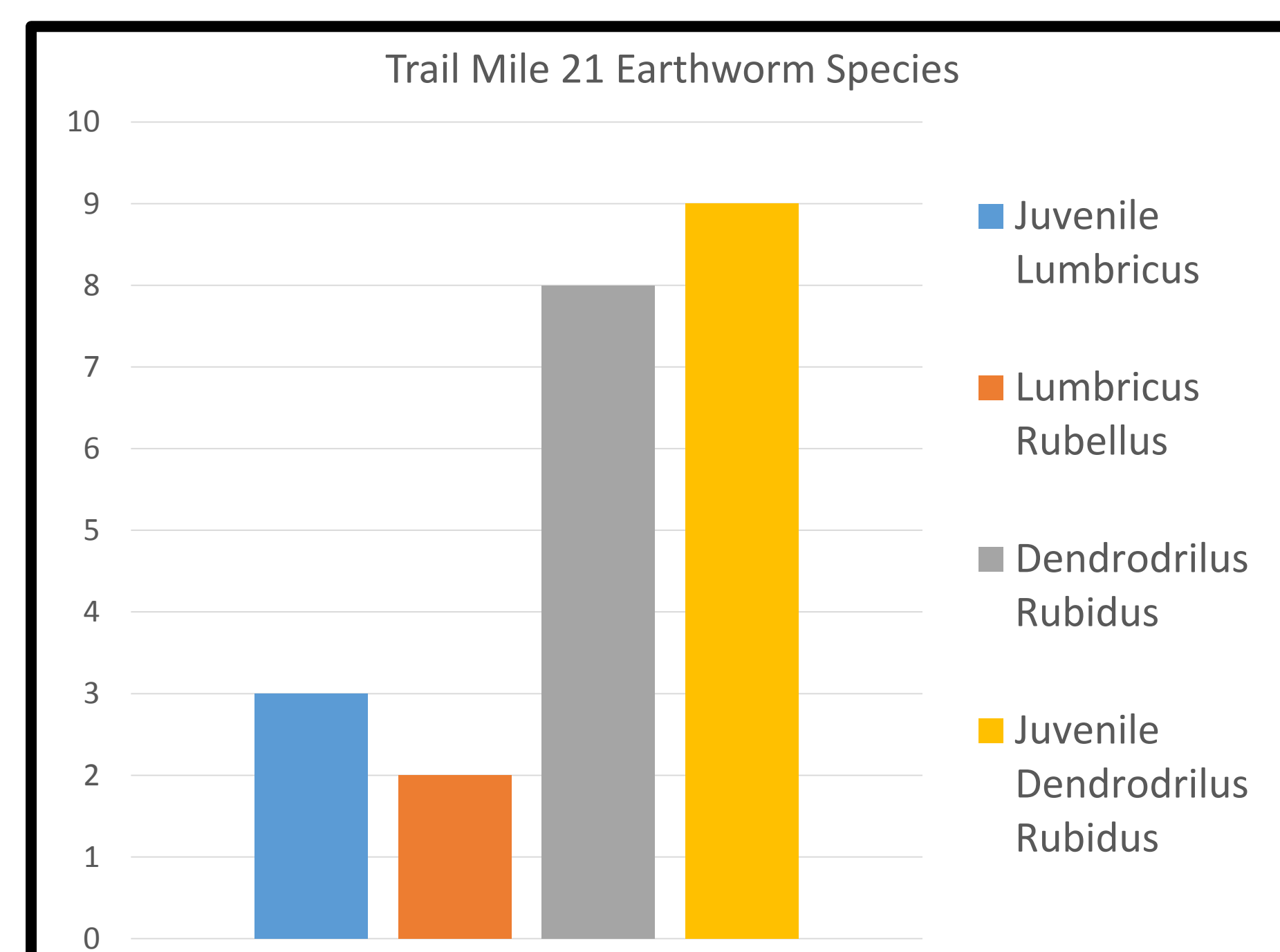
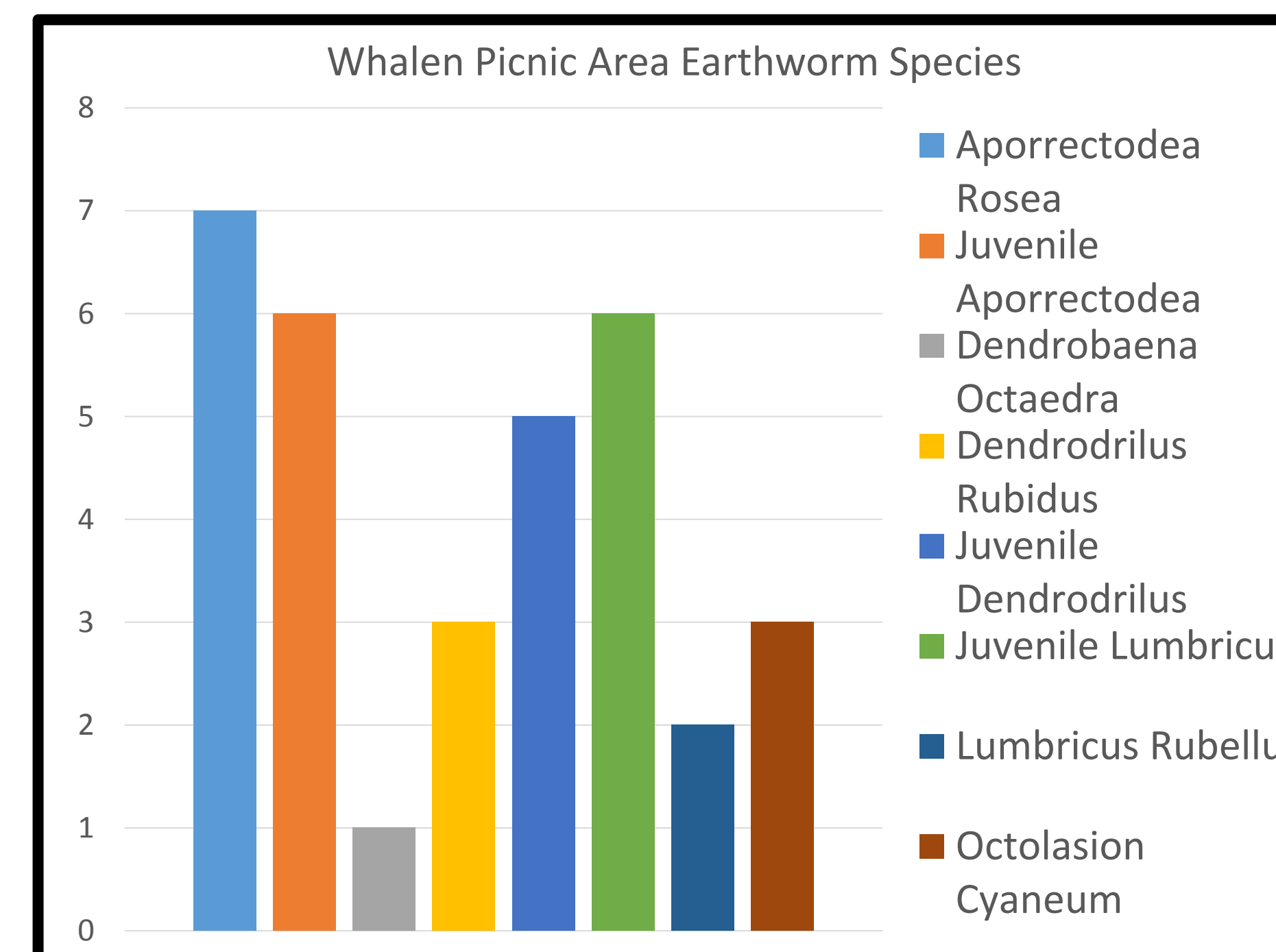
METHODS

- Earthworm Sampling: liquid mustard extraction used at three separate sites including the Whalen Picnic Area, Trail Mile 21, and Trail Mile 23
- Earthworm Identification: Lab observations and identification were done from defining characteristics observed during analysis
- Soil moisture content and pH was measured in both the field and lab and was determined by using soil samples collected at each site along the river
- Measured out 200g of a sieved soil sample (>500um), dried the sample, then placed it in a petri dish to examine for calcic granules under microscope

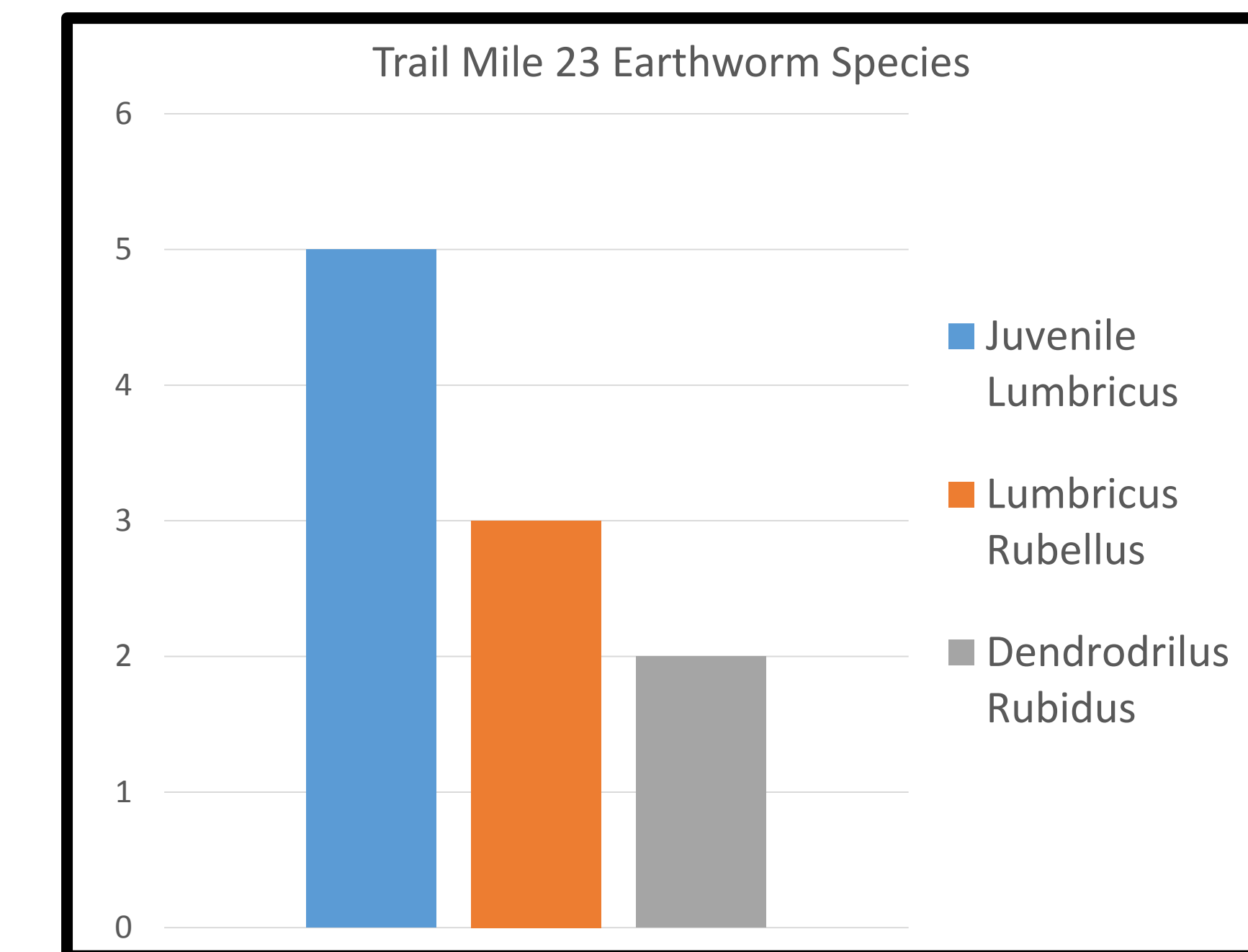


RESULTS

The Whalen Picnic Area had the greatest variety and number of earthworms sampled. This is primarily due to its proximity to human influence that the versatility of European species is higher. There was also a slightly higher soil pH due to the number of earthworms present. The soil moisture content was unexpectedly lower at this location despite the abundance of earthworms.



At Trail Mile 21 the earthworms were less diverse than the picnic area. More Dendrodrilus Rubidus were identified. These are commonly used as fish bait so their presence closer to the river is likely correlated with human activities. There was a very high soil moisture content at this site due to its proximity to the river and floodplain.



The Trail Mile 23 site did not have as many earthworms as the other sites. Only two species in addition to the juvenile lumbricus earthworms were identified. Despite the lack of earthworm abundance, the site had a slightly alkaline soil pH of 7.59. The site was forested further away from the trail, which indicates that decreased human interaction has led to fewer invasive earthworms.

Site Location	Lab pH	Moisture Content %
Trail Mile 23	7.59	24.71
Whalen Picnic Area	7.83	13.93
Trail Mile 21	7.43	27.35

CONCLUSION

- No native species were identified at any of the three sites despite these areas being unglaciated.
- The wide variety of species found at the Whalen Picnic Area is most likely due to the high amount of human activity at this location.
- Most of the species identified were from the Lumbricidae family including a large number of juvenile earthworms.
- The slightly alkaline pH, relatively high moisture content, and presence of calcic granules at the sites are characteristic of invasive European earthworms.
- To expand upon this survey and research, sampling beyond the influence of human activities in the Driftless area of Minnesota should be done to determine if native earthworm species are in this unglaciated region.
- Expanding beyond Root River into forested ecosystems of the Driftless Area may have a higher likelihood of native earthworm populations due to lack of human interaction.

REFERENCES

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2. Frelich, L. E.; Hale, C. M.; Scheu, S.; Holdsworth, A. R.; Heneghan, L.; Bohlen, P. J.; Reich, P. B.; Earthworm invasion into previously earthworm-free temperate and boreal forests. *BIOLOGICAL INVASIONS* 8:1235-1245. 2006
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