

Earthworm Abundance as a Soil Health Indicator in Agro-Ecosystems

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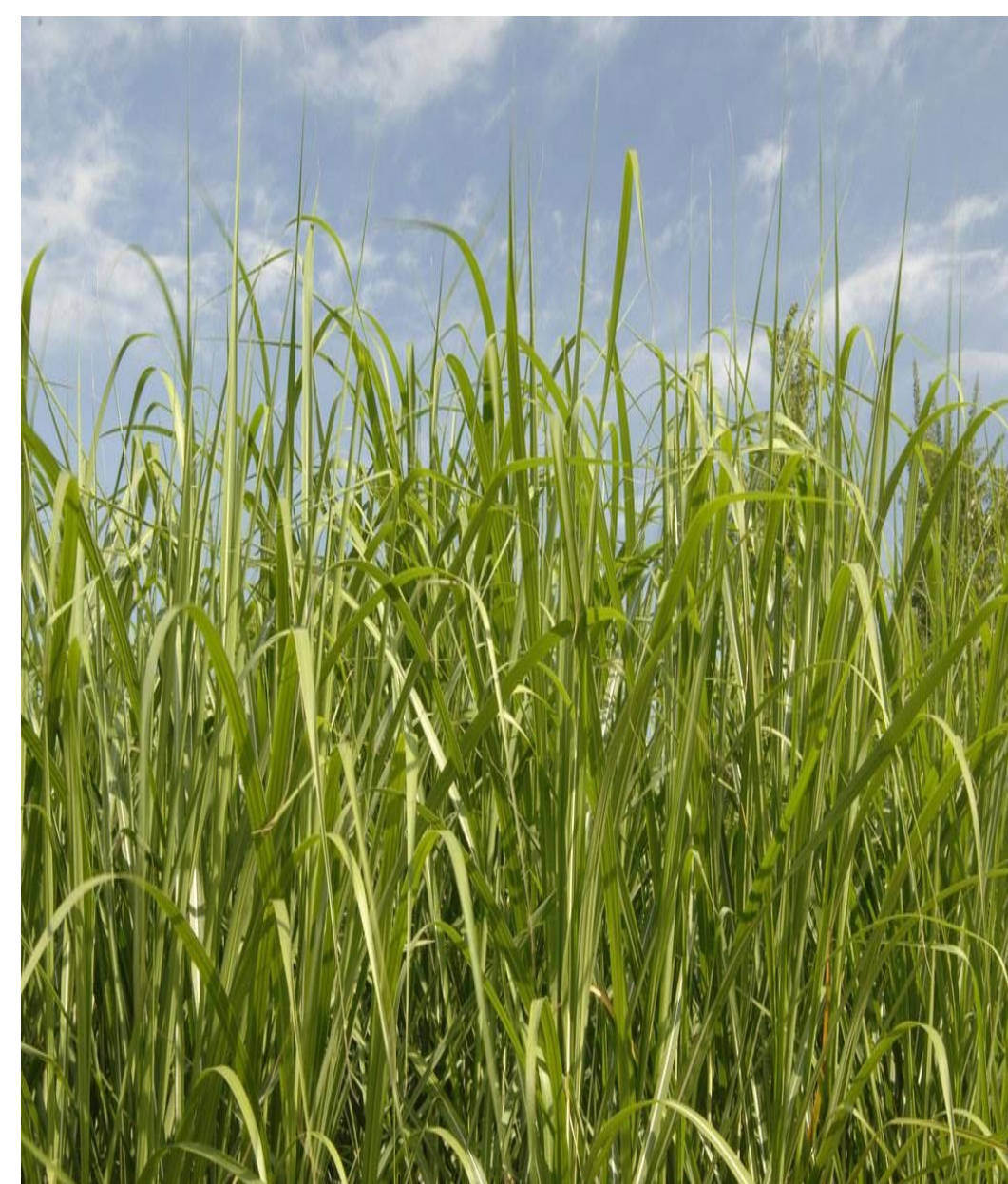
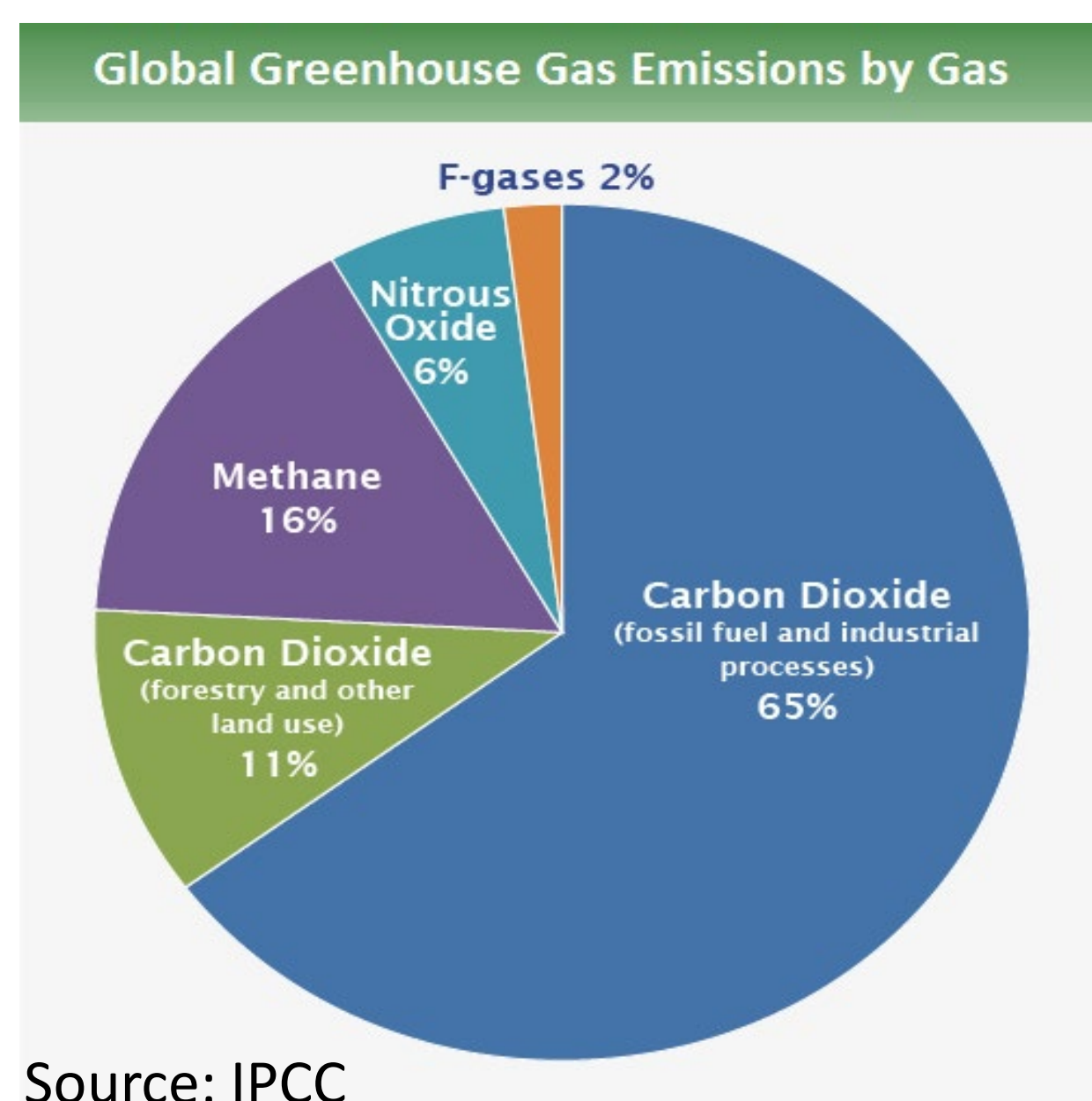
Objective

To investigate earthworm abundance as an indicator of soil health in perennial grass agro-ecosystems.

Rationale

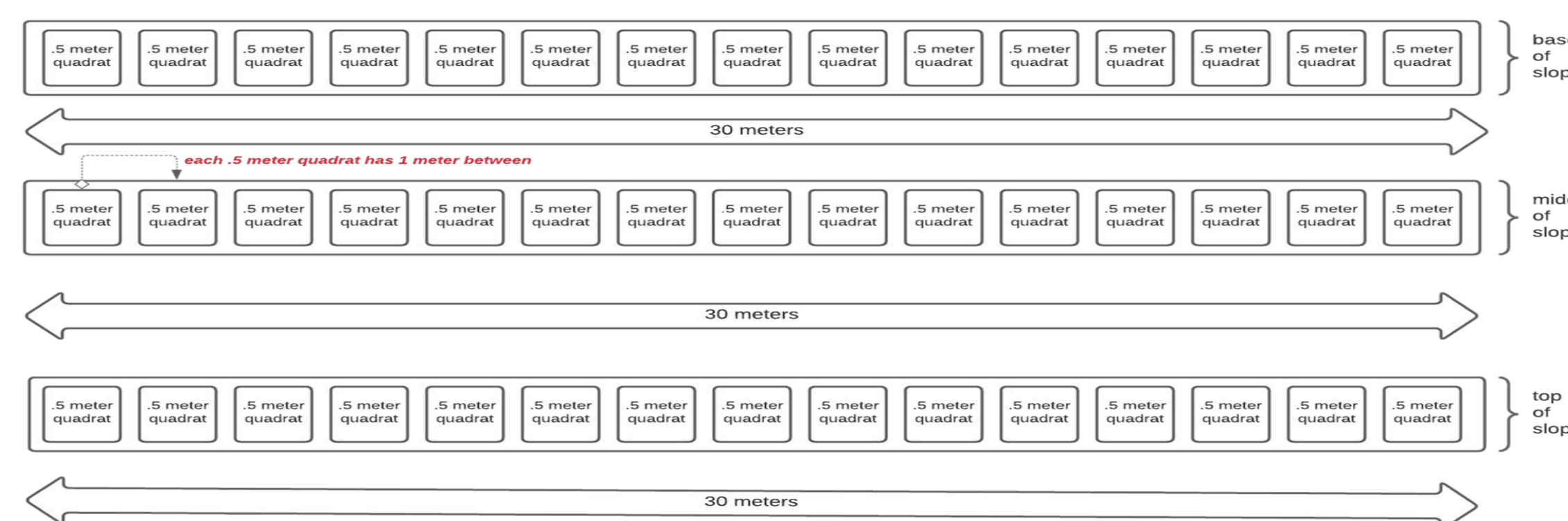
With the increasing effects from climate change, alternative fuel sources are being more widely investigated. According to the International Panel for Climate Change (IPCC), more than half of all global emissions come from fossil fuel use, driving the severity of climate change effects. Biofuels, like switchgrass, can begin to mitigate these effects while providing a fuel source needed. Secondary benefits to farming this warm-season perennial grass crop enhance soil ecosystem services like erosion control, carbon storage via sequestration, and improved water and nutrient cycling. Yet, little is known about how this land use effects soil health on already existing agro-ecosystems.

Since earthworms are an excellent indicator of soil health and fertility in agro-ecosystems, this investigation set out to identify how earthworm abundance could be used as an indicator of soil health in perennial grass agro-ecosystems.



Methods

- Three 30-meter transects used on a 3 acre farm.
- 15 half-meter quadrats used along each transect with 1 meter between each quadrat.
- Mustard powder extraction used to exact worms from soil. One gallon of water to 45g of mustard power per quadrat.
- Mean abundance of earthworms, soil moisture and temperature, and weather conditions noted.
- Classification chart used to compare potential soil health to mean abundance of earthworms/ transect.



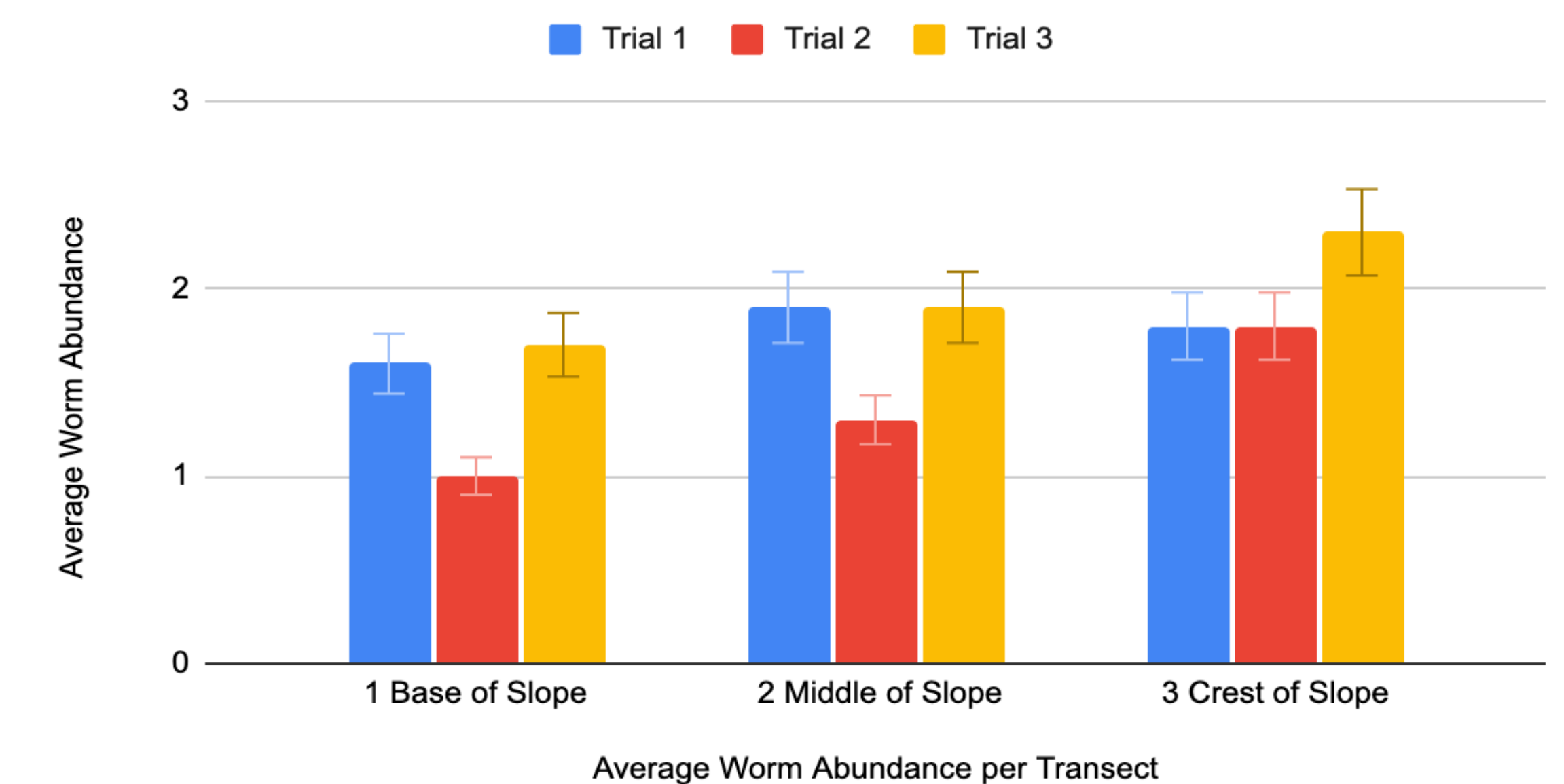
Classification	Average number of worms (per transect)
Excellent	≥5
Good	≥3 - ≤5
Moderate	≥1 - ≤3
Poor	<1

Results

Terrestrial worms found prior to switchgrass planting act as baseline data for future soil health indicator comparison. No statistical difference in worm presence among transects was found prior to planting and within three days after planting. Yet, more worms were noticed at the summit. Soil health measured prior to planting indicated healthy levels of nitrogen (N), potassium (K) and carbon (C). Literature reviewed suggests a higher mean earthworms abundance in farm fields with higher organic matter (OM) and K levels.

Results continued ...

Average Worm Abundance per Transect over three trials



Earthworm abundance is noticeably higher during the third trial. Heavy rain the day before is thought to be a driving factor in seeing a larger abundance.

Conclusions

- Worm abundance was higher at the top of the slope but statistical analysis offers little delineation to support the impact on soil health with the data collected from this investigation.
- Literature reviewed suggests a greater number of earthworms found in agro-ecosystems yields a wider variety of ecosystem services. Decomposition, mineralization of nutrients, and water and gas exchange are among the most noticed, along with pest control and soil restoration.
- Using the classification chart, soil health is in the moderate range but may improve over time as switchgrass field become established.

Recommendations for Future Work

1. To survey the field each year after plantings to compare worm abundance, biomass and soil health statistics.
2. Survey and reassess during early spring with earthworms are most active. Compare results to crop establishment and harvest. Ideally, researchers would notice an increase in worm abundance as fields become established.