Rain Gardens

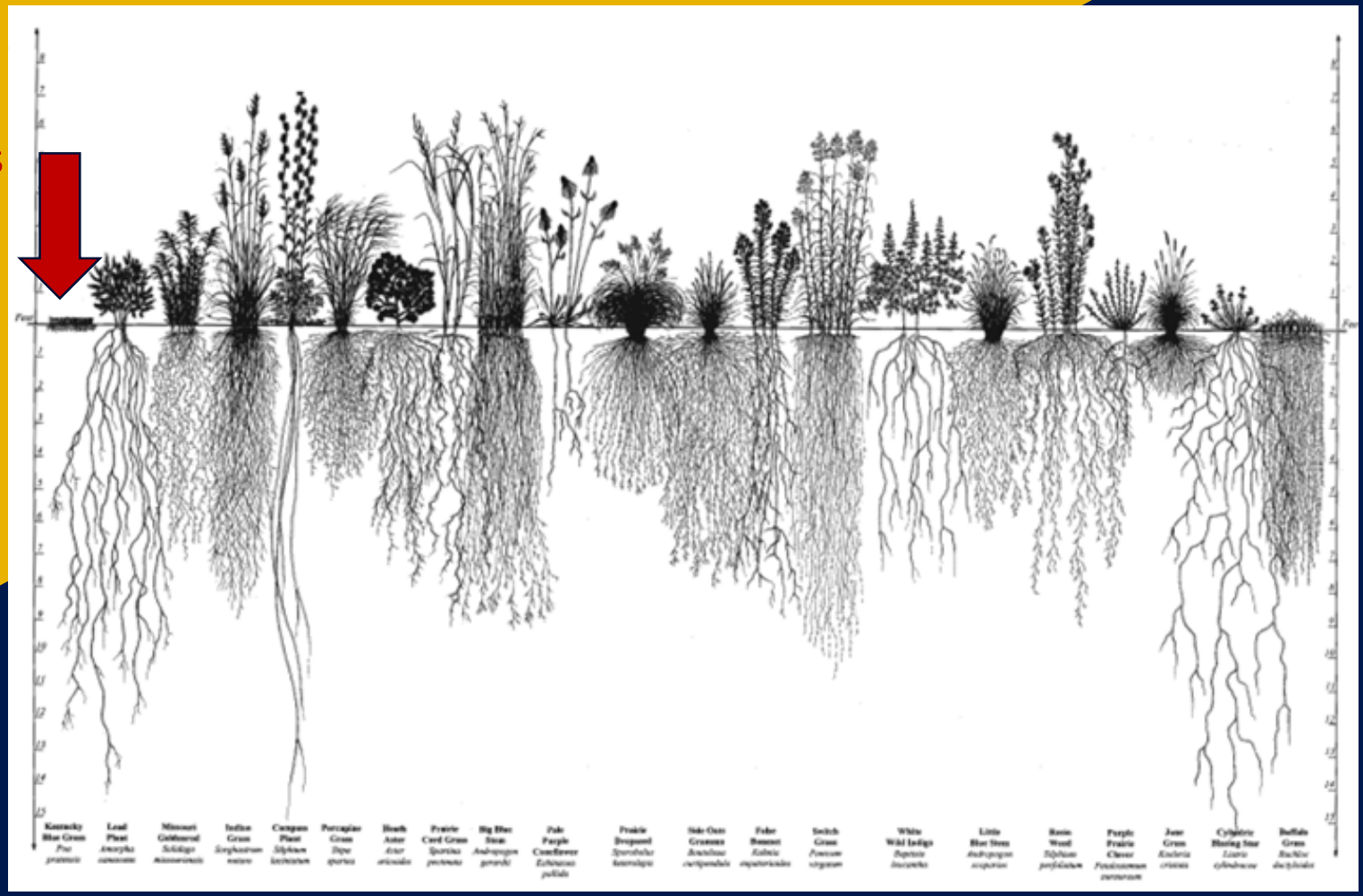
A Step Towards Reducing Nonpoint Source Pollution and Urban Flooding

What is a Rain Garden?

- Bio-retention pools incorporate the chemical, biological, physical properties of plants, microorganisms, and soils

Native Plants Have Deeper Root Systems

Lawn Grass



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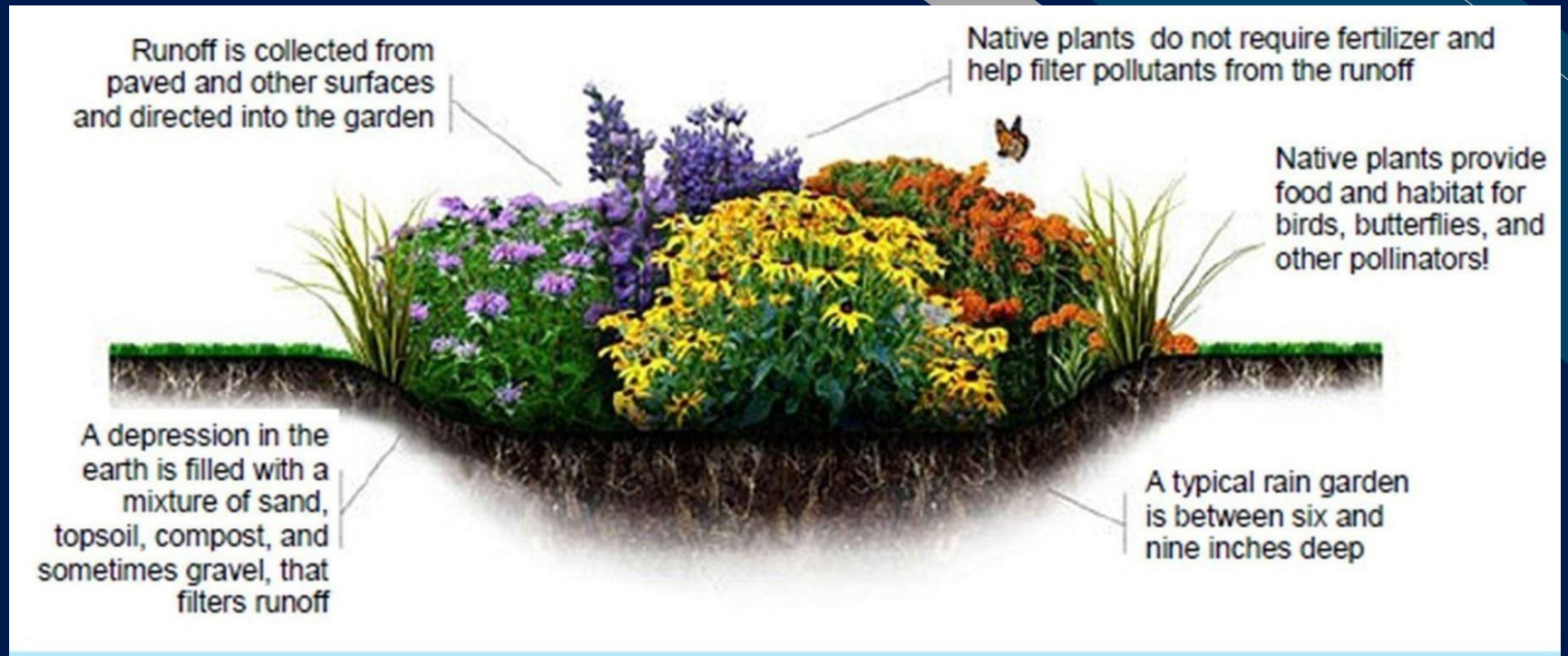
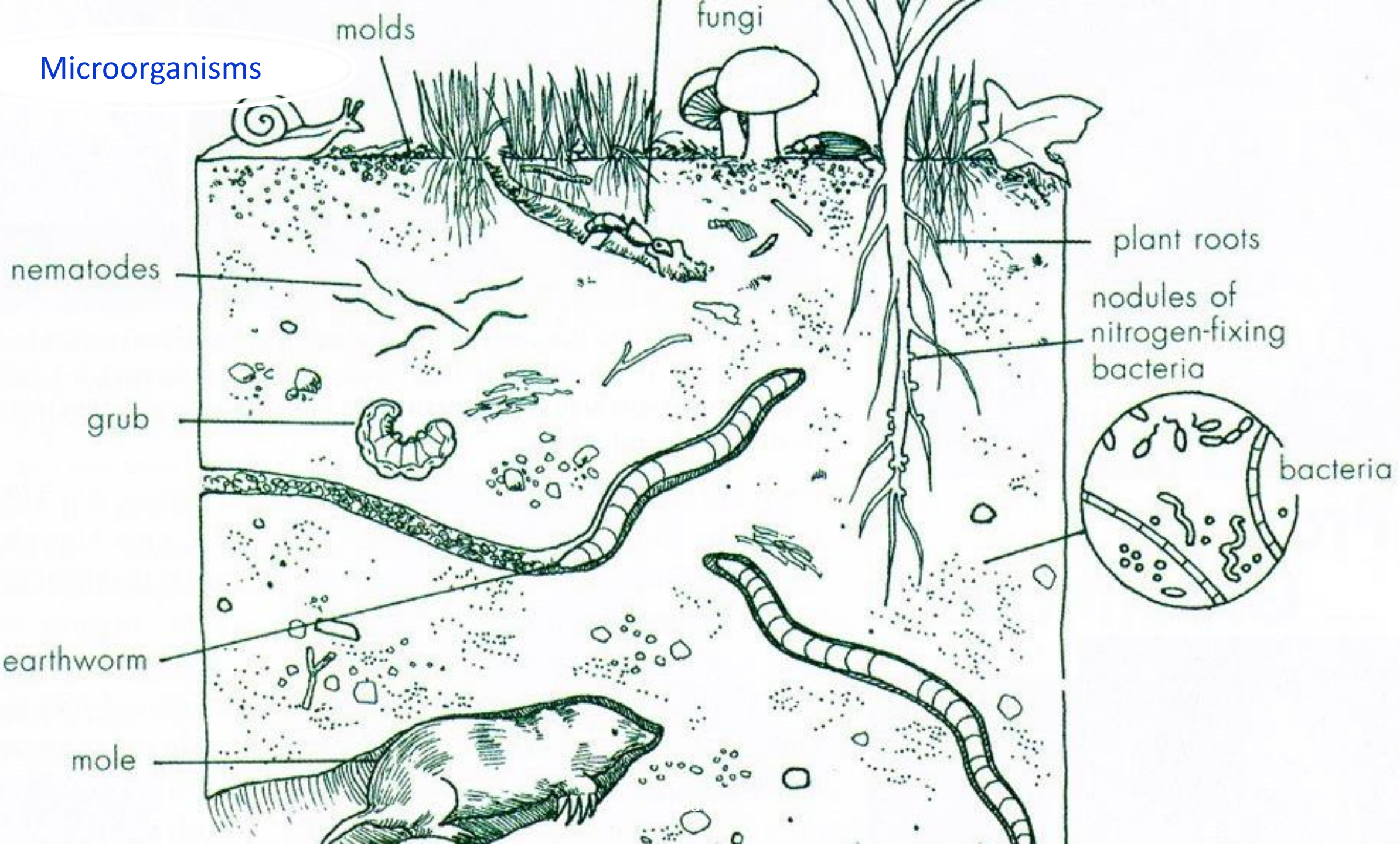


Rain gardens can turn this...

...into this!

Rain Garden Design

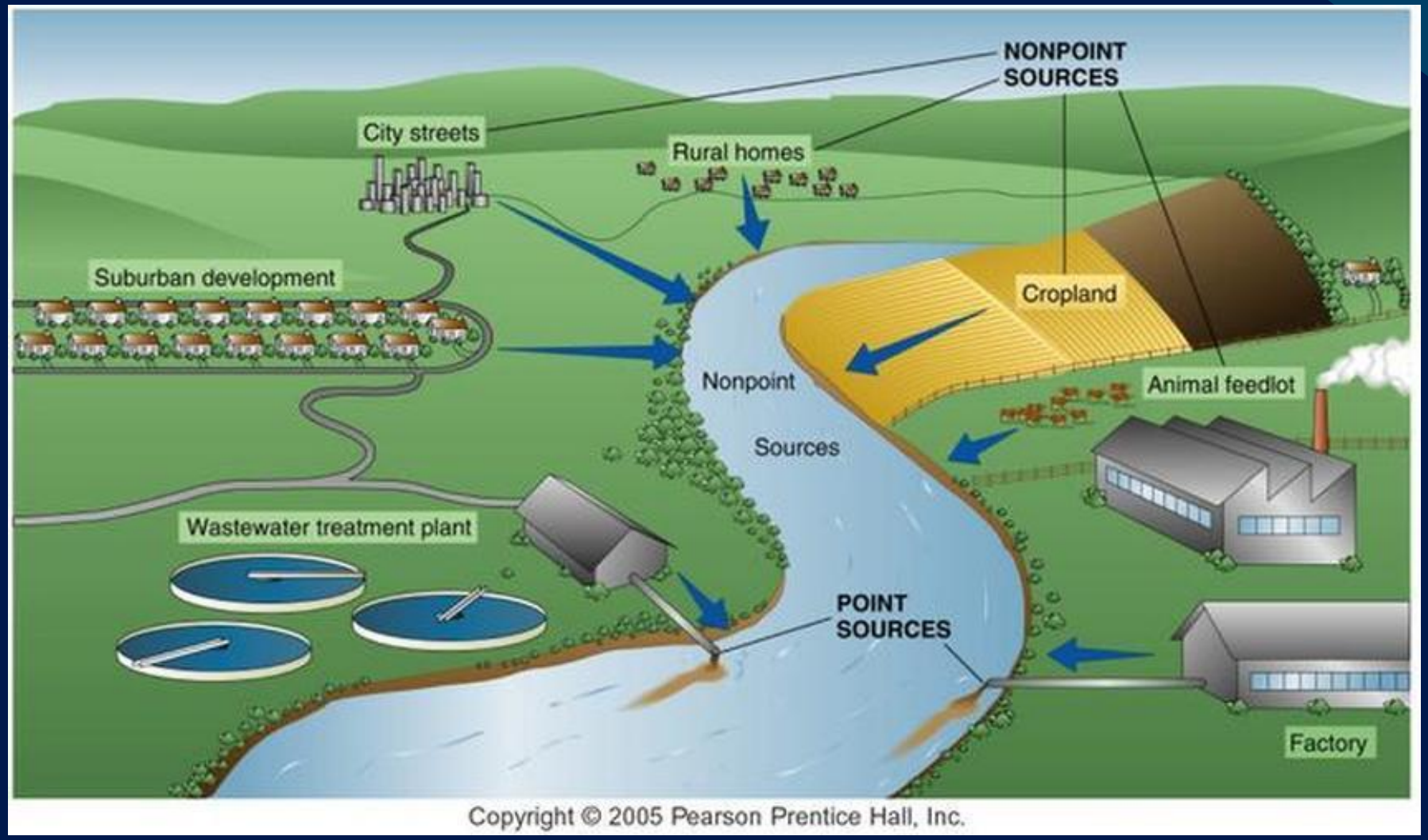
Microorganisms



Flood Control

- manage stormwater runoff
- improve runoff quality
- reduce erosion.

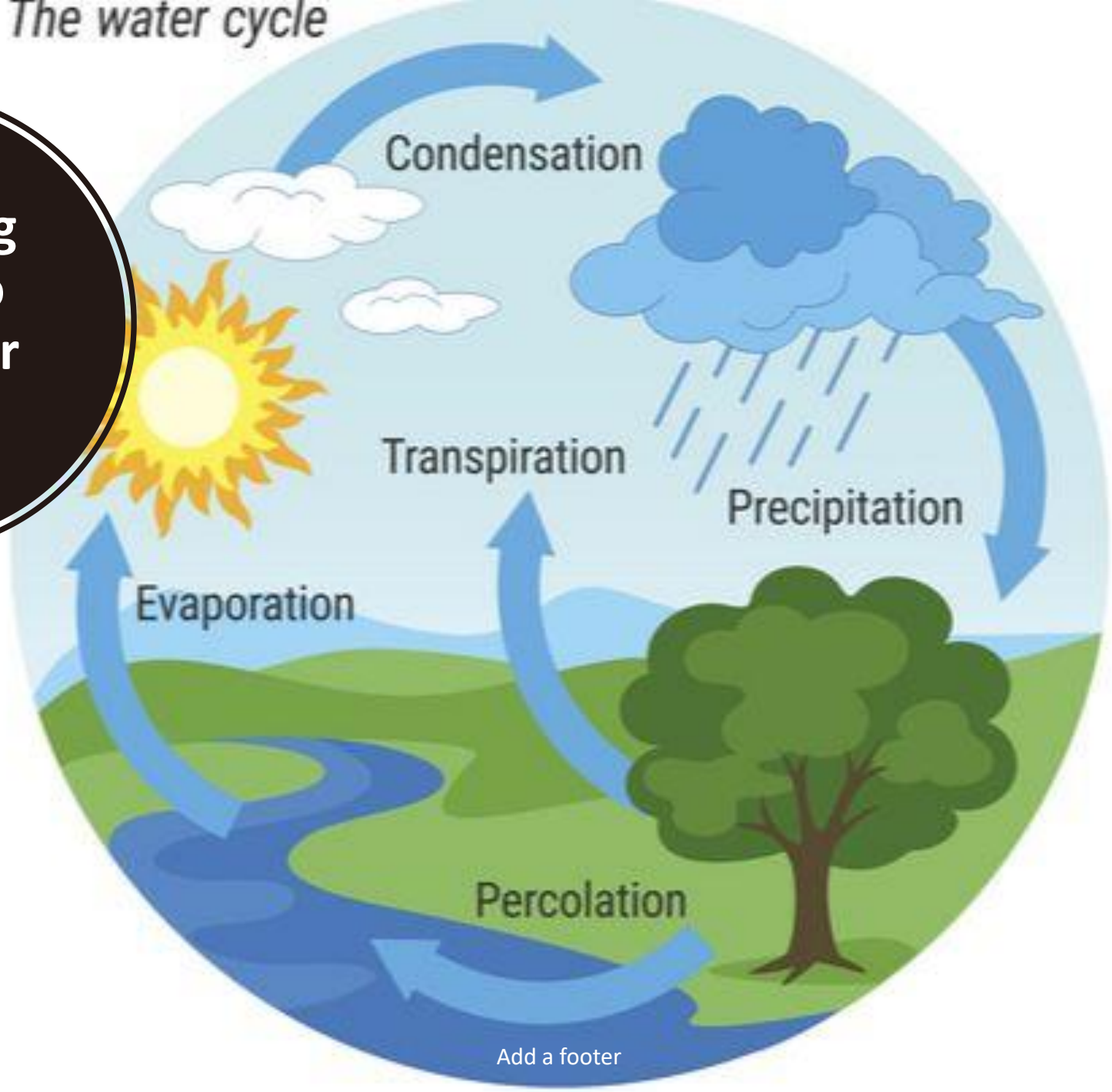
What is Nonpoint Source Pollution?



What are Nonpoint Source Pollutants?

- organic materials
- nitrogen
- phosphorous
- heavy metals
- oils
- sulfur oxides
- and dust from the air

Returning Water to the Water Cycle



My Hypotheses

Meta-Analysis of Rain Gardens focusing on species presence or absence.

1. Plant species with the highest positive coefficient of wetness will make up the group of plants that are counted as absent in the rain gardens.
2. Soil types with well drained soils verses poorly drained soils will have higher number of species present.
3. The more money put into the rain garden, the higher the species presence. Total cost reflected the cost of the plants only.

Hydrological Soil Group	Properties	Permeability
A	Sands with little slime and clay (minimum runoff)	Very High
B	Fine sands and slime	Good
C	Very fine sands, slime and quite clay	Medium
D	Clays in large quantities, shallow soils almost impermeable (maximum runoff)	Low

Methodology

- Grand Valley Metro Council (GVMC) of Grand Rapids, MI provided plant lists, soil types, garden measurements, and cost per garden
- I went out to each of the three rain gardens with the plant lists and evaluated if each species listed was present or absent on July 5, 2019

Data Analysis

- Data analysis included counts and percentages and the use of basic descriptive statistics.

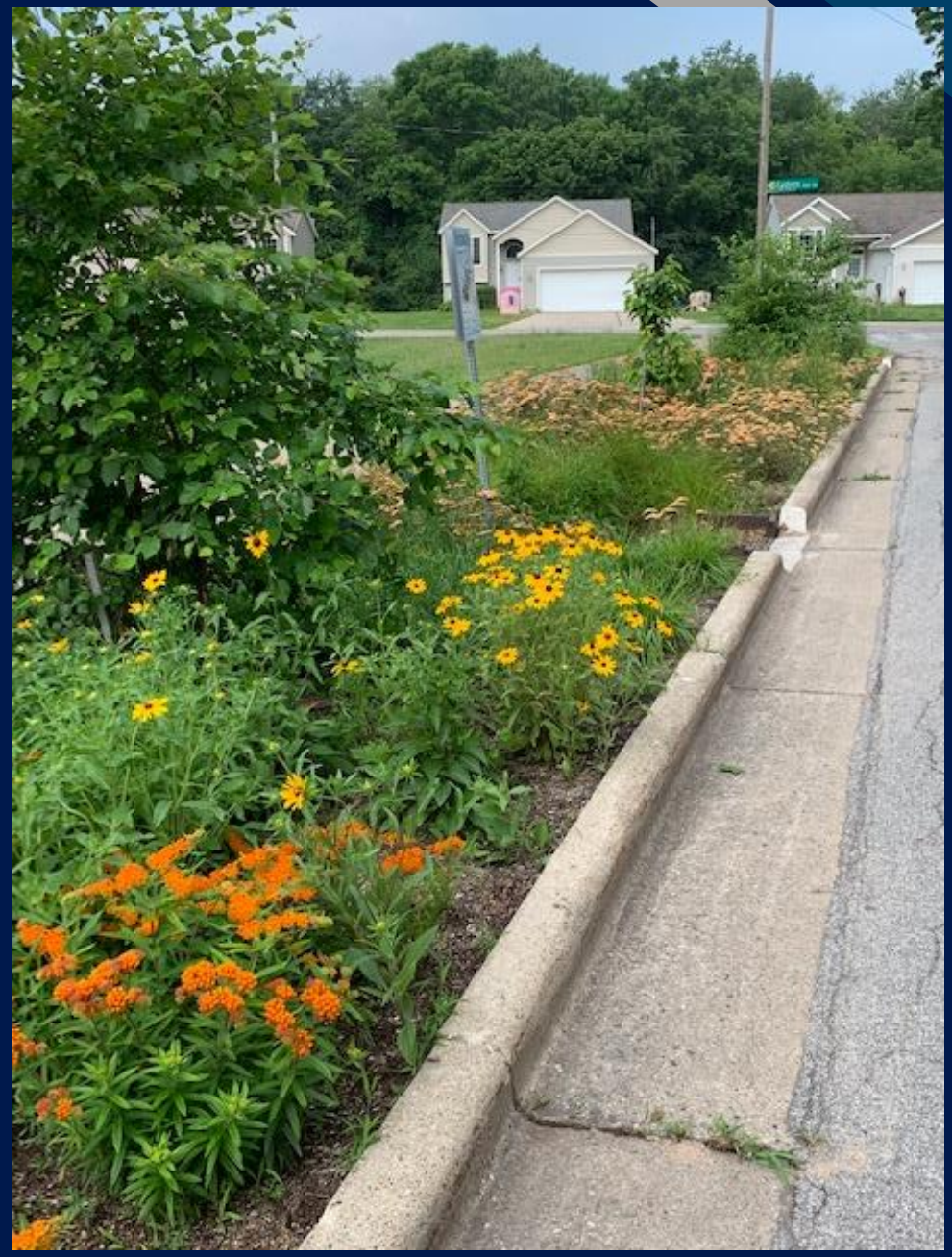
Rain Garden Evaluation

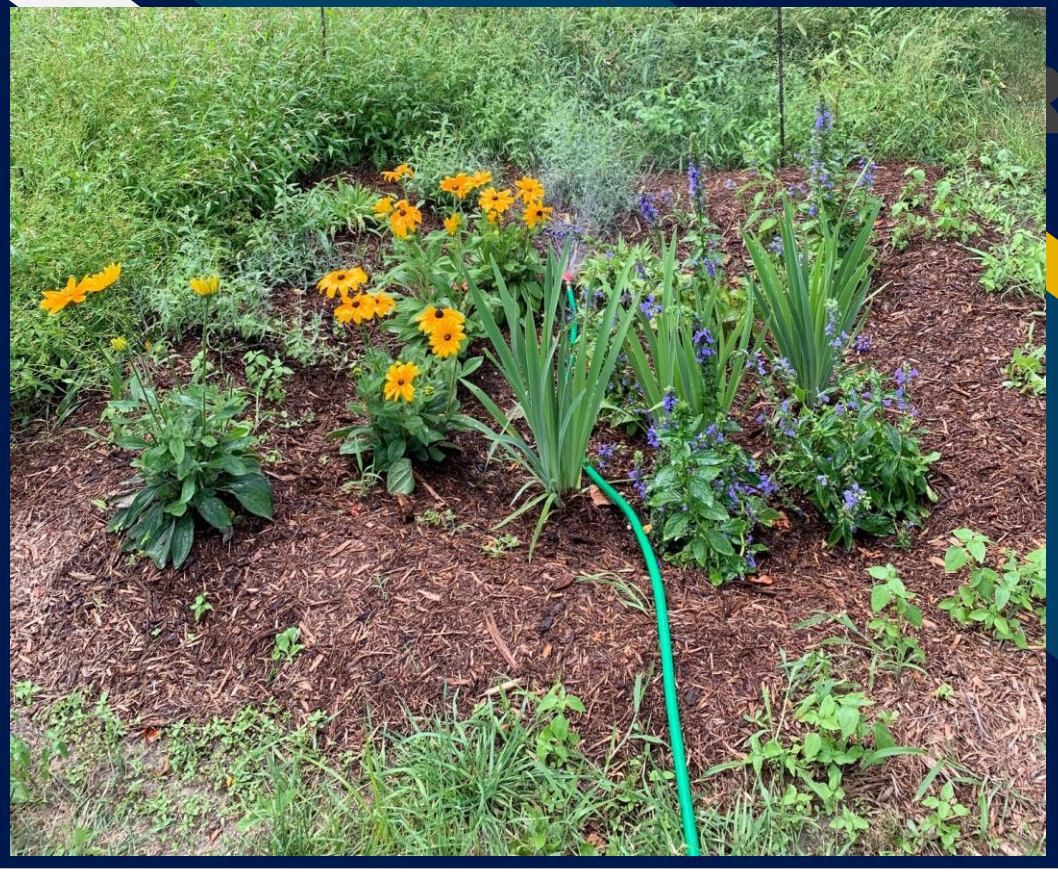
- 3 rain gardens planted by Grand Valley Metro Council
    - The West Catholic rain garden was installed in May 2018 – 10/10 Species
    - Elmdale was installed September 2017 – 7/8 Species
    - Blandford Nature Center was installed October 2018 – 21/29 Species

West Catholic

Blandford

Elmdale





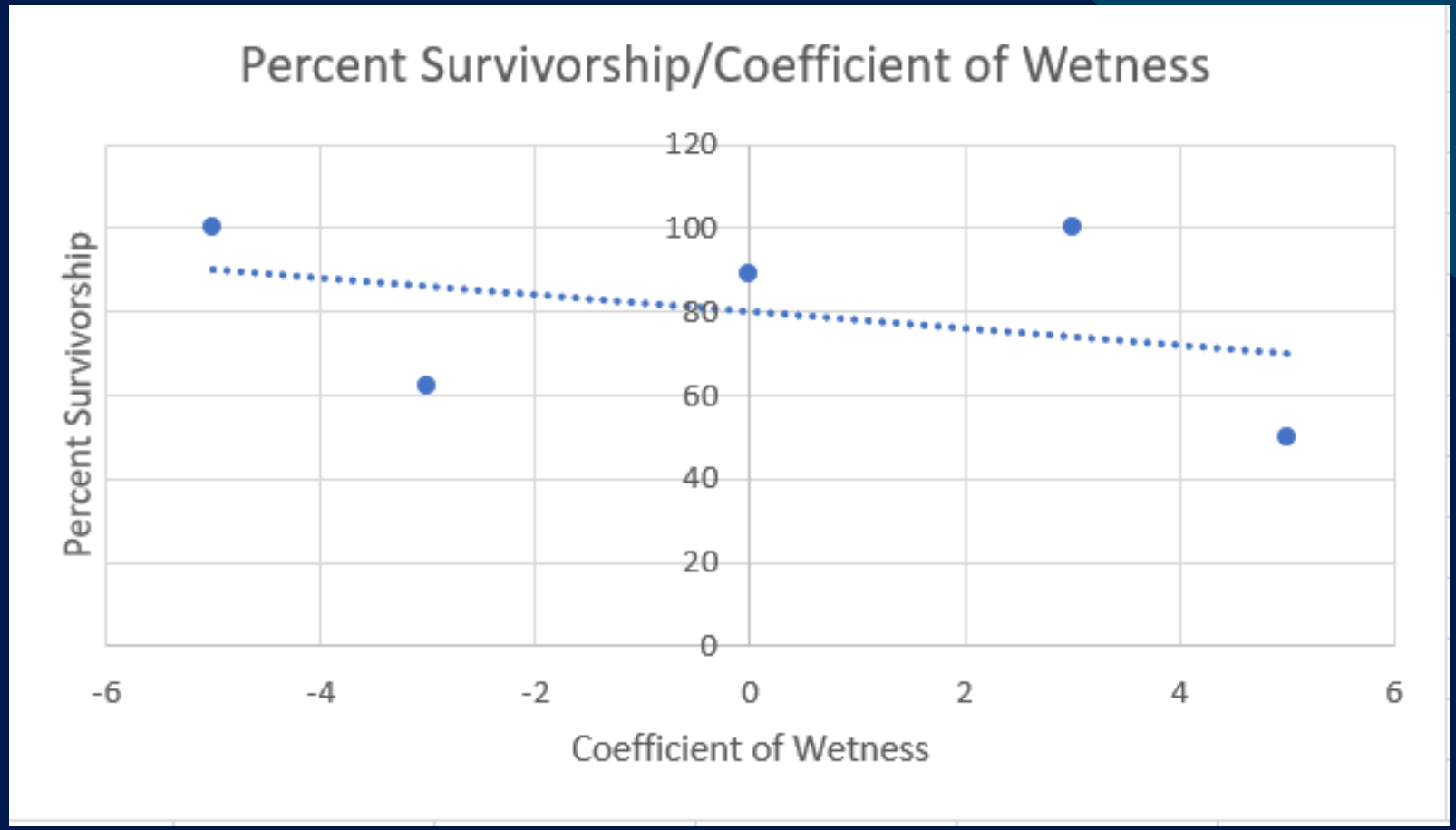
My Rain Garden

Results – Hypothesis 1

- I created a chart indicating whether a species was present or absent at each site based off of the lists from GVMC
- I then found the coefficient of wetness number for each species
- I found that the species with the highest positive coefficient of wetness were not always the species that were not present. There was not a strong correlation and the results were not statistically significant. The range of species not present was: 5 to -3.

Survivorship by Coefficient Number

The P-Value is 0.545803.
The result is not significant at p<0.05

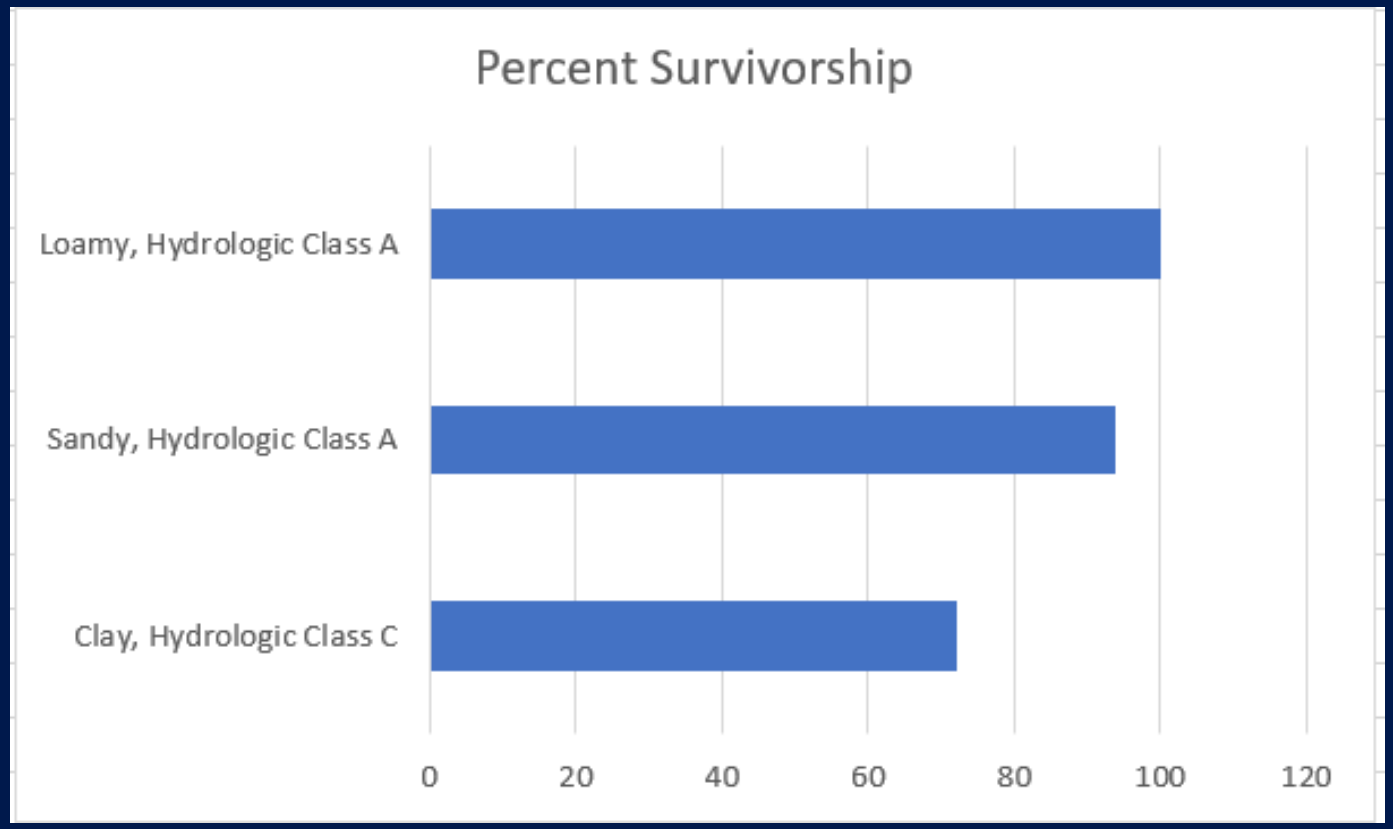


Results – Hypothesis 2

- I created a chart showing the average survivorship per hydrologic soil class

- I found that there was a correlation between soil type and the presence or absence of species. The Elmdale and West Catholic rain gardens both had sandy, hydrologic class A soil and 94% of their species were present while in the loam/clay loam hydrologic class C soil of the Blandford rain garden only 75% of the species were present.

Percent Survivorship By Soil Type



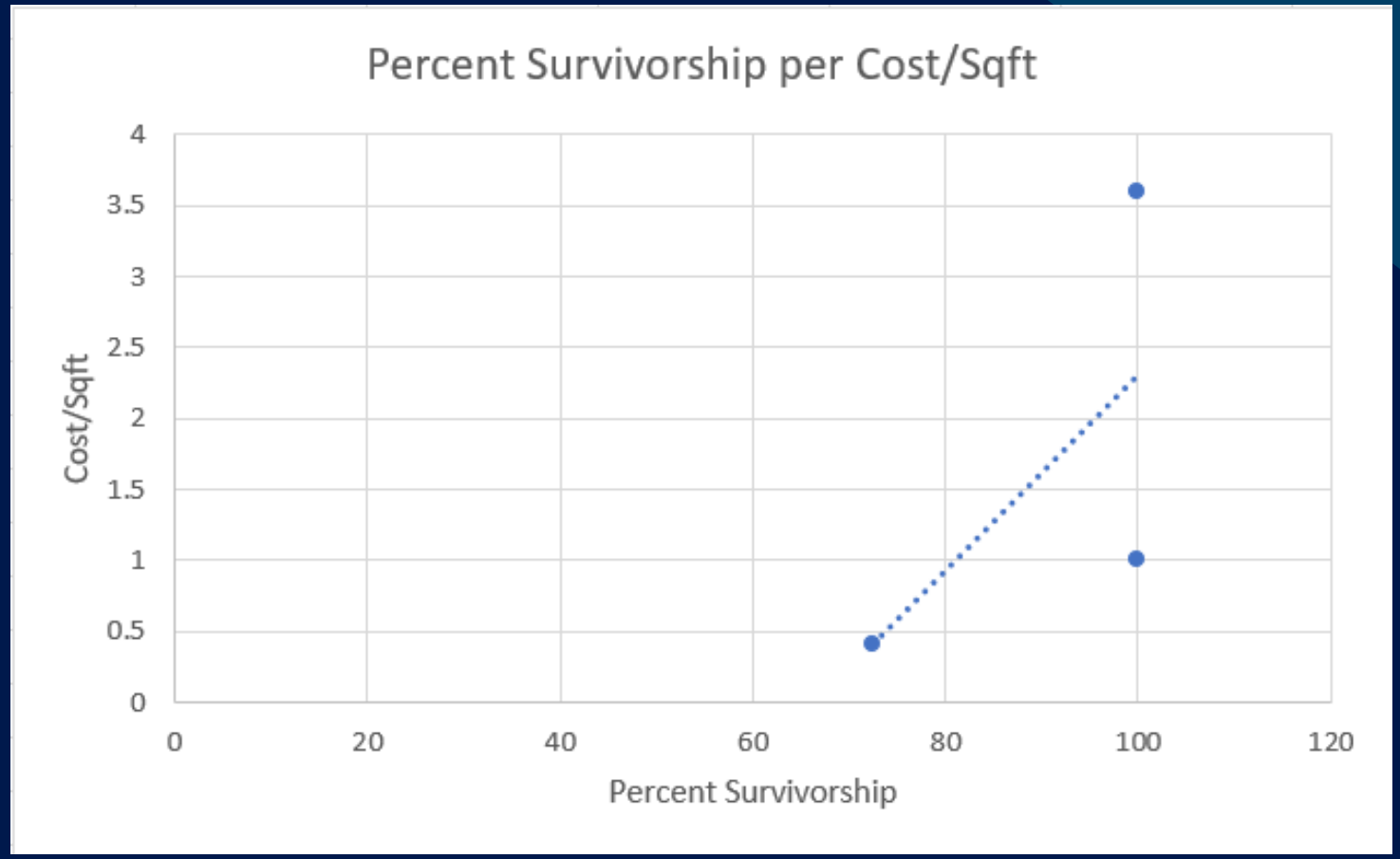
Results – Hypothesis 3

- I collected information on the square footage per rain garden and the cost per rain garden to calculate the cost/sqft

- I found that although there was a correlation between the cost of the rain garden and the presence or absence of species, the results were not statistically significant. In the West Catholic garden approximately $1/sqft was spent on plants and 100% of species were present. In the Blandford rain garden approximately $0.41/sqft was spent and only 75% of species were present.

Cost per Square Foot

The P-Value is 0.555462.
The result is not significant at p<0.05.



Species not Present - Elmdale

Sky Blue Aster/Symphyotrichum oolentangiense

Species not Present - Blandford

New England Aster
/Aster novae-angilae

Prairie Heart-Leaved Aster
/Aster oolentangiensis

Rattlesnake Master
/Eryngium Yuccifolium

Species not Present - Blandford

Northern Blazingstar
/Liatris scariosa

Mountain Mint
/Pycnanthemum virginianum

Showy Goldenrod
/Solidago speciosa

Butterflyweed
/Asclepias tuberosa

Discussion: Confounding Variables

- Small sample set
- Mis-identification
- Missed Identification
- Possible consumption by animals
- Invasive species
- Maintenance
- Weather

Conclusion

- In the end none of my three hypotheses were accepted. There was no statistical evidence that plant species with the highest positive coefficient of wetness made up the group of plants that were counted as absent in the rain gardens; soil types with well drained soils verses poorly drained soils had a higher number of species present; or the more money put into the rain garden, the higher the species presence.

- While the results of my research were not statistically significant, I believe that with a larger sample set statistically significant results could be found.

Thank You.

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