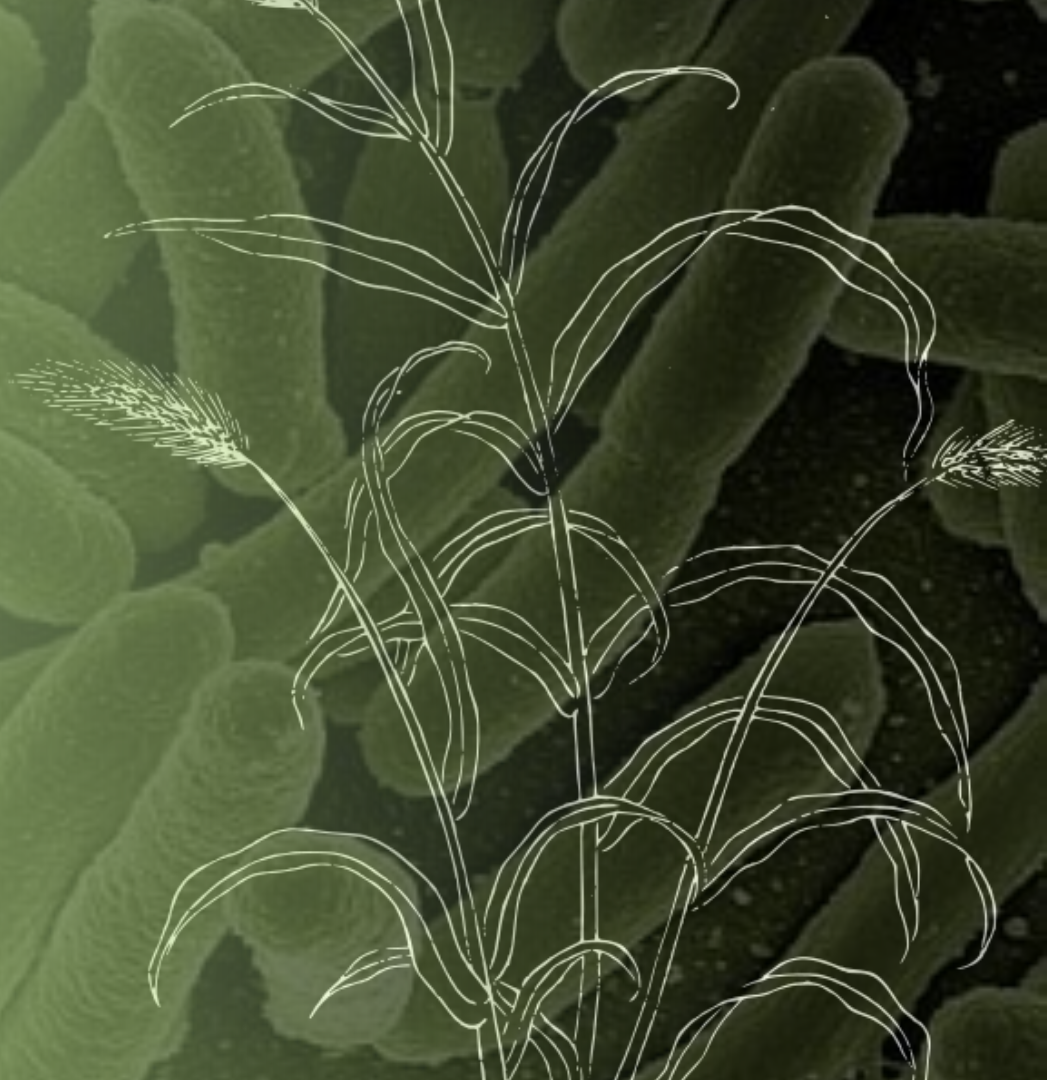


The Microbiome: How Microorganisms Can Be Harnessed to Act as Biocontrollers Against Invasive Species

Nia Pilauri





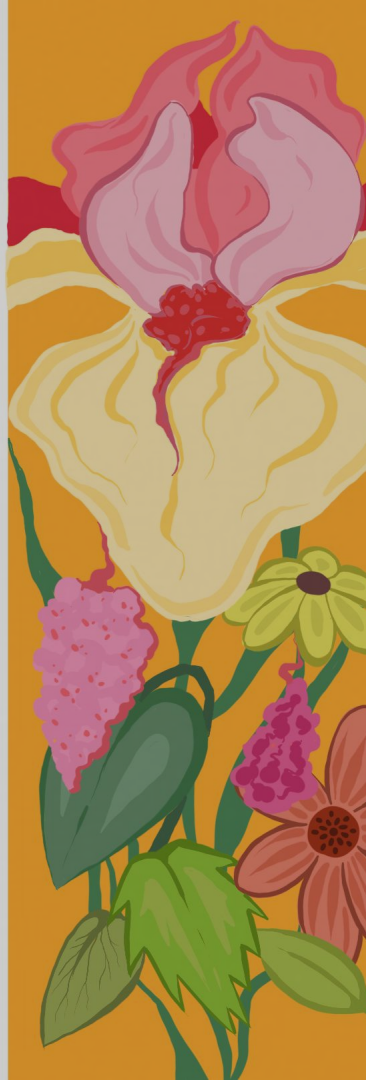
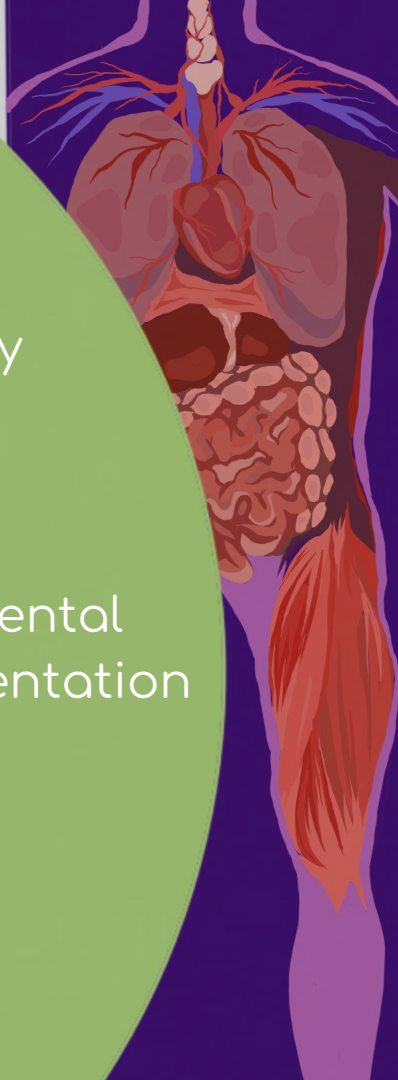
THE MICROBIOME

A collection of microorganisms in an environment

Mediating
balance

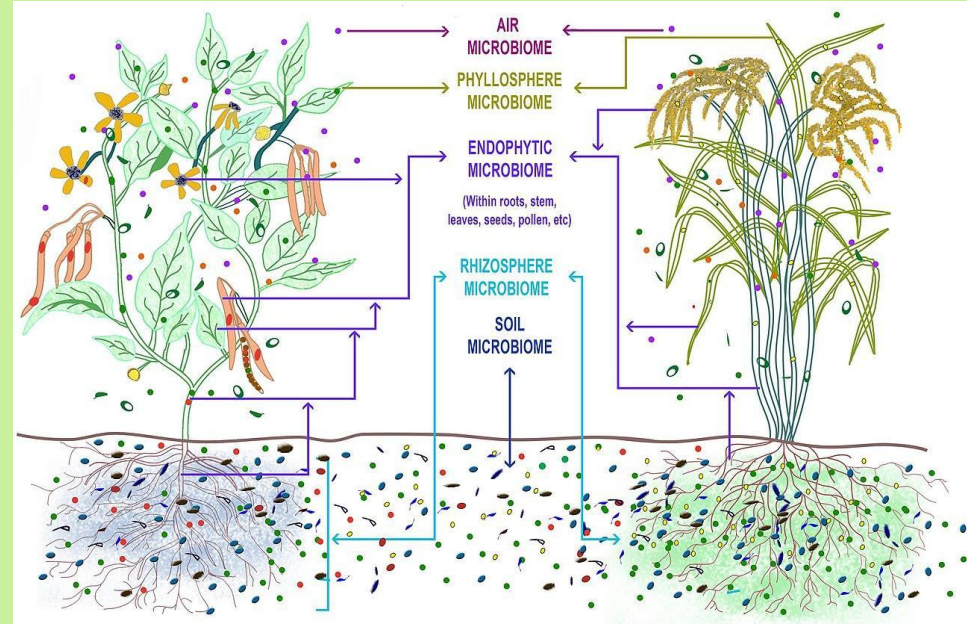
Assists Bodily
Function

Environmental
Supplementation



Plant Species: How They Benefit from Microorganisms

- Nutritional supplementation
- Mediation of soil; environmental sufficiency determined by microbial biomass in the soil
- pH regulation
- Provides balance allopathically (chemically) from the outside and internally in the plant



MICROBIAL SYMBIOSIS

Murali Gopal & Alka Gupta - Microbiome Selection Could Spur Next-Generation Plant Breeding Strategies, *Front. Microbiol.*, 07 December 2016

Invasive Plants: How They NEGATIVELY Disrupt Native Plants and the Microbiome

STATS

- According to the U.S. Forest Service: Invasive plant species have contributed to a the decline in 42% of native endangered and threatened species
- According to the Hilltop Conservancy: More than 33 invasive plant species populate the reservation

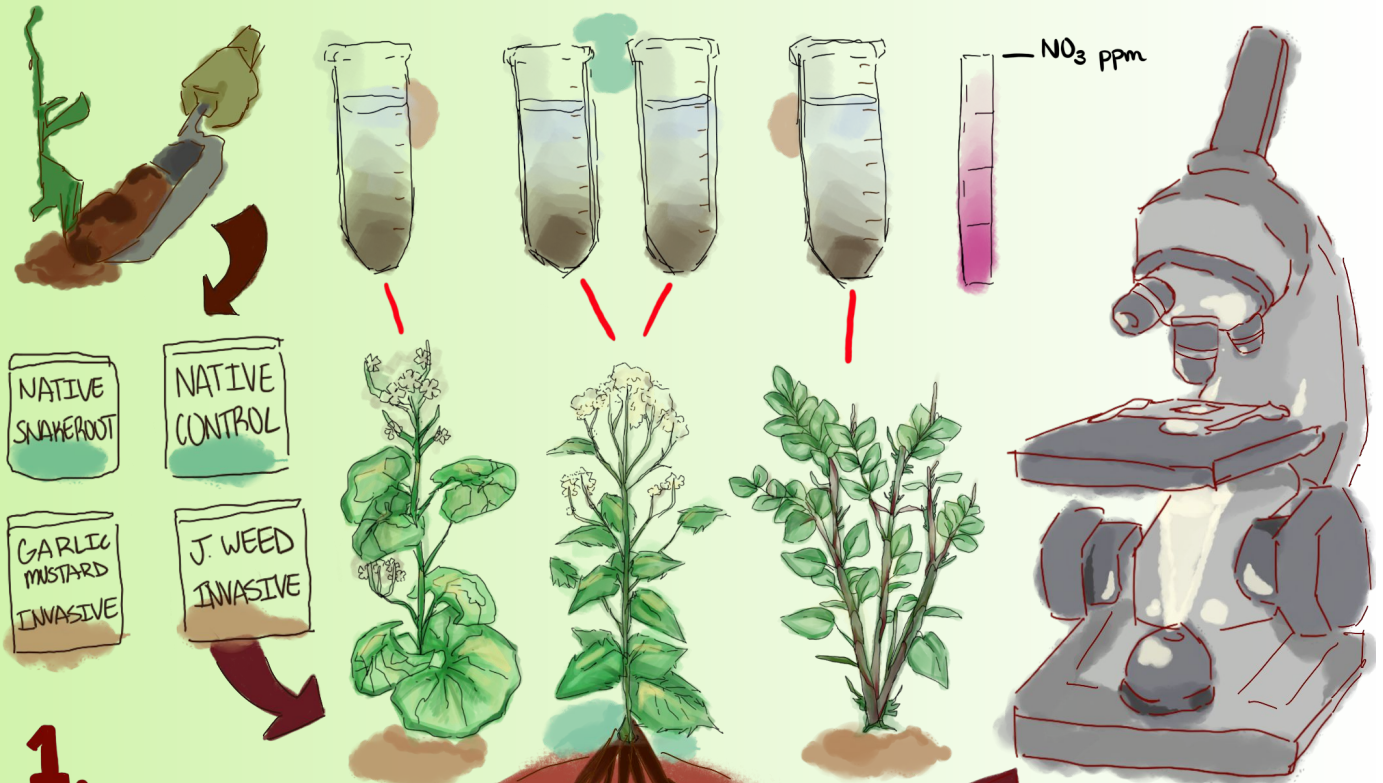
HOW

- Release unique chemical signals that take microorganisms and kill off native species to extract more nutrients
- Nitrogen Deposition, extracting nutrients from native species and soil
- Disrupting natural, diverse biomass of the soil along with the microbial material within - LEGACY EFFECTS

LOCAL APPLICATIONS

(Experimental Analysis)

*Took soil samples from Hilltop



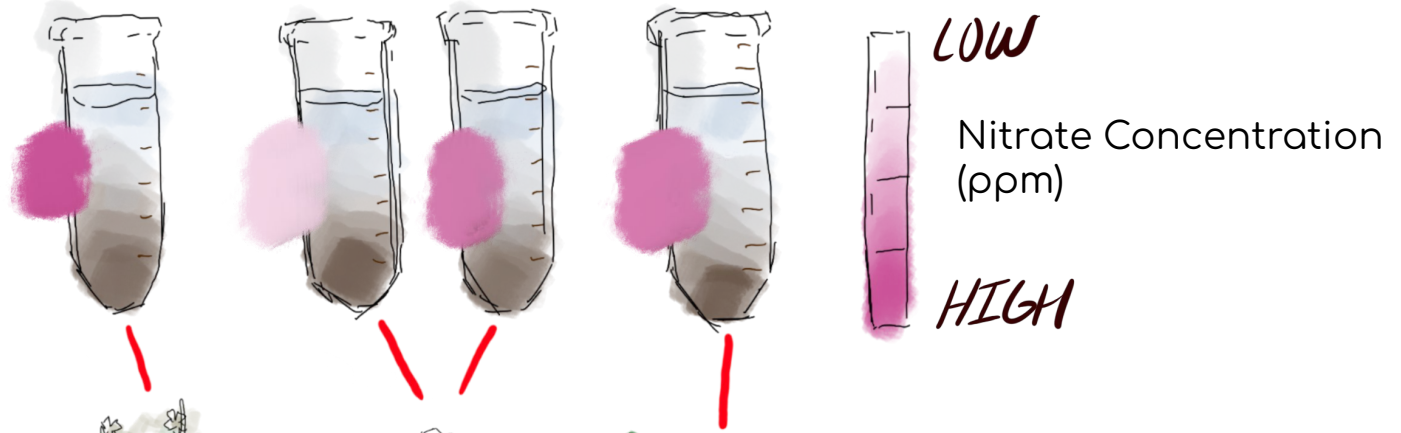
1.

Nitrate Quick Test

2.

Rhizosphere Microscopic Analysis

NITRATE QUICK TEST



Alliaria petiolata



Ageratina altissima



Reynoutria japonica

**Microscopic Evaluation From Each Root
(Supplement to the Nitrate Quick Test experiment)**

Means of Observation

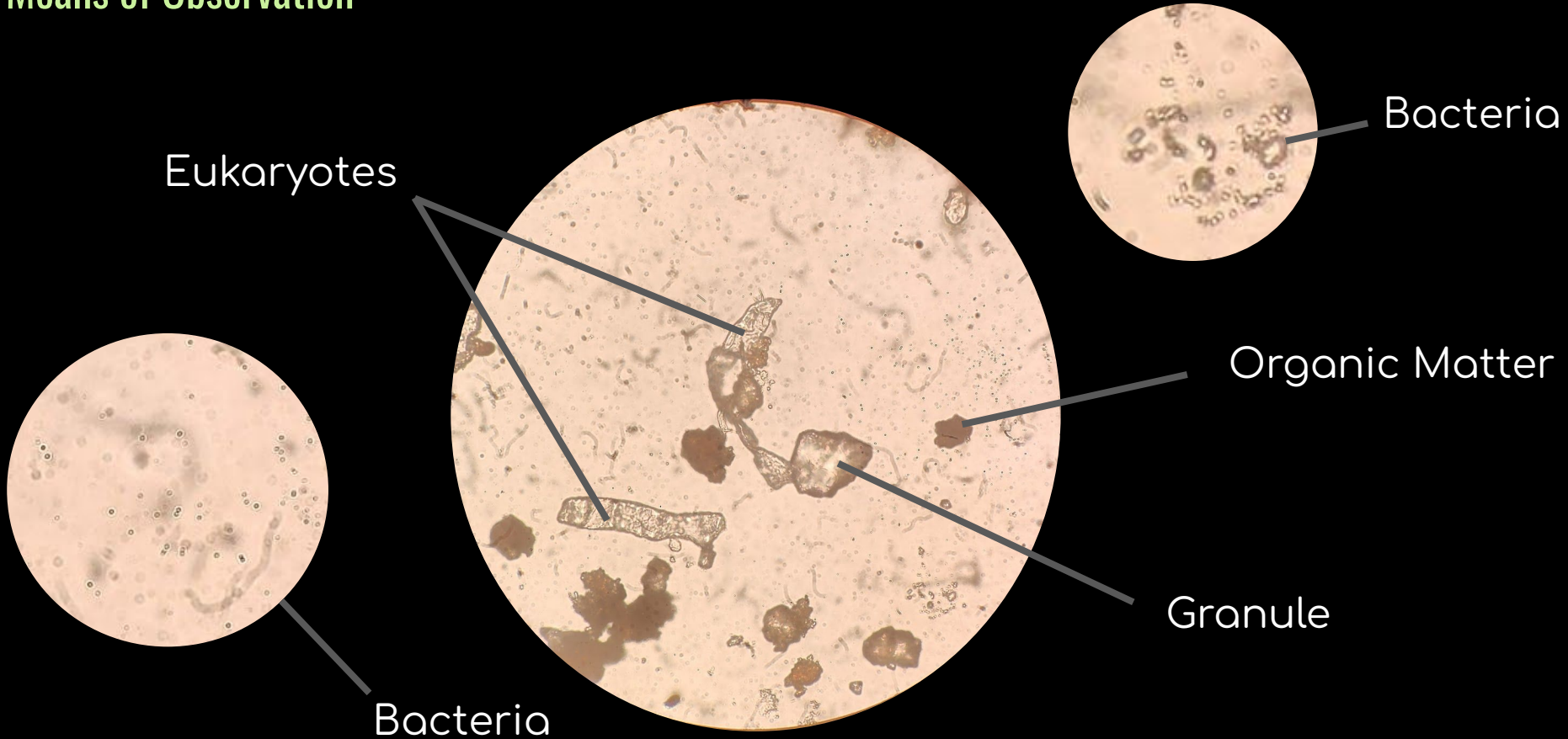
Eukaryotes

Bacteria

Organic Matter

Granule

Bacteria

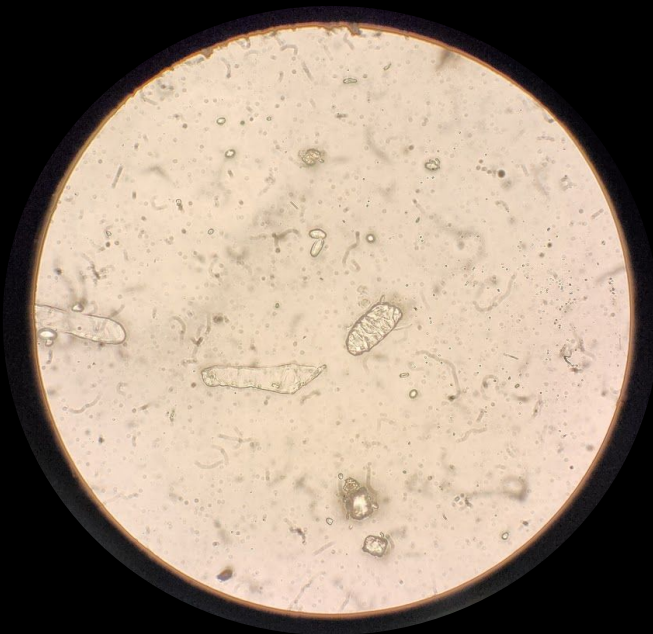


Garlic Mustard



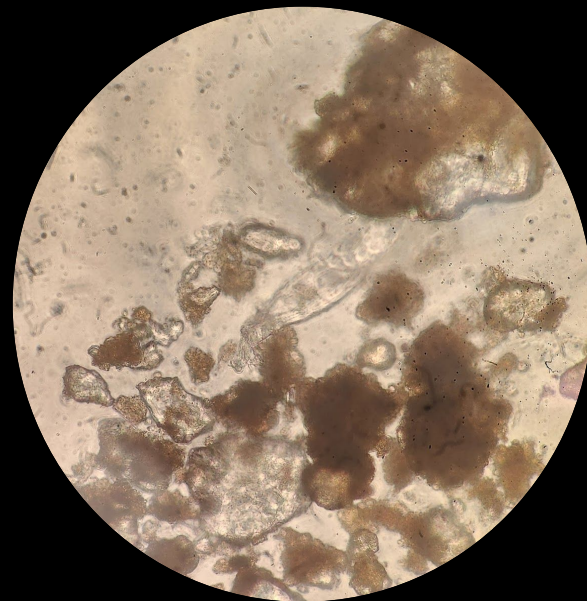
Alliaria petiolata

White Snakeroot



Ageratina altissima

J. Knotweed



Reynoutria japonica

OBSERVATIONS

Microscopic Evaluation

- Altered diversity of microorganisms in the “invasive” samples than in the “native” sample
- Greater *observable* abundance of microorganisms from the root exudate in the “invasive” samples than “native” sample

Nitrate Quick Test

- Greater nitrogen, nitrate concentration in “invasive” samples
- Control yielded greater value of nitrogen concentration as opposed to samples labeled “native 1” and “native 2” of the same species, exposed to invasive variants.
- Lower concentration calculated from native species that were in the vicinity of invasive species.

CONCLUSION

Invasive species are actively restructuring the microenvironment in the soil to further their advances in propagating across the area which they thrive, leaving native species to be depleted of their nutrients. They are now greatly affected from the changes that were done to the microbiome that were originally there to facilitate order and maintain good health.

Genetically Engineered Microbes

BIOCONTROLLERS

Microbes as Biocontrollers

PROGRESS

- Companies are advancing in their research regarding microbes and their versatility in eradicating destructive invasive plants.
- Examples of this already exist, and measures taken to eradicate invasive species through genetic manipulation have slowly been implemented

HOW

- Pathogenic Qualities
- Types of bacteria engineered to target specific aspects of the invasive plant, i.e. root growth or chemical releasing mechanisms
- Supplement native/specific beneficial exotic plants

Further Potential Recommendations

- Advocate and fund for more research
- Use measures that preserve microbial biodiversity in the soil, but target invasive species specifically
- Remember that microbes facilitate the balance and order needed to preserve the natural environment

A result of following this path: Can limit the use of pesticides and herbicides in the long term, and be more effective in supporting native plant growth!

Acknowledgement

Verona Environmental Commission

Hilltop Conservancy

Verona Educators