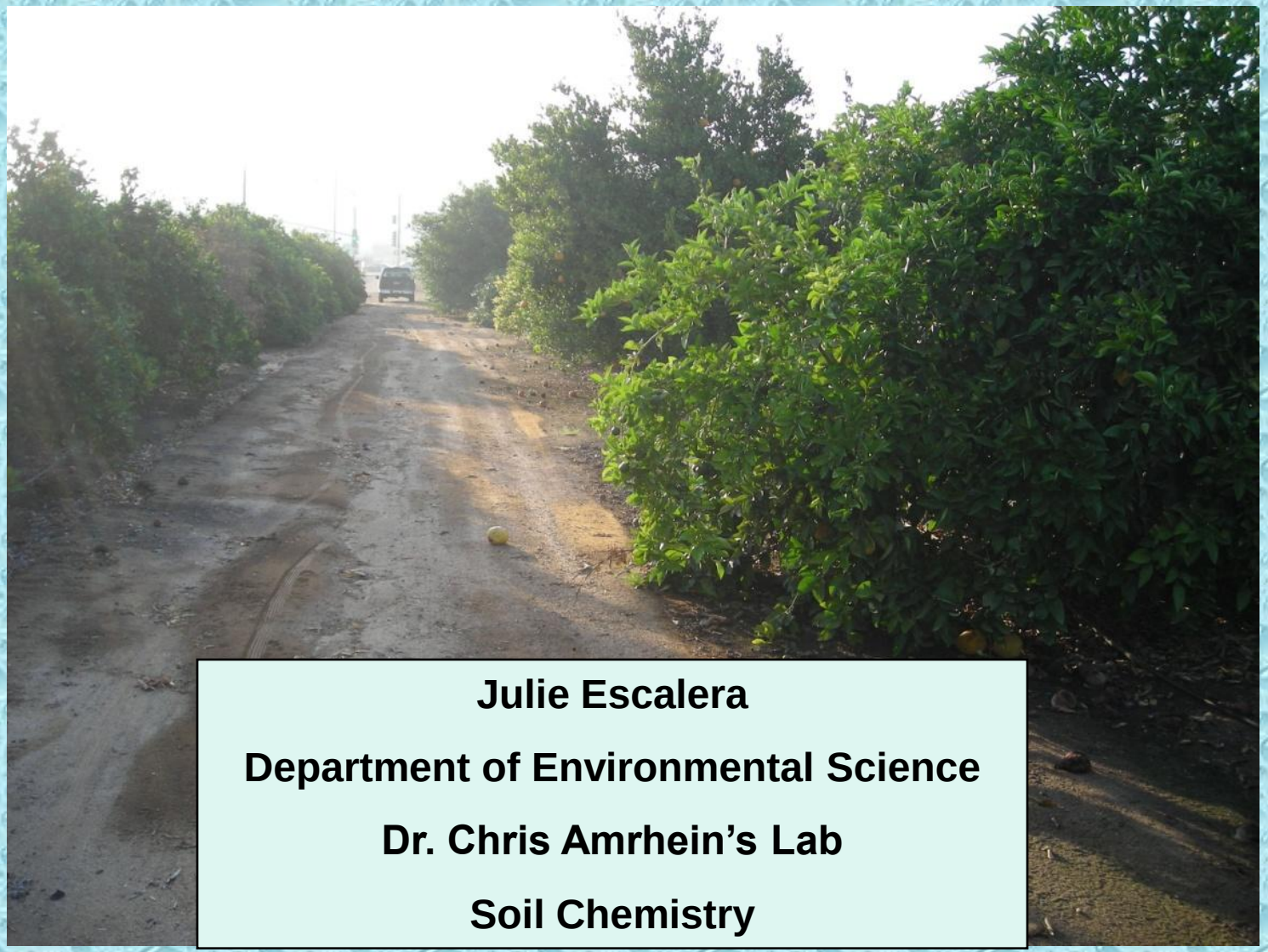
Effects of Waste Water Irrigation on Soil Properties in Citrus Orchards



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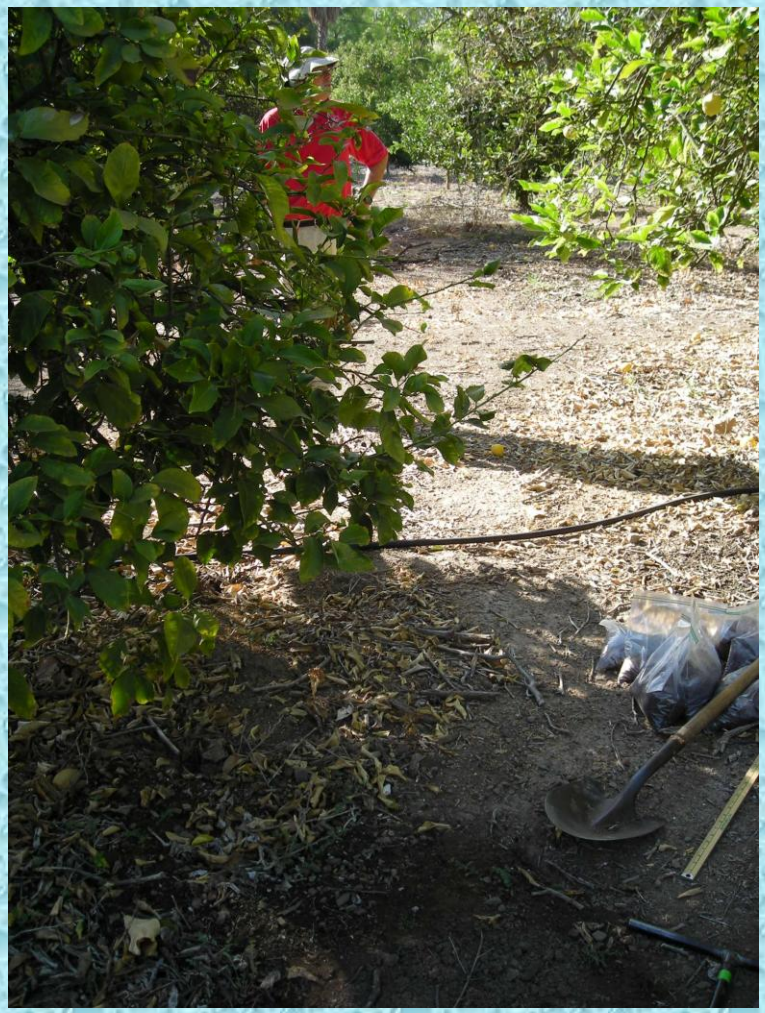
Soil Chemistry

Reclaimed Water

- Drought and water shortages are becoming an unavoidable crisis in arid regions.
- Reclaimed water is seen a good alternative to higher quality well water for agricultural irrigation.
- Reclaimed water can decrease saturated hydraulic conductivity in the soil due to it’s higher concentration of dissolved salts and sodium.

Research Objectives

- Study the affects of reclaimed water on hydraulic conductivity for soil in orange orchards
- Results will help to develop sustainable reclaimed water irrigation practices



Presentation Outline

- Overview of reclaimed water
- Relevance of project
- Location of site
- Methods
- Results
- Conclusions
- Further directions

Hypothesis

- Test whether reclaimed water will reduce hydraulic conductivity of soil used for citrus groves

- Question whether horizons with higher clay content will show significant decrease

The Gage Canal

USDA Natural Resource Conservation Services (NRCS)
http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

The Gage Canal irrigates the area in Riverside called the Greenbelt where approx. 5000 acres of citrus orchards are located.

Harrison St. Orange Grove

- Location selected in Greenbelt area
- Soils are representative of the area:

  Arlington Series

  Taxonomic Class:

  Coarse-loamy, mixed, active, thermic Haplic Durixeralfs
- Well established orchard in production for over 100 years

Aerial View of Sample Sites

Collection of Samples

- Soil collected in irrigation furrow

•Hand auger sampling

•Every 20 cm throughout profile

Process of Preparing Soil

•Soil was air dried (greenhouse at 120^{o} F)

- 2 mm sieve to separate gravel from fine earth fraction (sand/ silt/ clay)

Preparing Soil Columns

- 15 cm columns (6 in)
- Bottom covered with gauze and taped

- 200 g soil at same density
- Approx. same initial hydraulic conductivity

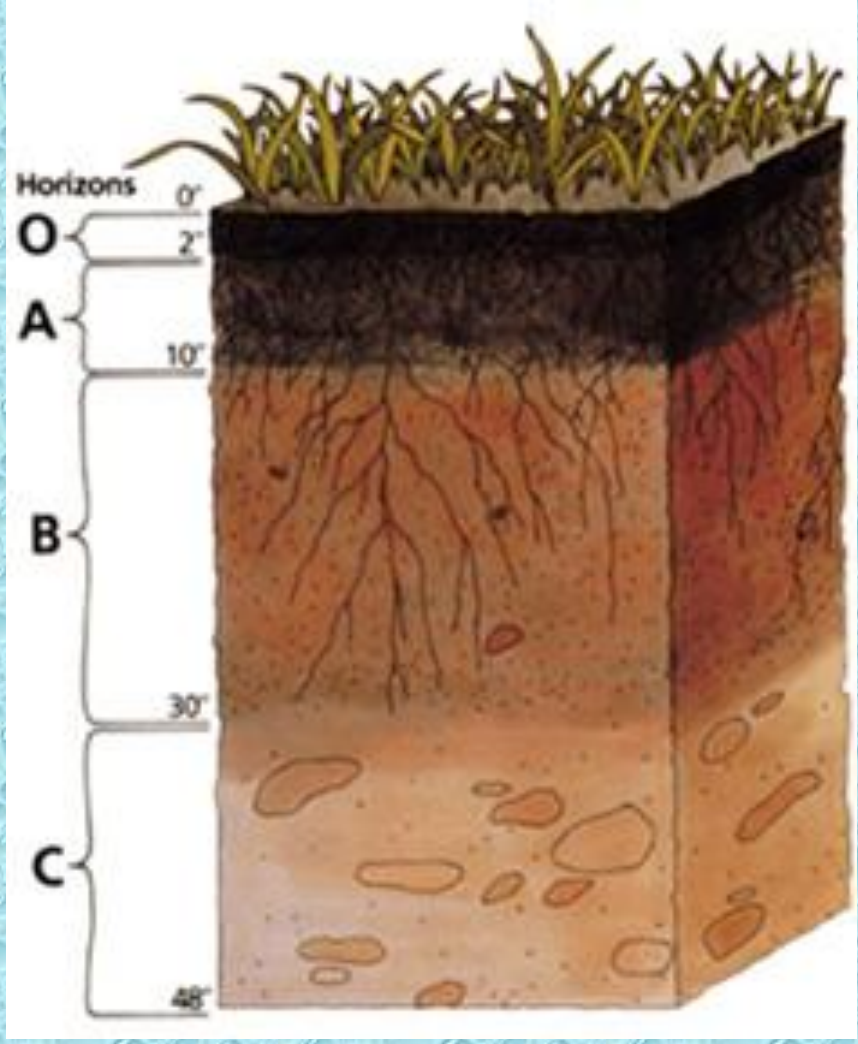
Three Water Treatments

Water Quality	Gage Canal (Control)	50/50 Reclaimed/control	Reclaimed
EC (mS/cm)	0.58	0.77	0.90
pH	7.9	7.9	7.6
Alk as mg/L $CaCO_3$	165	177	177
SAR	0.60	1.3	1.8

Soil Characteristics

The physical properties of soil vary with depth

Depth	% Clay	% Silt	% Sand	Bulk Density g/cm^3	%OM
0-20cm	18	38	44	1.54	2.0
40-60cm	19	41	40	1.61	1.5



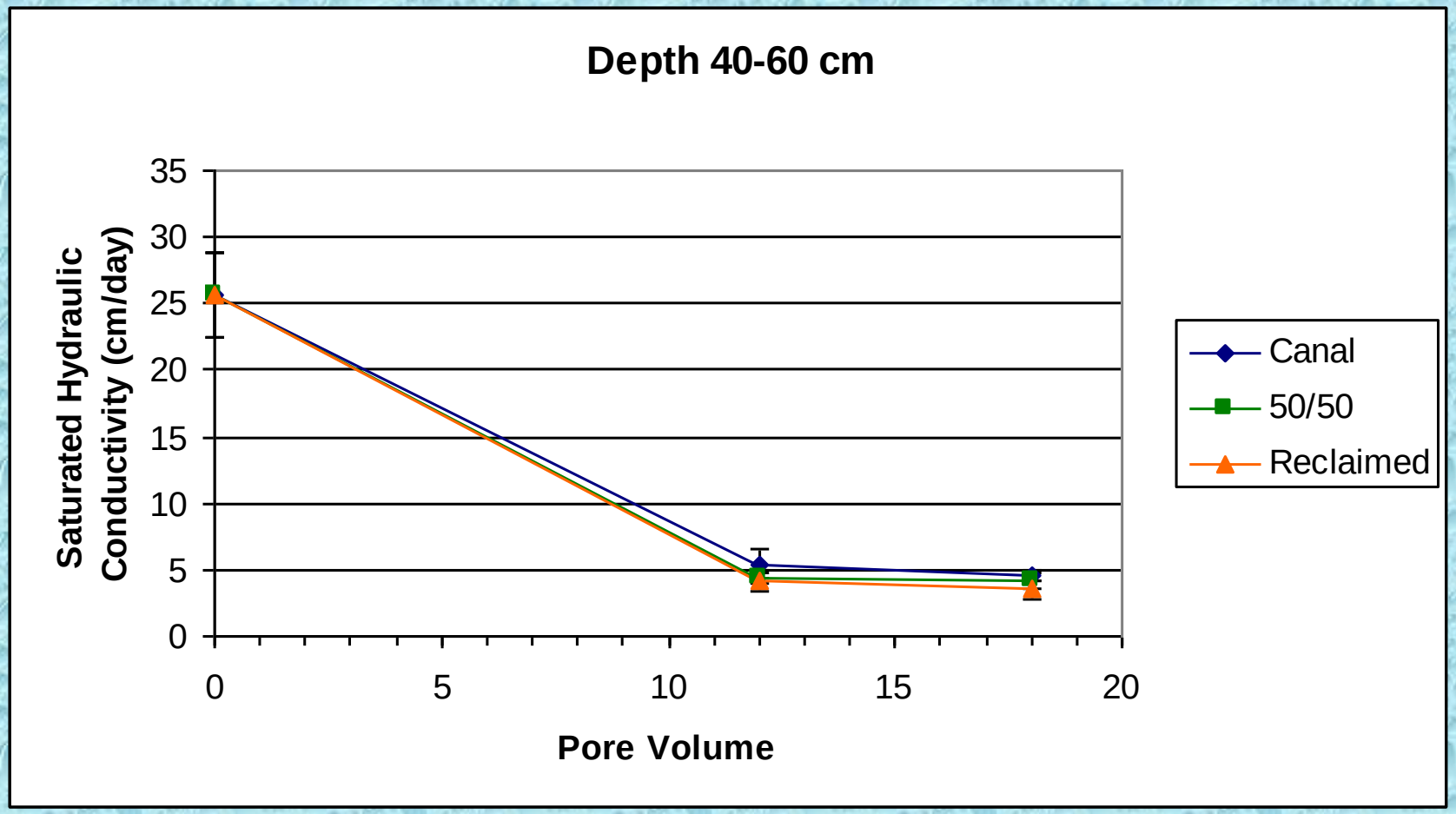
http://www.mo15.nrcs.usda.gov/features/gallery/gallery.html

Methods

- Water applied 100 ml increments
- 24 hour drying cycles between irrigations
- Hydraulic conductivity measurements using Darcy's Law constant head method

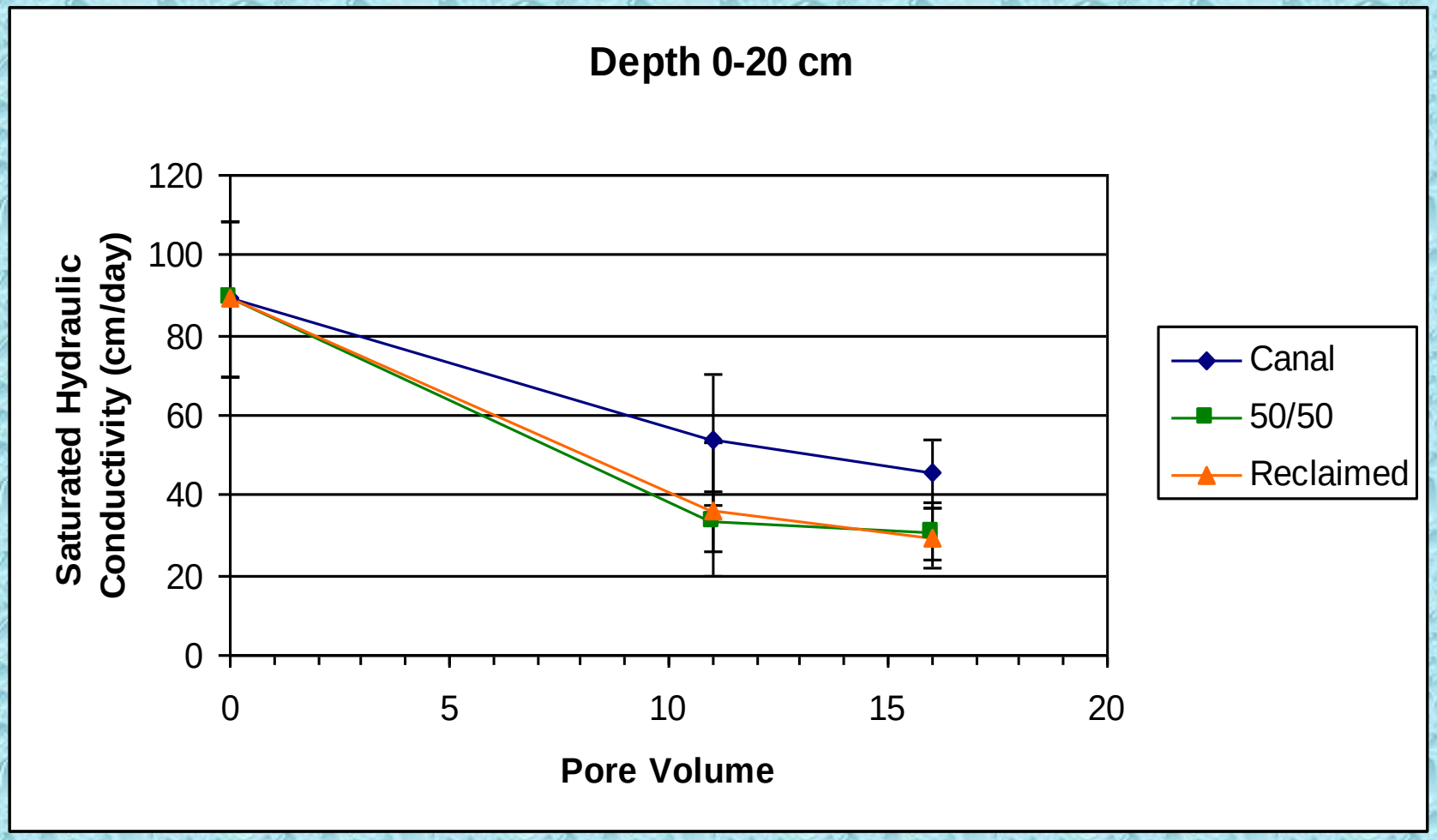
Results

No significant difference in saturated hydraulic conductivity was observed among all treatments in deeper horizons.



Results

Saturated hydraulic conductivity for the 50/50 treatment and the reclaimed water treatment decreased by 16-18% compared to the control.



Conclusions

- Surface horizon, showed the greatest **overall** reduction in saturated hydraulic conductivity for the reclaimed and 50/50 treatment when compared to the control.

- All treatments showed a significant decrease in saturated hydraulic conductivity which may be due to formation of vesicular pores.

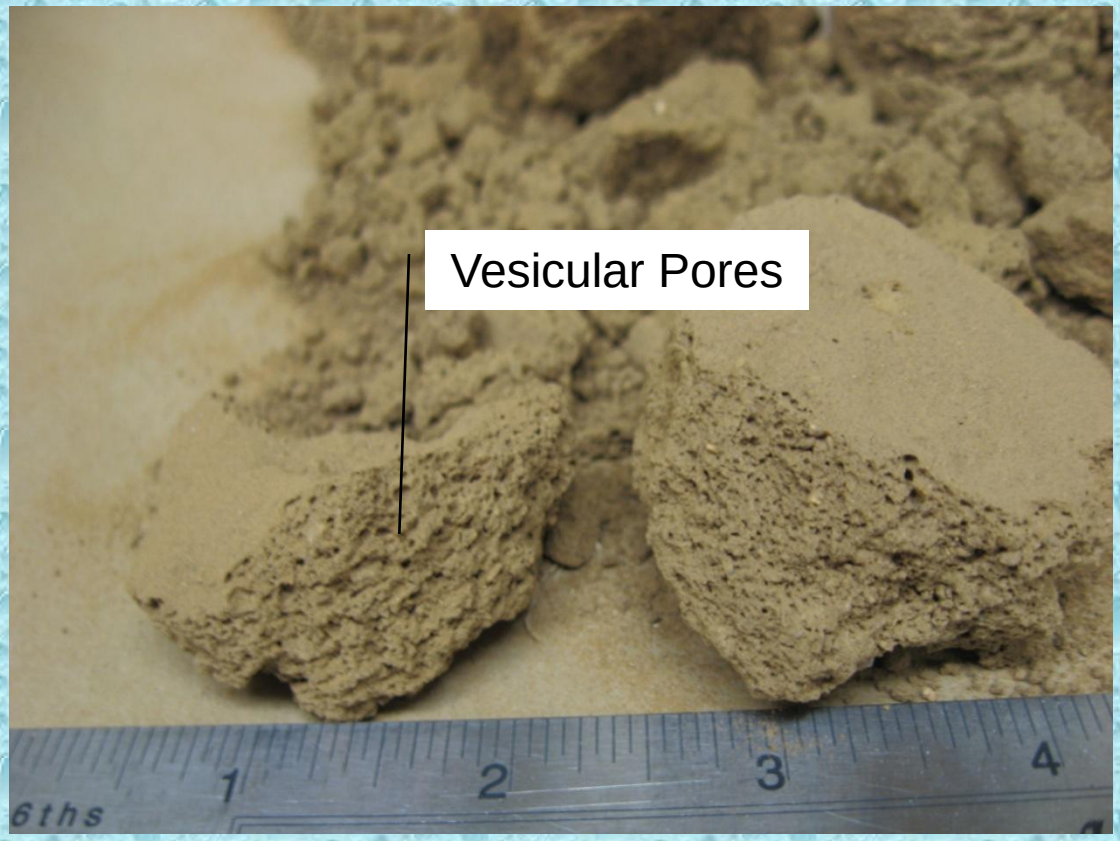
- Results suggests farmers might have to change their irrigation practices or add gypsum to the soil if they use reclaimed water for irrigation.

Future Directions

A reduction in saturated hydraulic conductivity was seen in all treatments which may be due to formation of vesicular pores.

Future research will focus on:

- How vesicular pores form in these soils
- How reclaimed water affects the formation of the vesicular pores



Continuing Research

- Continuation and expansion of current infiltration study

- Explore mitigation and potential remediation techniques to help establish guidelines for sustainable reclaimed water irrigation practices

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