Understanding Soil Moisture Levels on Soledad Ridge, Santa Rosa Island, California during the Summer Months

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Background Information

Santa Rosa Island located off the coast of Santa Barbara County was grazed by non native ungulates leaving the island stripped of vegetation and top soil layer. Since the removal of ungulates, the National Park Service began restoring the Cloud Forest on Soledad Ridge. Soledad Ridge is said to have once been covered by large stands of island oaks (*Quercus tometella*) and other endemic and native plants. The unique leaf and structural morphology of such vegetation collects water from wind derived fog which serves as the main source of water for this unique ecosystem. In an effort to jump start ecosystem vegetation recovery artificial fog fences and wattles were installed as a mechanism to harvest fog derived water, cope with erosion, and aid in soil moisture retention.

Cloud Forest Restoration Site on Santa Rosa Island

Study questions

- Is there a significant difference in how much fog derived water/moisture is being absorbed under various restoration treatments?
- At what depth in the soil is moisture the most intense?
- Is there a difference in soil moisture levels between soil and bedrock characterized sites?

Methods

- Calibrated soil moisture probes according to manufacturer specifications.
- Took soil moisture readings at 5 and 10 centimeters deep multiple times. Soil mois probe inserted for 30 secs before recording reading.
- Using a soil coring/probe device, a total of 120 soil samples at various depths were collected from each restoration treatment plot at each site.

Gravimetric soil moisture content test using oven-drying method:

- Initial weight of soil samples were recorded and then baked in the oven at 105 degrees Celsius until soil samples showed no change in mass.
- Ran paired T-test

Results

#	Moisture Reading Index Table 1
0-2	Extremely dry
2-4	Dry
4-6	Average
6-8	Wet
8-10	Extremely wet

Table 1: Moisture Reading Index

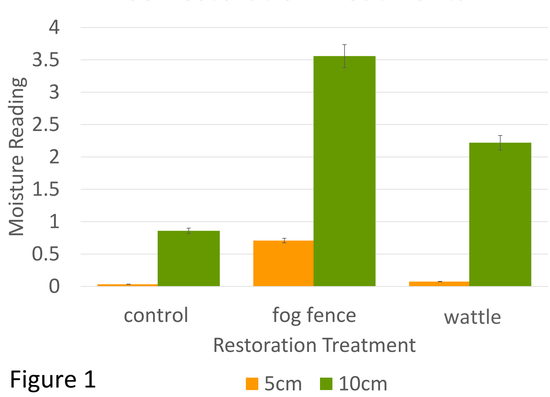


Figure 1

Figure 1: For control p=6.71E-11. For fog fence p=1.77E-34. For wattle p=3.01E-27. Where p≤0.05.

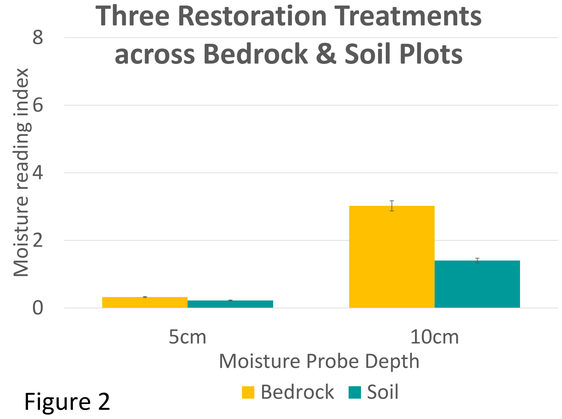
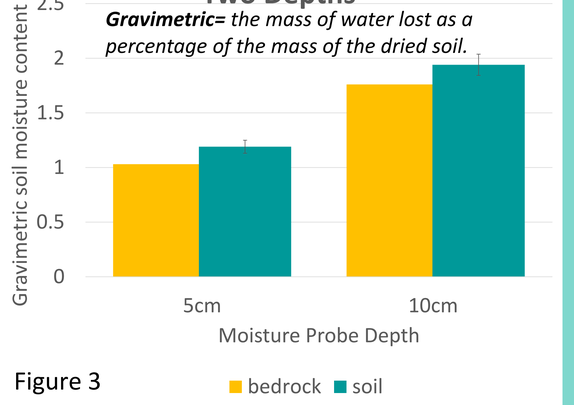


Figure 2

Figure 2: For bedrock p= 3.55E-41 and for soil p=9.17E-34. Where p≤0.05.



Gravimetric= *the mass of water lost as a percentage of the mass of the dried soil.*

Figure 3

Figure 3: There was very little moisture in both bedrock and soil but overall there is a bit higher moisture content going deeper (p= 0.000517861)Where p≤0.05.

Restoration Treatment	Description Table 2
Control	No water harvesting infrastructure. Drip line irrigation in first growing season only.
Fog fence	Fog fence covered in mesh fabric designed to capture/ harvest fog derived water.
Wattle	Cylindrical coconut fiber/mesh that aids in soil erosion control and prevention of water run-off.

Table 2: Restoration treatment descriptions.

Conclusion and Recommendations

- Results indicate that during the July-August Summer months soil moisture was relatively low.
- Soil moisture under the fog fence treatment showed a higher soil moisture probe reading in comparison to the control and wattle treatments.
- Soil moisture is significantly higher in depth in the soil and bedrock layers in all three restoration treatments.
- Figure 2 shows higher moisture in bedrock than in soil at both depths when measured with the soil probe.
- This study is important because it helps show the effect of installed infrastructure on fog water derived moisture retention which may be correlated to plan growth and ecosystem recovery.

Acknowledgements

The 2018 STEM Teacher and Researcher Program and this project have been made possible through support from Chevron (www.chevron.com , the National Marine Sanctuary Foundation (www.marinesanctuary.org , the California State University Office of the Chancellor, and California Polytechnic State University SLO in partnership with the Santa Rosa Island Research Station at CSU Channel Islands, U.S. Geological Survey, Channel Islands National Park, and Mountains Restoration Trust. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the funders.