Solar Panel Impact on Soil Temperature and Moisture

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Introduction

When researching and creating solar panels, their impacts on the environment are relatively ignored because they do not create carbon emissions; however, solar panels still affect the environment around them. As Shang et al. state, “it’s necessary to accurately evaluate the impacts of PV installations on local ecosystems to elucidate their ecological impact” (p. 2796). The importance of these studies is present when decisions are made to invest in large solar fields, for their investment may fail if the unstable ground they create destroys them.

However, their influence on their surroundings is not all bad; the shade created and retained moisture can greatly help the plants beneath them. “Water limited areas are most likely to benefit as solar management reduces…the water demand” (Adeh et al. p. 13). As a result, the water displacement caused by solar panels can pose a major problem but also allow the improvement of systems while contributing to the generation of clean energy. This study aims to investigate further the research question of how an individual solar panel affects the temperature and moisture around them.

Hypothesis

Solar Panels will lead to lower temperatures below and higher moisture below and in front of them, due to the shielding from the sun and rain. This may lead to landslides in hilly areas where panels are situated.

Objective

Finding how greatly solar panels affect the characteristics of the ground they reside over.

Methods

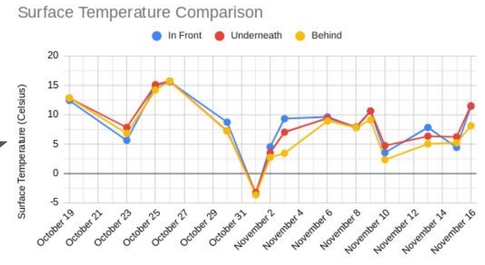
- Use Infrared Thermometer for Surface Temperature
- Use Dial Thermometer for Soil Temperature
  - Acclimated for 3 minutes each spot used
- Cans for Soil Moisture
  - Clear vegetation from collection area
  - Place can open end down, hammer into soil
    - Use wooden plank for even force distribution
  - Remove can using spade to ensure soil is retained
  - Measure weight of wet soil, bake in soil oven, then measure dry soil to find soil moisture percentage
- Enter data into the GLOBE website
- Use Stats Blue website to enter variables to look for correlations.
  - Stats Blue uses equation (y=c+a*x1+b*x2) to determine correlations.

A large Solar Field, for their size could make larger negative impacts

Collecting soil to measure Soil Moisture

Solar panels affect the earth around them; panels create colder ground and higher moisture levels. However, impacts are minimal.

Measuring surface temperature



Surface Temperature graph, measuring only the top of the soil

	Spot 1 and 2	Sport 2 and 3	Spot 1 and 3
Surface Temperature	0.01333333333	1.126666667	1.14
Soil Tempurature	0.2933333333	0.7866666667	1.08
Soil Moisture	1%	-4%	-3%

Chart showing the average difference between each spots

Measuring soil temperature

Main area of research

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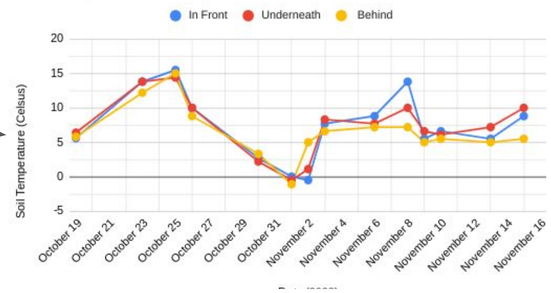

Soil Temperature graph, measuring deep into the soil

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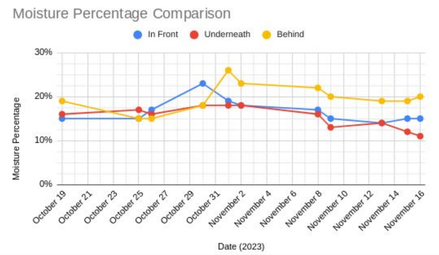
Abstract

When beginning the research, it was theorized that solar panels would greatly change the area below them with increasing moisture content and lower temperatures due to the shade. Over a few months, measurements with an infrared thermometer, a soil thermometer, and collected soil with cans created results which showed their effects were quite small. As a result, it was found solar panels have little negative impacts and should be encouraged even more. “We also found the PV panel had some beneficial effects on plant species composition, diversity patterns, and soil properties” (Shang et al. p. 2805).

Results

The results showed a low amount of difference between different spots, with temperature slowly decreasing over time, possibly due to the changing weather. In addition, behind the panel had a harder time gaining moisture, but maintained its level once it had some, remaining more wet than the other spots. Furthermore, the front of the panel was overall the warmest, with the temperature decreasing as we went back behind the solar panel. Moreover, as found in the multiple linear regression calculations, each temperature variable only had around a 20% impact on moisture, showing there was a weak correlation.



Model: $\text{Moisture Percentage} = 17.6814 + 0.1326 \cdot \text{Soil Temp.} - 0.2585 \cdot \text{Surface Temp.}$

Conclusion

Overall, solar panels do affect the area around them, with behind the panel becoming colder and retaining more moisture and a slow decrease of surface temperature over the complete area. However, the changes are extremely small and wouldn’t serve to discourage the installation of solar panels. Despite this, even small changes in soil moisture could impact the stability of a large solar array, especially in landslide-prone areas.

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