The influence of solar panels on local hydrology and plant ecology

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Abstract
Photo voltaic solar energy is a clean source of energy with much lower carbon footprint than other sources. However, the vast land requirements of solar energy arrays may make installation impractical when available land is better suited for other purposes. The goal of this research was to investigate changes to the environmental physics, grass production, and grass species diversification under solar panels in an active pasture. To this end, different land characteristics were studied observationally including the length of the growing season, the greenness, the production per acre, and the environmental physical processes.

Experimental setup
The observation setup involved two microclimatical stations that were installed in the Rabbit Hills solar array, OSU campus Oregon; one in and open area and the other in the solar array. The soil moisture was quantified using a complimentary system of electronic sensors and neutron probe readings. Soil moisture beneath the solar array was significantly higher.

Soil moisture measurements were taken at four locations in study area in April, June, July and August of summer 2015. Plot (1) depicts the soil moisture in April that is saturated and there is no significant differences. As days pass and soil becomes drier in June, the profiles separate. The driest places are the control, and the fully open area within the solar array. Plot (3) is the last day measurements that shows a clear separation of lines. Plot (3) shows the average soil moisture ratio varies dramatically inside the solar panel array by location. Time series in plot (4) shows the occurrence of wilting point at clayey soil that in fully open area is about 40 days sooner than totally covered area.

Weather station
Two weather station collected data: one in control area and one inside the solar panel array. These stations measured the temperature, relative humidity, solar radiation and wind speed. Devices were installed at four heights 0.5, 1.2, 2, and 2.3 meters. These plots are selected from the devices at two meters. Plot (4) shows there is no significant difference between temperature inside and control area. We see the same results for relative humidity in plot (6). But, solar radiation and wind speed have significant differences.

Vegetation monitoring
Grass type | Control area (%) | Inside solar panels (%)
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Hordeum | 75 | 10
Agrostis | 20 | 30
Alopecurus | 7 | 50
Schedonorus | 9 | 5
Bromus | 22 | 5
Calamagrostis | 6 | -
Cirsium | 10.5 | -
Dactylis | 0.5 | -

References

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