MS-GIST Projects Fall 2023
Monday, December 04

**** There will be 5 minute breaks between each back-to-back presentation to facilitate transitions in Zoom.***
***** Zoom links are available on request. Please contact Andrew Grogan - atgrogan@arizona.edu***

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Investigating the Influence of Solar Panel Arrays and Agrivoltaics Arrays on the Urban Heat Island Effect

Caleb Ortega
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12/04/23, 09:30 - 09:55 AM

Abstract:

Renewable energy, specifically solar power, has witnessed significant growth globally, emerging as a dominant energy source. While solar energy is praised for its emissions-reducing potential, it raises environmental concerns related to land use. One important consideration is the local temperature impact of photovoltaic arrays, referred to as the photovoltaic heat island effect (PVHI). This potential effect has halted many proposed solar developments and has significant implications in urban planning. This paper investigates multiple solar sites in the southwest region of the United States measuring the distance to drop-off (the furthest distance in where the panels significantly affect land surface temperature), and the average increase in temperature within the system from a natural non developed state. Secondarily, this paper will investigate the effects of nontraditional array types such as Agrivoltaics—which integrates crop and energy production within the same space. Analysis is conducted using raster data from the United States Geological Survey's (USGS) Natural Earth Portal, utilizing Landsat 8 and Landsat 9 Collection 2 Level 2 Surface Temperature data. Seasonal temperature variations are normalized by measuring the differences between “natural” and solar or urban points within the study area creating an urban heat island intensity index. Temperature drop-off is examined by using transects which extend from the center of an array outwards to create stack profiles for each solar site. The implications for the water, food, energy nexus is examined and informs policymakers and stakeholders facilitating sustainable development and potential PVHI mitigation strategies.

Keywords: solar, agrivoltaics, heat island, raster, climate change

Land Cover Contributions to the 2023 Maui Wildfires

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12/04/23, 11:00 - 11:25 AM

Abstract:

On August 8th, 2023, Hurricane Dora's heavy winds led to the collapse of power lines near Lahaina, Hawaii, sparking a brush fire that decimated the town. Simultaneously, other brush fires erupted on the leeward slopes of Haleakala in upcountry Maui, destroying homes in Kula. Invasive grasses in unused farmland were identified as a significant contributing factor in the aftermath. Notably, a major landowner is currently facing a lawsuit, with allegations of failed land management leading to fatalities during the fire. This study seeks to quantify the land cover on Maui with spectral signatures similar to these high-risk fallow farmlands and to determine the proportion zoned as private agricultural land. Using Landsat 8 and 9 OLI imagery and a K-nearest neighbors algorithm, land cover was classified. The burned areas in Lahaina and Kula were initially identified using a dNBR (differenced Normalized Burn Ratio). From these dNBR-derived polygons, training samples were then selected from a different image taken before the fire for the classification algorithm. Research reveals that ownership of these high-risk areas is divided fairly evenly among private entities, county, and state government agencies, emphasizing the complex nature of responsibility in land management.

Keywords: Maui, dNBR, Landsat, Lahaina, Wildfire

Recreational Trails in Olympic National Park that will be Affected by Climate Change in the next Century

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12/04/23, 01:00 - 01:25 PM

Abstract:

Olympic National Park covers nearly 1 million acres of the eponymous peninsula in Washington State with over 600 miles of maintained trails across diverse ecosystems. Recreational activities using the trails found in Olympic National Park are enjoyed by 2.4 million people every year. Olympic National Park has designated addressing climate change, which refers to long-term shifts in temperature and weather patterns, as a priority for the National Park in the next century. Climate changes in the park are projected to result in a variety of hydrological changes, such as decreased snow residence times and an increase in flood frequency and magnitude, in addition to extreme and unseasonable weather patterns. Regardless, there is no scientific literature studying the effects of climate change on recreational trails in Olympic National Park and the weather pattern changes that would have the highest levels of impact and what those levels would be. Data from the National Ocean and Atmospheric Association (NOAA), the National Park Service, the Forest Service and NASA helped paint a picture of five specific climate change scenarios: temperatures, flooding, precipitation levels, snowmelt, and sea level rise. Using the highest projections, with a Representative Concentration Pathway (RCP) of 8.5, it was found that a majority of the 600 recreational trails in Olympic National Park will be impacted by either one or more of the stated climate change scenarios in the next century.

Keywords: Olympic National Park, recreational trails, climate change, projections, impacts

Geo-Spatial Analysis of the Number of Active Fuel Supply Equipment Registered in Oregon under the Clean Fuels Program

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12/04/23, 02:30 - 02:55 PM

Abstract:

The Oregon Department of Environmental Quality (DEQ) launched the Clean Fuels Program (CFP) in 2016 that primarily focuses on reducing emissions from transportation fuels such as diesel and gasoline. The program has set standards to reduce the carbon intensity of these fuels by 10% in 2025, 20% in 2030, and 37% in 2035. Within the CFP framework, "Fuel Supply Equipment" (FSE) is the umbrella term for various equipment that dispense alternative fuels, from electric vehicle chargers to hydrogen fueling stations and propane dispensers. Credit Generators, i.e., providers of natural gas, propane, electricity, and hydrogen, must register such equipment to accurately report the fuel dispensed and consequently generate credits. This research investigates the relationship of the active FSEs registered under the Oregon CFP and Oregon's demographics, such as population, housing units, and employer establishments. Utilizing Geographic Information Systems (GIS) and statistical methodologies, this study analyzes data from 2016 through September 30, 2023, at both state and county levels. It found a high concentration of active FSEs in counties along the U.S. Interstate Highway 5 (I-5). Spatial autocorrelation analyses revealed a positive correlation between active FSEs and demographics in Multnomah, Washington, and Clackamas counties. The analysis reveals that counties with higher populations, more housing units, and more commercial establishments are likely to have more active FSEs, contributing to the achievement of the state's emission reduction goals.

Keywords: Clean Fuels Program, Fuel Supply Equipment, Alternative Fuels, Spatial Correlation Analysis, Sustainable Transportation, Low Carbon Fuels