MS-GIST Projects Spring 2022
Monday, May 02

**** 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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Land Use Effects on Urban Heat Islands in Maricopa County

Kyle Bollinger
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05/02/22, 08:30 - 08:55 AM

Abstract:

Maricopa County of Arizona is the 4th most populous county in the US, growing over 20% in population between 2010 and 2020. The Urban Heat Island (UHI) phenomenon in the county has increased alongside. The continued growth of urban and suburban structures, roads, and vegetation removal have created a heating effect near the ground that can be measured by the Land Surface Temperature (LST). By comparing Landsat 8 TIRS data the LST and thus UHI can be analyzed to better understand the long-term costs associated with urbanization. This effect is commonly associated with the removal of vegetation and using low reflective building and paving materials which can disproportionally influence the surface temperatures and thus heat in the area. Due to the sparse desert vegetation of Maricopa County, one would suspect that the newly developed areas may not be much warmer but due to the nature of the built materials that can absorb and release more energy after the sun sets than typical Arizona dirt. However, newly planted, and harvested farmland had the largest mean LST shifts within the study period contributing to the UHI problem even though farming occurs in rural areas. The urban space needs additional considerations and model variables that county officials could consider. Using an exploratory regression with an average land use per American Community Survey census tract and a generalized linear regression, results show which areas might exacerbate UHI issues so that the associated costs can be considered as part of future planning.

Keywords: Urban Heat Index, development, Arizona, Maricopa County, land use

A Retro-Analysis of the January 7th, 2022 Flood Closure of Interstate 5

Georgianna Strobin
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05/02/22, 10:30 - 10:55 AM

Abstract:

Floods pose an acute risk to transportation networks and impose large costs on travelers. A twenty-mile section of Interstate 5 (I-5) was forced to close on January 7th, 2022 when rising floodwaters from the Chehalis, Skookumchuck, and Newaukum Rivers threatened to cover the highway. Many travelers and residents were unable to reach their destinations and alternate routes quickly became congested . This retroactive analysis investigated the total cost of the flood closure using traffic counts from permanent traffic recording stations, AAA's estimated cost per mile of operating a vehicle for 2021, and the standard velocity equation—time equals distance divided by velocity—to solve for time cost. Through a GIS-based network analysis, two unique alternative routes are identified and time and mileage costs for travelers are calculated. Route One costs $151.97 while Route Two costs $160.67 in time per vehicle. Respectively, the routes cost $103.65 and $114.20 in mileage costs for each vehicle. Additionally, two historic Washington State Department of Transportation (WSDOT) detour routes are compared in time and mileage costs. Historic Route One costs $266.10 in mileage and $703.94 in time. Historic Route Two is much more expensive at $338.10 in mileage and $1,136.47 in time. The total cost of the flood closure was $924,950. With only one direct route to access so many destinations, it continues to be vitally important to increase access to urban and rural destinations during flood disasters.

Keywords: transportation network, flooding, road closure, travel costs, Interstate 5, I-5, rivers

Collection of PLSS Section Corners in Pima County, Arizona

Nathan Gardner
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05/02/22, 11:00 - 11:25 AM

Abstract:

The Northwest Ordinance of 1787 was the beginning of the Public Land Survey System (PLSS) and subdivided the lands of the United States into a rectangular grid system. This grid did not include the 13 original colonies or Texas, but it did cover the remaining current and future lands of the US. In most cases this grid system controls how land is divided regardless of who owns it. While each corner in the PLSS has a unique location and name, there is not a universal system to record and share their monumented locations. Each state and county have been left to decide if they will create a location database and how they would like to achieve that. This project is starting that process for Pima County, Arizona. This was accomplished using a data collection process for both field work and data files, then populating a web map database and displaying that on a dashboard. The dashboard allows viewing and downloads of those points to the public. These are available as tools for those who need to locate PLSS corners for any reason. The locations in this database may not be the most precise and accurate locations or considered “survey” grade. They do give a starting point for anyone needing to find one of these entries, and provide a record, including a timestamp, of what is or was at that location. This information can be used by professionals, the public, and municipalities to increase map accuracy or just find the point.

Keywords: section corners, Pima County, record, monumented, survey

Using Spectral Indices to Determine the Effects of the Summer 2021 North American Heat Wave at Mount Rainier, Washington

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05/02/22, 12:30 - 12:55 PM

Abstract:

Quality of life at Mount Rainier and the surrounding region is dependent on annual snowpack and subsequent snowmelt. Winter storm observations, snowpack, and the rate of snowmelt all play critical roles in determining the health of the environment. To help analyze these factors, users and consumers rely on remotely sensed data to analyze the past, present, and future of the area. The Normalized Difference Snow Index (NDSI) and Normalized Difference Vegetation Index (NDVI), collected from satellite imagery, are two spectral indices used with analyzing snowpack and vegetation health to assist risk mitigation for wildfires, glacial change, and river ecosystems. This project used NDSI and NDVI to determine if the 2021 North American heat wave had any significant effects on vegetation health, snowpack, and glacial size over a five-year study period. Landsat 8 satellite imagery was acquired, corrected any atmospheric bias, and processed through GIS techniques. Despite yearly fluctuation of warmer and cooler years, results show a progressive increase in snowmelt with 2021 showing the highest percentage during the study period and the highest differential from the mean of all years in the study. Vegetation labeled as “Healthy” saw the biggest decrease between consecutive years from 2020-2021. In 2021, Mount Rainier saw its glaciers recede to their lowest total area since 2005. Conclusions show that general warming trends are occurring in the Pacific Northwest and the heat wave exacerbated total glacial area, total snow area, and vegetation health. This Masters project contributes to future extreme weather anomalies and related results.

Keywords: NDSI, Landsat, GIS, NDVI, snowmelt, vegetation, Mount Rainier

Detection of Distress and Disease in Deciduous Trees Utilizing Remote Sensing

Jacob Morris
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05/02/22, 01:00 - 01:25 PM

Abstract:

Locating and identification of plant stress and diseases plays a major role in plant conservation and human safety concerns relating to falling hazards and reduction in fire blocks between structures in medium sized population centers. Overall flora heath can be indicated by visual observations of the chlorophyll and other pigments in the leaves. As outside interference with the plants ability to naturally produce the required nutrients, such as environmental and pathological interference, the visible pigmentation change. In this study, pigment variation is evaluated and analyzed by machine learning methods including image classification for the evaluation of health in deciduous trees. By utilizing multispectral imagery this study compares wavelength values for identified affected individuals showing visual symptoms to located other affected individuals both showing symptomatic and non-symptomatic individuals. Data analysis was conducted utilizing a trained supervised classification, support vector machines and K nearest neighbor method to determine which method was most precise in identifying affected pixels for fast-tracking management evaluations for resource managers. The overall classification accuracy of targeted, healthy, fields, and urban was relatively good, with kappa values ranging from 0.66 to 0.75 and overall accuracy ranging from 70% to 83%. Support vector machines resulted in an accuracy of 82.13% with a kappa coefficient of 0.74 at a 750 point accuracy assessment making it the best method of the two for detections of symptomatic and asymptomatic individuals.

Keywords: distressed detection, disease detection, machine learning, multispectral imaging