MS-GIST Projects Summer 2022
Monday, August 01

**** 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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Forecasting buffelgrass (Cenchrus ciliaris) distributions in Southern Arizona under multiple climate change scenarios

Patrick Hellmann
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08/01/22, 02:30 - 02:55 PM

Abstract:

Buffelgrass (Cenchrus ciliaris) is an invasive grass that can alter fire regimes, reduce local biodiversity, and convert complex arid ecosystems into buffelgrass dominated grasslands. As buffelgrass populations continue to grow, it will be important to be able to predict which areas are most susceptible to future buffelgrass invasion. This study attempts to provide some insight into this problem by creating a model to predict changes in the extent of potential buffelgrass habitat under different climate change scenarios between 2020 and 2100. Maximum entropy modelling was conducted using known occurrences of buffelgrass in the Santa Catalina mountains of Southern Arizona in combination with 19 bioclimatic variables from WorldClim to create a baseline model, which was then applied to future climatic conditions under the Canadian Earth Systems Model 5 (CanESM5) for three different climate change scenarios. The maximum entropy method produced an accurate model with an area under curve (AUC) value of 0.9913 and in validation trails it was able to accurately predict the presence of buffelgrass with 91.37% accuracy. When applied to future climatic conditions, the model showed a 280% increase in potential buffelgrass habitat under light and moderate climate change scenarios, and a 501% increase under a more severe scenario. Considering this potential for buffelgrass to spread, it may be essential for land managers to aggressively combat buffelgrass introductions to prevent it from being able to spread further and continue to damage ecosystems, as well as emphasize the importance of minimizing the impacts of climate change.

Keywords: Buffelgrass, Tucson, Maximum Entropy, Modelling

Measuring Ground Deformation Using Interferometry

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08/01/22, 03:00 - 03:25 PM

Abstract:

The 2018 earthquake near Big Island, Hawaii caused landslides and ground deformation along the east coast. Ground deformation from seismic activity is of interest to scientists as it gives indications of volcanic activity below the Earth's surface. Measuring this deformation can be challenging and typically requires Global Positioning System (GPS) monitors in place prior to an event to measure change, however, radar satellites provide a clear picture of wide scale movements. Interferometric Synthetic Aperture Radar (InSAR) is a collection method that compares Synthetic Aperture Radar (SAR) collections to measure vertical and horizontal ground displacement. Specialty software reads these InSAR collections to create an interferogram, a deformation map that precisely measures the ground shift after seismic events, glacial movements, or biomass change. Processing an interferogram starts with raw radar collections from a SAR satellite such as Sentinel-1 and applies a series of corrections and transformations to create measurable data. The final interferogram indicates ground movement from -0.405 meters to +0.185 meters over the most active seismic area in Hawaii. A negative value indicates an underground eruption, or intrusion, which normally causes downslope lava flows while positive values often indicate buckling. The result from the interferogram quantifies the effects of seismic activity and how InSAR can be used to accurately measure deformation for use in planning safe urban and infrastructure growth in areas of seismic activity.

Keywords: Interferometry, Remote Sensing, Synthetic Aperture Radar, Deformation Measurement

LEAD AND COPPER RULE REVISIONS: A CASE STUDY IN IDENTIFYING AND TRACKING LEAD WATER SERVICE LINES WITH ARCGIS FIELD MAPS

Robert Martin
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08/01/22, 03:00 - 03:25 PM

Abstract:

The United States Environmental Protection Agency enacted the Lead and Copper Rule in 1991 to protect community water system consumers from exposure to lead and copper. The rule ensures levels of lead and copper in drinking water systems are below action levels. If the action level is exceeded, additional steps are required from water utilities to control corrosion in water systems. Significant quantities of lead in naturally occurring water sources are rare. However, with the use of certain plumbing fixtures containing brass, bronze or lead pipe prior to the Lead and Copper Rule of 1991, these materials can dissolve, flake or be found as small particles posing serious health risks. Corrosion can be a serious problem and is controlled through chemical treatment of source water. Considering events of the Flint, Michigan water crisis, revisions to improve the existing rule have been promulgated. The Lead and Copper Rule Revisions published on January 15, 2021, require service line material inventories, public outreach, and equitable replacement of lead service lines. Compliance is October 16, 2024. This case study includes a GIS based approach to identify and document all service line materials within the Ute Water District in Grand Junction, Colorado. GIS data architecture, methods and procedures utilizing ArcGIS software particularly ArcGIS Field Maps are shown to improve workflows, reduce time and redundancy over traditional paper record keeping methods. Data collection will be ongoing due to the large service area; however, a subset area will be analyzed within this study.

Keywords: Water, Lead, Copper, GIS, Field Maps

Evaluating replanting priority using GIS: Proposed model for replanting California in the wake of wildfires.

Alexander Wade
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08/01/22, 05:00 - 05:25 PM

Abstract:

As the number and scale of wildfires in California continue to increase, so too has the amount of land in need of replanting. Severely burned areas run the risk of soil loss as unsupported soil formations are eroded by exposure to wind and water, damaging the environment and potentially endangering infrastructure. In order to reduce environmental degradation and potential secondary fire-related damage to infrastructure, a new geospatial model should be developed to help prioritize the most at risk areas for urgent replanting efforts. At the same time, due to the many stakeholders involved with these replanting efforts, such tools should be as easy and accessible for use. This Master's Project aims to create an automated model that anybody with access to ArcGIS can use. Using publicly available data, the model produces a polygon file of the most at-risk areas in a given burn area on the basis of slope, erosion potential, burn severity, as well as recommended Forest Service species for replanting. Using the instructions provided with the model, the user will be able to locate the raw data necessary to generate a prioritized area file for their own fire incident and customize the model to suit their specific incident. While not a comprehensive tool, this model will provide a starting point for targeted post-fire replanting efforts.

Keywords: Erosion, California, fire, replanting, tool

Seattle Crime Abstract

Alec Bieler
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08/01/22, 07:30 - 07:55 PM

Abstract:

The purpose of this Master Report is to spatially analyze violent crime rates in Seattle in 2020 to determine common demographic or locational relationships. I will be testing population subsets, number of households, mandatory affordable housing zones, unwanted land, and police station locations against crime using various types of analysis including spatial regression, heat maps, and bivariate maps. The data comes from Seattle City GIS including base map layers and 3,300 violent crimes. Population data came from the US Census Bureau. Preliminary results show a strong relationship between mandatory affordable housing and increased crime rates.

Keywords: Seattle Crime Analysis