MS-GIST Projects Summer 2022
Tuesday, August 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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Waterkeeper Alliance Coal-Ash Pilot Project: Development of Web GIS and Thermal Infrared Imagery Processing Tools for Preliminary Correlation Between Stream Temperatures and Proximity to Coal-Ash Waste

Raena Ballantyne Demaris
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08/02/22, 01:00 - 01:25 PM

Abstract:

Coal-ash toxic waste is a "dirty energy" byproduct of coal-fired power that includes heavy metals and contaminants and is associated with climate change. Its disposal is poorly regulated in the United States; in some cases, coal-ash is discharged directly into rivers. Coal-ash contributes to elevated stream temperatures, adversely impacting living organisms and ecology. Waterkeeper Alliance, a non-profit organization advocating for clean water, initiated a coal-ash project with three aims: creating web tools that aid waterkeepers in identifying coal-ash concerns; developing a tool that processes Landsat Surface Temperature data derived from thermal infrared imagery and prepares it for analysis; and exploring the correlation between water surface temperatures and proximity to coal-ash waste using Landsat data. Coal-ash data were transformed into web layers in ArcGIS Online and formed the basis of web maps and apps for waterkeeper use. Using ArcGIS Pro ModelBuilder, a model was built to process Landsat data in a Pilot Study Area (Missouri and Kentucky). In the model, high-quality water pixels are identified, converted to Celsius, and extracted as vector points with distance to coal-ash added as an attribute. The model concludes with a bivariate spatial correlation between water temperature and coal-ash proximity. In one iteration, ninety-four percent of data showed a geostatistically significant correlation between water surface temperature and coal-ash proximity. Twenty-four percent showed a negative linear correlation and thirty-seven percent showed a complex relationship. While the analysis affirms a non-random relationship between variables, the relationship appears far more complex than two variables and Landsat imagery can explain.

Keywords: coal-ash, toxic waste, thermal infrared imagery, climate change, stream temperature

Cartographic Survey of Golder Ranch Fire District

Danny Lawlor

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

Abstract:

The goal of this project was to complete a series of layouts for Golder Ranch Fire District (GRFD) to be incorporated into a report, Golder Ranch Fire District: Community Risk Assessment – Standards of Cover, created by the district as part of an ongoing accreditation process. Granted by the Center for Public Safety Excellence, the accreditation is centered around a thorough self-assessment that identifies strengths and weaknesses so that the fire district can better use its resources to serve the community. To this end, this capstone project provided a cartographic survey of GRFD, with maps and analysis displayed in layouts that featured a variety of assets and hazards. This was a collaborative project in which drafts were shared and revised until reaching satisfactory results. Ultimately, over thirty layouts were completed, covering everything from fire hydrant locations and water providers to wildfire risk and travel time analysis. As it would have been impractical for this paper to analyze all of the layouts as well as the methods involved in their creation, two layouts were selected for review: Senior Population and NWFD and TFD Stations That Can Reach GRFD within Eight Minutes. Looking at these layouts provided a window into the project's methods and the cartographic techniques employed in a real-world application of the skills acquired as a result of completing the MS-GIST coursework.

Keywords: Golder Ranch Fire District, Accreditation, Cartography, Tucson

Mapping Crime Analysis

David Garritson
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08/02/22, 02:00 - 02:25 PM

Abstract:

Working in law enforcement is a difficult task, having the right tools available could mean success over failure. A proven method to identify and deter crime is mapping incidents from existing data so that it can be analyzed to identify patterns. Many small to medium size law enforcement agencies do not have the resources to utilize crime analysis mapping. Whether it is a matter of knowledge, time, staffing, or other factors; the benefits of mapping crime are unfortunately missing. By offering an understanding of the benefits of GIS, it will lead law enforcement agencies to use mapping in their crime analysis. With a clear understanding of where crime is being committed, trouble areas can be policed to reduce crime. Through creation of simple maps that depict criminal activity for a given area, it is possible to deter that crime. Learning how to utilize GIS tools that are currently available to prepare a visualization of crime in the form of a map, could lead to improved policing. Safer communities are possible with the proper training, a clear understanding of problem areas, and using mapping as a solution.

Keywords: analysis, crime, mapping, policing, safe

New method to identify illegal uses of water by using remote sensing and neural network in Laguna de Aculeo, Chile.

Héctor Leopoldo Venegas Quiñones

08/02/22, 03:30 - 03:55 PM

Abstract:

The Aculeo lagoon basin has been declared an emergency drought place, limiting water usage strictly for domestic use. Chile's laws impose economic sanctions on individuals who use water resources to irrigate grass in these places. This project evaluates the healthy lawn condition in a specific dry season (period without rain events) to identify the areas that have potentially been using the water resource illegally by using multi-spectral and multitemporal free satellite data at the Aculeo lagoon basin. We derive different soil indices, the Normalized Difference Vegetation Index (NDVI), Enhanced Vegetation Index (EVI), Green Normalized Difference Vegetation Index (GNDVI), Soil Adjusted Vegetation Index (SAVI), Normalized Difference Moisture Index (NDMI), Moisture Stress Index (MSI), and Bare Soil Index (BSI) during October 2021 to April 2022. Also, we perform a cluster analysis to evaluate the statistical distribution of healthy vegetation cover. All the results are available in an ArcGIS interactive web map. This research proves some properties have probably used water to irrigate lawns because their health has maintained or increased over time. Thus, we estimate the lawn areas in the basin and their water consumption to illustrate how much water has been used illegally. In addition, the cluster analysis demonstrates a consistent pattern of healthy vegetation covers, concluding that these groupings are unusual compared to the entire basin. We present tools and protocols to be used in areas of water scarcity to identify locations that use the water resource illegally, helping governmental authorities to accomplish personal inspections and impose legal sanctions.

Keywords: remote sensing, neural network, laguna aculeo, chile, aculeo lagoon

Using Earth Observations to Map the Spatial Distribution of Buffelgrass in the Sonoran Desert

Victor Batres
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08/02/22, 05:30 - 05:55 PM

Abstract:

The Sonoran Desert is recognized as an arid ecosystem with a year-round warm climate and biodiverse desert flora. The desert spans across the southwestern United States and northwestern Mexico. Much of the native flora, like the saguaro cactus (Carnegiea gigantea), are important members of the Sonoran Desert for native wildlife and human society. Currently, the ecosystem is being threatened by the rapid spread of an invasive grass species known as buffelgrass (Cenchrus ciliaris), as it is changing the desert landscape to a grassland and contributes to more flammable fuel of surging wildfires. This project, in partnership with the Tucson Sonoran Desert Museum's "Save our Saguaros" initiative, utilized satellite imagery of Tumamoc Hill and Sentinel Peak from Google Earth to develop and assess an optimal workflow marking the spatial distribution of buffelgrass via manual mapping. This would aid in early detection and rapid response management not only within the study area but other areas of the Sonoran Desert. GIS analysts worked with a predetermined buffelgrass identification key to manually plot growth sites of the species across the study site. Satellite Imagery from 2017-2020 was found to provide the best visual reference for historical buffelgrass growth and through remote mapping and ground truthing a significant accuracy level was achieved.

Keywords: Sonoran Desert, buffelgrass, conservation, wildfires

Using Earth Observations to Map the Spatial Distribution of Buffelgrass in the Sonoran Desert

Scarlet Jackson
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08/02/22, 05:30 - 05:55 PM

Abstract:

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