MS-GIST
Master Projects Spring 2021
Thursday May 7th (Livestream via Zoom)

*** There will be 5 minute breaks between each presentation to facilitate transitions in Zoom.**

**** Zoom links available on a per request basis. Contact: atgrogan@email.arizona.edu**

Date/Time	Title	Person *
05/07/2021 1:00 – 1:30 pm	Evaluating Observations of GIS Visualizations: An Exploratory Spatial Analysis of College Football Recruiting in the Southeastern Conference	Terry Bearb
05/07/2021 1:30 – 2:00 pm	Mapping the Quality of Life (QoL) for Urban Communities: A Case Study of the Town of Miami Lakes, FL	Michael Zayas-Morales
05/07/2021 2:00 – 2:30 pm	Post-Wildfire Landslide Susceptibility Analysis: LNU Lightning Complex Fires Case Study	Kayla R. Haneline
05/07/2021 2:30 – 3:00 pm	2020: Visualizing the Spread of the COVID-19 Pandemic and Government Responses Across United States	Tyrel Borowitz
05/07/2021 3:00 – 3:30 pm	A Comprehensive Study of Forest Health and Structure Following the West Fork Fire Complex in Southwest Colorado through Normalized Difference Vegetation Index (NDVI) and Normalized Burn Ratio (NBR)	Michael Rodriguez
05/07/2021 4:00 – 4:30 pm	A Habitat Suitability Analysis of Texas Horned Lizards in Texas and New Mexico	Reid Wolfgang Piehler
05/07/2021 5:30 – 6:00 pm	Socioeconomic Status and Land Cover as Predictors of the Urban Heat Island Effect in Tempe, Arizona	Sean C. Madigan

05/07/2021 **7:00 – 7:30 pm**	**A Deep Look of Wildfire Contribution Factors in Santa Catalina Ranger District, AZ**	**Zhicong Ma**

Evaluating Observations of GIS Visualizations: An Exploratory Spatial Analysis of College Football Recruiting in the Southeastern Conference

Terry Bearb
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Abstract:

The Southeastern Conference (SEC) in the NCAA is widely known as being a competitive college football conference, comprising the most elite athletes. What is not apparent is where the recruits originate, which universities in the SEC recruit with efficiency, and which universities are required to seek athletes from out-of-state. To investigate this phenomenon, recruit point data was obtained and ultimately used to visualize densities, dispersions, and point distributions via choropleth, graduated symbol, heat maps, and map overlays. For each university in the SEC, spatial analysis tools were used to map the number of recruits that existed within the bounds of each state, map the geographic center for each university's set of recruit point data, identify recruits within a proximity of each campus location, and map the directional tends of each university's recruits by way of standard deviational ellipses. The final cartographic products are used in a visualization survey to determine which maps are the most informative and are best utilized to help identify spatial patterns of recruiting. Survey questions not only focused on specific dispersion tendencies for each cartographic medium, but also fixated on overall map interpretation, preference, and aesthetics. Results of the survey indicate that Heat Maps were overwhelmingly favored and allowed map readers to answer survey questions with the highest success.

Keywords:

Spatial Patterns, College Football Recruiting, Visualization, Point Distribution

Mapping the Quality of Life (QoL) for Urban Communities: A Case Study of the Town of Miami Lakes, FL

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Abstract:

Public employees are in the front lines debating climate change, sustainability, community, and economic development, among others. Government officials make decisions regularly that affect the quality of life of the residents they serve. Still, they do not systematically keep track of how positive or negative is the current urban quality of life (QoL) of the different communities in the municipality. Through literature review, five indicators were selected in this project to measure QoL in the Town of Miami Lakes, Florida, including a total of 14 ranked variables to measure location suitability based on socioeconomic, environmental, and sustainability factors. Variables collected were from first and secondary sources about transportation, jurisdictional and physical boundaries, land use, and demographic and environmental indicators, which were gathered from open-source GIS hubs or created by the author of this capstone project. Using weighted linear combination of such ranked variables in a GIS workflow, computation and visualization of a QoL index across the Town of Miami Lakes was made possible. Multiple ring buffer analysis allowed the classification of space as a function of proximity to QoL resources, while raster algebra was used for the weighted linear combination of ranked variables. Results show that the most frequent QoL values in the study area are average or high relative to the selected indicators. Based on these results, we discuss how municipal planning in the Town of Miami Lakes has aligned with the improvement of the residents' quality of life, and recommend further steps for future improvement.

Keywords:

Quality of Life, Miami Lakes, Sustainability, Pollution, Risk

Post-Wildfire Landslide Susceptibility Analysis: LNU Lightning Complex Fires Case Study

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Abstract:

Debris flow landslides are a common and dangerous hazard following wildfires, and landslide susceptibility should be assessed targeting burned areas to mitigate future risks to the public. Post-fire landslide susceptibility analysis is a complex topic that must consider a plethora of factors and variables to create an accurate susceptibility surface, and researchers have investigated many methods' effectiveness in predicting post-wildfire landslides. Providing an opportunity to analyze landslide susceptibility, the LNU Lightning Complex fires burned in Northwestern California from August 17, 2020 to October 2, 2020, burning 363,220 acres. The objective of this study was to create a landslide susceptibility map of the LNU Lighting Complex burn area and predict possible future landslide locations. To create the landslide susceptibility surface, a weighted sum calculation was carried out based on five factors that affect post-fire landslide susceptibility. Each factor was mapped over the study area and categorized into index values based on landslide risk before being included in the weighted sum calculation. Weighted sum raster models were created for both short-term and long-term susceptibility. The study concluded that there are four prominent regions at a high risk for landslides. Of these four areas, two should be prioritized due to the higher number of high-risk pixels occurring within one mile of a major highway. Results of this study can be used to prioritize areas of high risk and minimize risk to the public.

Keywords:

Landslide Susceptibility, Wildfire, California Wildfire, Debris Flow, Weighted Sum

2020: Visualizing the Spread of the COVID-19 Pandemic and Government Responses Across United States

Tyrel Borowitz
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Abstract:
As the COVID-19 pandemic has impacted the world, there have been numerous ways governments have responded to the health crisis. From mandating facial coverings and closing schools to investing in contact tracing and public information campaigns, state governments are taking different measures to limit the spread of the virus while keeping society operating. This study sought to better understand how these government policies are affecting the number of cases and deaths by visualizing how these numbers have changed throughout 2020. Using data from the Oxford COVID-19 Government Response Tracker, the progression of government action is mapped to show when the containment health index changed for each US state as well as how cases and deaths grew over the year for each state. This study also utilizes a public survey to evaluate the effectiveness of several different visualization methods, including interactive and animated maps. The effectiveness is measured by how well each method communicates significant facts, temporal changes, and the possible contributing factors of the spread of the pandemic as well as government policies enacted in response to the pandemic. The findings can further inform which methods toemploy based on the purpose of the visualization.

Keywords:

COVID-19, Government Policy, Pandemic Response, Survey, Animated Temporal Map, Visualization Methods

A Comprehensive Study of Forest Health and Structure Following the West Fork Fire Complex in Southwest Colorado through Normalized Difference Vegetation Index (NDVI) and Normalized Burn Ratio (NBR)

Michael Rodriguez

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Abstract:

In June 2013, southwest Colorado faced one of the largest wildfires in state history, the West Fork Fire Complex. Being composed of three separate fires (Papoose, West Fork, and Windy Pass), the wildfire burned approximately 110,000 acres within the Rio Grande National Forest. This project aims to understand how the West Fork Fire affected forest structure and recovery, and measures these impacts using Landsat 8 imagery to analyze NDVI and NBR. NDVI was calculated to understand impacts to vegetation, while NBR was calculated to understand overall burn severities. Specific measurements of NDVI and NBR values were collected across 30 designated control points within each set of imagery. NDVI results showed a decrease of 63% in control point values from June to August 2013, indicating immediate impacts to forest structure. The average values fell from greater than 0.20 to less than 0.10, classifying these once sparsely covered lands into areas of barren rock or sand. NBR values saw a decrease of 309% over the same period. ΔNBR values averaged 0.33 which indicated moderate to low severity burns throughout the landscape while ΔNDVI averaged 0.12. July 2016 NDVI saw a 123% increase from the 2014 data, and NBR a 114% increase. Both analyses presented higher values in 2016 than their 2013 data, showing forest recovery. The results indicated the West Fork Complex had a moderate to low impact. The results also show how NDVI and NBR aid in classifying the severity of wildfires, vegetation health, and how these methods can be reproduced.

Keywords:

Wildfire, NDVI, NBR, Landsat, Burn Severity

A Habitat Suitability Analysis of Texas Horned Lizards in Texas and New Mexico

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Abstract:

The Texas Horned Lizard (Phrynosoma cornutum) is a state-protected lizard native to the American Southwest. To rebuild the Texas Horned Lizard population, they are bred in captivity and released into the wild. Identifying factors that impact habitat suitability is vital to finding the proper areas for release and reintroduction. Environmental and human factors were examined in Texas and New Mexico counties native to the Texas Horned Lizard, as well as counties without known sightings, to determine which factors most impact habitat suitability. Four statistical and geospatial software packages were used to map, analyze, and evaluate 24 potential variables and it was discovered that elevation, road density, natural gas pipeline density, seasonal rainfall, land use category, and proximity to Red Harvester Ants are all statistically significant to Texas Horned Lizard habitat suitability at a 95% confidence level. Texas Horned Lizards are most prevalent in counties with low elevation, high percentage of open water or snow, low precipitation levels, and native habitats for Red Harvester Ants. Horned Lizards are also less prevalent where road density or natural gas pipeline density is high. No significant difference was detected in habitat suitability relative to Imported Fire Ants as suggested in previous studies. To protect viable environments for Texas Horned Lizard reintroduction, pipeline and road construction should be limited in the most suitable regions: eastern and southern New Mexico, the southern Gulf Coast, the Texas Panhandle, Edwards Plateau, and the Rio Grande Valley.

Keywords:

Texas Horned Lizard, Texas, New Mexico, Habitat Suitability, Herpetofauna, Phrynosoma Cornutum

Socioeconomic Status and Land Cover as Predictors of the Urban Heat Island Effect in Tempe, Arizona

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Abstract:

Developed land emits heat more effectively than rural land. This results in an urban heat island effect, where cities have hotter temperatures than surrounding rural areas. Urban heat islands pose a public health risk in many cities and especially affect areas of lower socioeconomic status, where people are more vulnerable to extreme heat conditions. The Phoenix Metropolitan Area in Arizona is one of the fastest growing metropolitan areas in the United States and regularly experiences extreme heat in the summer. Tempe, a city within the metropolitan area, has outlined a plan to decrease the urban heat island effect by increasing tree cover to 25% by 2040. Landsat 8 OLI/TIRS satellite imagery was used to estimate land surface temperature (LST), a measure commonly associated with urban heat island effects. A land cover classification and US Census data were used to predict mean LST in Tempe. Exploratory regression and spatial regression identified a six-variable model with increases in mean household income, college population, grass land cover, and water cover all decreasing mean LST, while increases in urban land use and a spatial lag variable increased mean LST. Although overall estimates of tree cover were 23% of the land surface, estimates were high as the classification model overestimated tree cover due to the spatial resolution of the Landsat 8 sensor. Results suggest that although Tempe has made progress in its goal, there are discrepancies between areas of differing socioeconomic status.

Keywords:

Urban Heat Island, Remote Sensing, Landsat 8, Spatial Regression, Land Surface Temperature, Tempe

A Deep Look of Wildfire Contribution Factors in Santa Catalina Ranger District, AZ

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Abstract:

On June 5, 2020, a lightning strike ignited the Bighorn Fire in the Santa Catalina Ranger District northwest of Tucson, AZ. The fire quickly grew into a 119,987 acres mess since the dry and windy weather accelerated the pace of picking up flammable fuels. This project aims to evaluate possible factors that could cause severe lightning-induced wildfire burns between May and July around Santa Catalina Ranger District and eventually come up with precaution measures to mitigate wildfire damage as much as possible. At first, surface reflectance and raw satellite imagery showed the fire's scale both visually and graphically. Then supervised classification interpreted the graphic product about what type of vegetation gets the most burn and which area of the Santa Catalina Ranger District receives the most devastation. Further investigation was made for the most burned region by adding slope, rainfall data into consideration. After that, spatial regression was performed based on the vectorized raster layer to determine the conditions needed for a wildfire to grow into enormous size. Lastly, some preventive measures were discussed for protecting the ecosystem, residents, and property. The results show dry (avg. humidity<20%), gusty (avg.>10mph) weather conditions are likely to trigger a lightning wildfire. Then, other factors like steep slopes and short brushes could fuel the wildfire to expand relentlessly. Finally, sediment and debris run-off are a big concern for locals who live around burn scars due to the decreased slope stability, which might require further attention in building barriers and watching the flooding alerts.

Keywords:

Bighorn Fire, Coronado National Forest, Aspen Fire, Bullock Fire, Regression Analysis, Supervised Classification, Land Cover Change Detection, Normalized Burn Ratio