

MS-GIST Projects Summer 2022

Wednesday, August 03

** 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 Suitability Analysis of the Fredericksburg Viticulture Area in the Texas Hill Country

Stacy Teet
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08/03/22, 11:30 - 11:55 AM

Abstract:

In the last 50 years, commercial vineyards in Texas have grown from a handful to more than five hundred. Wine production has tripled since 2012, making Texas the sixth largest producer of wine in the United States. Like California's renowned Napa Valley, the Texas Hill Country is ripe for agritourism and wine cultivation bringing millions of visitors and billions of dollars to the state annually. Wineries and vineyards continue to grow, but few new owners have agricultural experience. Due to its unique climate and lack of historical data, growers and winemakers are still determining the best use of the terrain while navigating harsh weather and regional hazards. Proper site selection is critical. Spatial analysis of climate, soil and terrain characteristics were used to determine variables with the most impact on land suitability in the Fredericksburg viticulture region of the Texas Hill Country. Geospatial software was used to create a weighted overlay model of 14 potential variables. Surface analysis found aspect, slope, solar radiation, flood frequency, drainage class, current land usage and available water storage to be statistically significant to this study. Potential areas were ranked on a scale of one to five, with one being permanently unsuitable and five being highly suitable for viticulture. Results found 594 acres (27%) to be highly suitable, 1,158 acres (53%) to be moderately suitable, and 430 acres (20%) not suitable for viticulture. Safeguarding vineyards from climate extremes is the best way for growers in Fredericksburg to ensure high quality yields. Results of this study could help growers select prime areas for viticulture, but emphasis on natural and biological hazards, like Pearce's disease, and varietal specific factors are also essential.

Keywords: Suitability Analysis, Viticulture, Weighted Overlay, Surface Analysis, Spatial Analysis

LAND COVER CHANGE ACROSS BARBADOS USING REMOTE SENSING AND GIS TECHNOLOGY

Tia Browne
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08/03/22, 02:00 - 02:25 PM

Abstract:

This paper focuses on the use of GIS (Geographical Information Systems) technology to determine the land cover change in Barbados between 2014 and 2021. The island has experienced drought and urban expansion over the years which has raised concern about the availability of agricultural land on the island. Data acquired from the U.S geological survey earth explorer portal for February 2nd 26th and March 2nd, 2021, were used to compute the Normalized Difference Vegetation Index (NDVI) for both years. Supervised classification using Support Vector Machines was used to determine seven (7) identified classes and their changes over the eight (8) year period. Results from the NDVI showed a general decrease in healthy vegetation from 2014 to 2021. 43.22% of the island experienced vegetation loss with 56.52% having vegetation remaining unchanged. Interestingly, only 0.26% of vegetation experienced regrowth mainly in forested areas. The validation of the supervised classification method used yielded an overall medium level of agreement with between 64% and 67% accuracy. The most significant change in land cover was from bare soil/barren land to urban areas which accounted for 23.2% change. 10.4% of grassy areas in 2014 changed to urban areas in 2021 with less than 10% change from forest to urban and agriculture to urban.

Keywords: NDVI, vegetation change, supervised classification, Barbados, Landsat 8, Caribbean

Monitoring the Mega Drought and the effects it has on Reservoirs In Southwest Colorado using a Change Detection Analysis

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

Abstract:

All across the Western portion of the United States water is an increasing topic of concern. A majority of the mainstream discussion revolves around Lake Mead and Lake Powel the two largest reservoirs in the United States. This project aims to shed light on the “Mega Drought” impacting three reservoirs in Southwest Colorado, McPhee Reservoir, Lemon Reservoir, and Vallecito Reservoir. The way the impact of the “Mega Drought” will be monitored is by generating a Normalized Difference Water Index (NDWI) every year from 2013-2021. The NDWIs were generated by using Landsat 8 Level 2 Collection 2 data. The data was compiled into ArcGIS Pro software. That data was compiled into a multidimensional raster format so a time series analysis could be performed as well as the generation of a change detection raster. To quantify the results of the NDWI sample points were generated to extract the pixel values. The results of this study showed that over the nine-year study that reservoir levels rose to the highest value in 2016 and have continued to fall to the year 2021. In 2021 all their reservoirs are registered with an average NDWI value that is classified as a moderate drought, non-aqueous surfaces. The results of this research are showing that these reservoirs in Southwest Colorado are decreasing in volume year after year. Mostly caused by decreasing snowpack, warmer spring and summer temperatures, and increasingly unproductive monsoon seasons.

Keywords: NDWI, Landsat 8, Change Detection, Time Series, Remote Sensing

HOT SPOT ANALYSIS & EXPLORATORY REGRESSION ON HARMFUL ALGAL BLOOMS IN FLORIDA

Gregory Stanley
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08/03/22, 03:00 - 03:25 PM

Abstract:

Harmful Algal Blooms (HABs) are a natural phenomenon occurring 10-50 miles offshore, the size and concentration growing once they become more coastal. These blooms carry a neurotoxin that are not only harmful to marine life, but humans too, creating respiratory problems that could lead to death. Natural conditions such as the amount of sunlight, salinity, and temperature influence their survival and growth but there is also a human factor that accounts to their toxic state. Nutrient rich coastal runoff can attribute to the size and length of time of a red tide; this includes industrial and municipal waste discharge which contains nitrogen and phosphorus, key nutrients that the algae need to grow. This study focuses on an exploration of variables that may or may not affect the size and concentration of the HAB, *Karenia brevis*, which is responsible for red tides in the Gulf of Mexico, particularly in Florida. I used point data sets for the years 2015-2020 to create density maps that included salinity levels, chlorophyll concentrations, and three Toxic Release Inventory categories to see which affects HABs using Exploratory Regression. Additionally, a hot and cold spot analysis on these six datasets were tested to see if there was any high probability of occurrence around Florida. After running the regression tool, no passing models indicated any variables are related to HABs. However, the criteria VIF and Koenker (BP) of each model did pass as well as hot spots to occur in the Tampa Bay area and Cape Coral.

Keywords: Harmful Algal Blooms, Florida, Toxic Release Inventory, Red Tides

Housing & Race by Location Affordability

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

Abstract:

This Master's Report focuses on how price-to-income ratio and race by location affordability affect housing in Washington State. There are two levels of analysis. First, a price-to-income ratio using an affordability index was created to show areas of affordable to non-affordable housing. Price-to-income ratio calculates the median home value divided by the median household income resulting in a level of affordability ratio. The State of Washington has an affordability ratio of 5.6 and the ten highest ratios were in the following counties: San Juan (9.2), Whatcom (6.7), Chelan (6.6), Jefferson (6.5), Whitman (6.4), Skamania (6.4), King (6.3), Skagit (6.2), Kittitas (6.1), and Douglas (5.9). County to block group level shows King County tends to have the highest and most frequent affordability ratio score in Washington State. Cities/suburbs areas tend to have a higher price-to-income compared to the small town/rural areas. Second, race was added to a second affordability index. Race was compared to the median home values represented through dot density and bivariate symbology to visually show race by location affordability. In terms of affordability by race index, majority of the State of Washington's White and Hispanic/Latino population can afford a house. Regarding affordability by race, White being the majority outlier compared to Hispanic/Latino, Black, Asian, American Indian or Alaskan Native, Hawaiian or Other Pacific Islander, and other races able to afford housing. The goal of this project is to bring further insight on where to focus efforts in providing equitable housing opportunities for racial disparities.

Keywords: Washington, Housing Affordability, Race, Price-to-Income Ratio, Race and Housing Affordability

MODELING THE CHANGE IN DISTRIBUTION OF AN ENDANGERED LICHEN SPECIES UNDER PROJECTED CLIMATE CONDITIONS

Julia Jones
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08/03/22, 05:30 - 05:55 PM

Abstract:

Sulcaria spiralifera, or Dune Hair Lichen, is endemic to coastal dune forests along the Pacific coast in the continental United States. The species' habitat is vulnerable to drought and temperature extremes. Modeling the possible impact of climate change can assist with conservation planning and bolster preservation of the entire ecosystem. This study investigates the impact of climate change on the distribution of *Sulcaria spiralifera*, a rare and endangered species, by using maximum entropy probability distribution principal to build a predictive species distribution model. The approach has demonstrated success in predicting the distribution of rare species that may include limited data and lack absence points. The probable distribution of the species was modeled under current and historic climate conditions and used to train new models that would predict distribution under future climate conditions. Results of the study shows a spatial change in habitat between 2021 and 2100 with suitable locations becoming more abundant. Positive changes in presence prediction shift inland while locations along the coast experience negative change. Despite an overall increase in suitable habitat, the predicted point of presence remains relatively stable with gradual increases around 2% every 20 years until a decrease of 4% between 2080 and 2100. Although the study shows an increase in habitat suitability over time, it is unclear whether the Dune Hair Lichen could survive potential relocation as habitat shifts inland. The species distribution model under future climate conditions can help conservationists monitor and inventory the species to assess adaptation success.

Keywords: Species distribution model, Climate change, Endangered species, Geographic information systems, Habitat suitability, Environmental conservation

HABITAT SUITABILITY ANALYSIS FOR THE JAGUAR IN THE AMAZON BIOME OF BRAZIL

Riley James
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08/03/22, 05:30 - 05:55 PM

Abstract:

Jaguars are a keystone species of the Amazon Rainforest and they are suffering from habitat loss at an increasing rate. Brazil remains an integral portion of the jaguar's habitat, specifically the Amazon Rainforest. This study performs suitability analysis on habitat within the Amazon biome to highlight suitable locations for potential future conservation units. Five variables were used for the analysis, high tree cover, wetlands, shrubs, human activity and terrain ruggedness. A weighted linear combination method was used to compare each variable and produce a map of suitable locations ranked from high suitable (1) to not suitable (4). A majority of the study area was considered high suitable at 80.02%, 19.92% was medium suitable, .06% was low suitable and 0% was not suitable. The habitat suitability model was also compared to protected areas within the Amazon biome. When compared to protected areas within the biome, 73.61% of areas fell under high suitable, 26.36% were medium suitable and .04% were low suitable. The areas that fell outside of protected land were 86.52 % high suitable, 13.39% medium suitable and .09% low suitable. These results can lend conservationists, policy makers or other interested parties the groundwork on where to increase protection efforts and ensure the jaguar doesn't suffer more habitat loss and fragmentation.

Keywords: suitability analysis, habitat loss, jaguar, Amazon, Brazil