UNM GIS Day 2018 Student Poster Competition

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Abstracts:

Anderson, Kat: *Stressed Out: The Best Place to Study Symbiotic Plant-Fungal Relationships Under Climate Change Stress*

Fungi that grow on the roots of plants have been shown to benefit their plant host's growth by providing them with otherwise unattainable resources. Several grass species are known to have fungal partners that aid them in growing better in stressful environments. Such stressful environments are hotter and drier than average, making grass survival harder without a fungal partner. In addition, future climates across North America are predicted to experience hotter temperatures and more variable precipitation, leading to frequent periods of drought. Under the threat of climate change, there is still much research that can be done to observe how vital plant-fungal interactions will be affected. 18 ecological study sites across the Great Plains of the United States currently research these interactions in grasslands. For this project, I wanted to determine the best site for studying these mutualistic interactions. By factoring in future climate predictions of temperature and precipitation, I was able to determine the best site for studying plant-fungal mutualisms under predicted climate change to be Big Bend National Park in Texas.

Apodaca, Summer: *Maintenance of Pedestrian Access During Construction: Application of GIS Modeling for Maintenance of Traffic Engineering Design*

Within transportation infrastructure project development, the maintenance of traffic (MOT) is vital to the road users and contractors building the proposed design. In tradition project delivery, construction documents are prepared before the contractor uses them and it is necessary to show that road users can move through the work zone while the project is being built.; if this is not done, the contractor can assert that the design is not buildable. Geographic Information Systems (GIS) are underutilized in traffic engineering and the need the model temporary conditions for MOT present an opportunity to supplement traditional methods of laying out work zone areas.

Regarding pedestrians, there are federal requirements to provide equal or greater access for users as defined in the Public Right-of-Way Accessibility Guidelines (PROWAG); these guidelines have been developed by the United States Access Board under the Americans with Disabilities Act (ADA) (United States Access Board, n.d.).

WSP is currently developing construction documents for the reconstruction of NM 528 between Ridgecrest Dr. and Rio Vista Dr. At this stage in the project, the construction phasing has been selected considering optimization for vehicular traffic. There is a need to further evaluate the sequence of construction and ensure that pedestrian access is being maintained per PROWAG requirements.

Corning-Padilla, Alexis: *Best Location for A Complete Street: Which streets in Albuquerque should be improved?*

In Albuquerque, NM, most streets are designed to accommodate vehicles and to make sure that they move as quickly and efficiently as possible. However, most of these designs do not put much focus on other modes of travel such as for bicyclists or pedestrians. This includes roadways lacking in bike lanes, barriers between the sidewalk and street, pedestrian crossings, lighting, etc. Many people such as those in lower-income households, or those with disabilities, may rely on other modes of travel to get around since owning or operating a vehicle may not be an option for them. Therefore, the main objective of this project will be to identify areas and roadways that should be improved to be safer and more accessible for all modes of travel- i.e., where a complete street should be built. This will include identifying areas where

there are high crash rates, specifically high pedestrian fatality rates, areas that are close to stores and commercial areas since those will most likely be places that people will be traveling around most, and areas that do not have any bike lanes. Using Suitability Modeling in ArcGIS, preliminary results indicate that street improvements may be needed in the central/southeast-central parts of Albuquerque, specifically, areas surrounding Menaul Blvd and Central Ave. Although there are several other factors that contribute to determining if a street needs improvements that are not included in this analysis, the preliminary findings from this study show that there may be streets in Albuquerque that do need improvements.

Davies, Angela: *Green space accessibility and perceived safety*

This research explores the accessibility of green space in Albuquerque, New Mexico. Accessibility is assessed by walking time through network analysis within ArcGIS. To explore one potential barrier to citizens' perceived feelings of safety toward walking access to green spaces, New Mexico Department of Transportation pedestrian and cyclist crash incident data is used. Results suggests that green space distribution in not equal across Albuquerque, but that much of the city is considered to be within a 10-minute walk of green space. Crash incident data suggests that a high percentage of incidents occur within the 10-minute walk areas, but further analysis needs to be done to assess any statistical certainty among relating data.

Flores-Garcia, Amaldelia: *Suitable Wind Farm Locations in New Mexico*

New Mexico is situated in an area with wind speeds that can generate electricity in a cost-effective way. "Land-based utility-scale wind is one of the lowest-priced energy sources available today, costing between two and six cents per kilowatt-hour..." (Advantages and Challenges of Wind Energy). Using resources that is already provide is a benefit especially if there is enough wind speed to generate power. Not only is it sustainable, a clean domestic energy source but it is clean which the "U.S. wind power avoids the carbon pollution of 28 million cars" (Alvarez). Building wind turbines generates jobs, it's less harmful to the environment but can also cause controversy since it can harm wildlife, especially birds. By locating areas that are suitable for wind turbines to generate enough power and in no direct path of harming critical habitats for migratory birds, it can lead to a greater acceptance in building wind turbines and creating a clean energy source. This is especially beneficial for a state like New Mexico where we are considered the poorest in the union. For wind farms to benefit the state, wind farms need to be located on state land rather than federal land. The main criteria of this project focused on appropriate wind farms to be situated on state land and avoids critical habitats for migratory birds.

Hanttula, Mollie and Rebecca Bixby: *Effects of Geomorphology on Light Penetration in the Rio Grande*

Light penetration in aridland rivers, such as the Rio Grande, is restricted by parameters including turbidity, depth, and flow. Understanding the relationship among these parameters and light penetration will help provide a better understanding of habitat limitations for primary producers, such as algae; who are dependent on light to support photosynthesis. The purpose of my study is to examine the geomorphology of an aridland river and show the relationships among

depth, turbidity, and light penetration to better understand the abiotic factors shaping the producer communities. Two sites were chosen along the Rio Grande in the Albuquerque reach along a gradient of turbidity. Velocity (m/s), depth (cm), light intensity (μmol), and turbidity (NTU) were collected along vertical transects through the water column that were 25 cm or greater in depth. Preliminary results show that changes in turbidity and water depth were significant statistically ($p < 0.05$) when predicting light penetration intensity with light availability decreasing exponentially at greater depths along the vertical column transect. By understanding the controls of light penetration in turbid waters, future studies can better delineate the limited environments for primary producers often constrained by the geomorphology of aridland rivers.

Hickman, Miranda: *Bodie State Historic Park*

Bodie State Historic Park is a gold-mining ghost town located in California's eastern Sierra Nevada. It's significance arises from the fact that it has been exceptionally preserved, attracting visitors from all around. Bodie is historically known for being riddled with gold and silver. According to the California State Mining Bureau, Bodie contained forty to fifty active mines during the period of 1879-1881 (1888). It was not until around 1915 that Bodie was classified as a ghost town due to its population steadily decreasing for various reasons. In 1942 all mining operations came to a halt, further intensifying the decline in the population. In 1962 the California Department of Parks and Recreations officially declared Bodie a State Historic Park. Present day Bodie is full of unique structures and artifacts making it a special place to visit. Preservation of historical parks such as Bodie can be further enhanced through the implementation of the various techniques offered by Geographic Information Systems (GIS). By use of low-altitude aerial imaging and photogrammetric processing, a man by the name of Scott Winslow was able to put together a geovisualization of Bodie's past and present landscapes. Exploration of historical data in Bodie allows for the reconstruction and visualization of its historical landscape to gain a better understanding of its history and future preservation efforts. As a result, a GIS-based thematic gazetteer was created.

Hollis Romero, Ryan: *Assessing Access to Green Space in Indianapolis, IN*

The goal of this project is to provide a general assessment of the state of accessibility to green space in the city of Indianapolis. Once this is accomplished, spatial analysis techniques will be used to allocate four new parks based on demand points, existing parks, and areas zoned for development. This will be accomplished using ESRI's ArcMap software. Analysis techniques include, but are

not limited to select by attributes/location, network analysis, and vector analysis. A total of four maps will be created for the final poster: a map of existing parks within the city, two maps showing examples of the analysis process, and a final map showing the locations of the selected parks. Explanations of each map as well as a discussion of the results of the analysis will be included as well.

Liu, Zhouming: *Global ozone's spatial and temporal distribution from 1979 to 2014*

Based on the ozone data from 1978 to 2014, after doing some researches about the distribution of ozone around the globe, this research get the conclusion that the ozone is decreasing with the increase of latitude. And there is an ozone hole over New Guinea along with the area below Antarctic Circle and Arctic Circle. On the periphery of the Antarctic and Arctic Circle, the amount of ozone abrupt surge over 350DU. Again, the ozone decrease as the latitude increase over the Antarctic and Arctic Circle. With the linear tendency estimation and the weighted sliding average method, it is found that the ozone went through a downward trend generally, and there are three fluctuations in the past 40 years. According to the results of the Mann--Kadell method, more evidences are needed to claim the mutation time node of the changing tendency. The monthly average ozone concentration showed a trend as a trigonometric function with a period of 10 months.

Martinez, Miguel: *G. I. Software: DoggyDex*

Dog parks are a recent phenomena and I would like to eventually showcase the attributes of a Dog park that make them successful. Development of this cultural nexus is furry recently. There are opposing benefits and liabilities that this probing does not get a bite on. The outputs from this project will serve as a readily available, digestible, one-stop resource for selecting a bone-a-fide location. The end result is also aimed as a powerful social tool for developing and bringing awareness to developing cultural niches.

Miller, Stewart: *Geologic Correlation of Land Zoning*

The objective of this study is to determine whether a correlation can be established between the geologic composition of an area and how the area is zoned for use. This information will answer the question of whether geologic data for an area would be a suitable variable to include in the training of a neural network to predict future urban expansion. In order to accomplish this the city of Albuquerque and the surrounding North Western area will be used as a test case. Data on the geologic structure in the area and the zoning of the land will be obtained from

RGIS. The will then be processed in order to determine the unique zoning and geologic feature combinations. The unique area combinations will then be processed in order to determine what percentage of the underlying geologic feature area they occupy.

Mora, Alex: *Santa Fe, New Mexico. USA – Flood Study: Flood Risk Ranking within a Complex Setting*

During Summer 2018, the city of Santa Fe in New Mexico, USA was impacted by two Federal Emergency Management Administration (FEMA) 1,000-year classified floods that resulted in devastation to property and environment. Contemporary flood severity is significant and the City of Santa Fe setting is complex under flood events.

This study intends to show, by means of GIS analysis, visualization tools and methods, the potential risk elements that could be impacted during a flood event within a complex setting. The study focus on the Santa Fe River watershed and its three significant waterways: the Santa Fe River, the Acequia Madre, and the Cerrillos Road, examine the ***characteristics, nature and relationships*** of and between the watershed, waterways, buildings, selected facilities and infrastructures, and rank the examined elements with regard to the potential risk to flood.

Peck, Katherine Marisa: *The Impact of Irrigation on Agricultural Suitability in South Kohala, Hawai'i Island*

The South Kohala Field System (SKFS), Hawai'i Island is a network of agricultural features, first constructed in the prehistoric period but utilized into the 19th century. The SKFS is located on the leeward side of the island and thus receives substantially less rainfall than other areas in the archipelago. Previous research has assumed that this lack of rain imposes a strict limit on agriculture in this area. However, remote sensing reveals a number of features in the SKFS located below the 750 mm annual rainfall isohyet, the proposed lower boundary for rainfed agriculture in Hawai'i. I this study, I re-assess the accuracy of a previously developed suitability model for predicting the presence of agricultural features in leeward Kohala. I argue that, in order to sustain agriculture in the SKFS, Hawaiians built 'auwai (irrigation ditches) and modified existing drainages to make water accessible throughout the field system. Incorporating 'auwai density and distribution data into this suitability model produces a stronger correspondence with known archaeological features.

Peterson, Dianne: *Species Richness and Elevation in the Small Mammal Community of El Malpais National Conservation Area*

El Malpais National Conservation Area (EMNCA) (34⁰51'32''N 108⁰01'16''W) is located in Cibola County, New Mexico approximately 80 miles west of Albuquerque. This protected wilderness is under consideration for the reintroduction of the endangered black footed ferret *(Mustela nigripes)*, a carnivorous mammal once considered extinct in the wild. Recovery of this species is partially due to the reintroduction and successful repopulation of their main prey base – the prairie dog (*Cynomys gunnisonsi)*. Concerns regarding reintroduction efforts include the presence of plague in the wild (sylvatic plague), a deadly disease that can cause mortality rates of near 100% in prairie dogs resulting in extirpation of the affected colony within weeks to months (Barnes, 1993). Certain drivers of plague, including overabundance of reservoir species, may result in plague spilling over into more susceptible populations like prairie dogs and black footed ferrets; therefore, a knowledge of the mammalian faunal composition including species richness is essential in order to develop mitigation strategies if this area is a potential plague focus (Gage, Kosoy, 2005).

Factors that affect species composition and richness includes elevation which is inversely related to the number of species (Lomolino, 2001). The EMNCA is a high-altitude piñon-juniper and grassland wilderness ranging in elevation from 2000-2600 meters. Since fall, 2016, in collaboration with the Bureau of Land Management (BLM) and the Museum of Southwestern Biology, UNM, we have been sampling the small mammal community of the EMNCA in order to identify which species are present, their abundance, and to measure their changes over time. Here, I measure the species richness of this study area as well as calculating the species diversity index to describe mammalian faunal composition, and then compare species richness against elevation to determine if there is a correlation between the two.

Roberts, Aron: *Network Resiliency in the Amtrak Network*

The Amtrak network has a large coverage across the United States; however the network varies significantly in its regional configuration between the northeast/eastern states and American West. In this paper a network analysis is carried out on the western half of the Amtrak network to determine how line failures affect travel times across the network. It is found that line failures significantly increase travel times between major cities, with increases of up to 816%. These increases are due to a lack of redundancy built into the network, and a dominance of east-west lines, particularly in the American West and as such the network is found to be characterised by an overall lack of resiliency.

Rudolph, Ashlee: *Species Identification using Drone-collected Visible and Multispectral Imagery*

Aerial data collection and mapping has become increasingly affordable through the advancement of drone technology, and the desire to replace or supplement traditional field-based vegetation sampling methods is rapidly increasing. However, the utility of this new technology is heavily reliant on the type and quality of data collected, as well as the post-processing methods employed. Several techniques for identifying vegetation species have been published and document varying levels of effort, cost, and uncertainty.[1][3][4] The objective of this project is to collect and analyze high resolution (4 cm/pixel) visible and multispectral imagery with a Phantom 4 drone to determine if it is a viable method for natural resource practitioners to monitor the distribution of key native and invasive vegetation species within riparian habitat restoration sites.

Rutherford, Jillian Joan: *Quantifying Chimpanzee Home Range: A comparison of three home range estimation techniques*

Research investigating the spatial ecology of endangered primates can provide valuable information towards furthering our understanding of life history issues relevant to their conservation and management. Various methods of calculating home range have been applied across chimpanzee groups, including the Grid Square Sum (GSS), Minimum Convex Polygon (MCP) and Kernel Density Estimate (KDE) techniques. Because of the inherent flaws in each method, it has been suggested that a combination of these techniques be employed in determining an accurate home range estimate (Sterling et al., 2000). GPS-derived positional data tracking the ranging patterns of the Kanyawara chimpanzee community have been collected since 2009 but have not, as of yet, been analyzed. Research Question: What is the area of the annual home range of the Kanyawara chimpanzee community between 2009 and 2018, and how do calculations vary with range estimation technique?

Sanchez, Rachel & Nick Laan: *Winding up New Mexico*

The importance of Renewable Energy is on the rise. Cities around the world are increasing their awareness and introducing new, clean ways to power the world. In 2016, Wind Energy in New Mexico was responsible for 11% of electricity that year. Currently, New Mexico derives 13.5% of energy from wind. The strive for an energy

efficient New Mexico based on availability of the natural resource must be our focus. Our goal is to find the most efficient location for wind turbines and wind farms based on: average wind speeds, distance from power grid, surface ownership. (Most likely to support infrastructure.), and location relief for logistical purposes.

Sandlin, John & Christopher Oscar Bayer: *Stormwater as an asset, not a problem*

As the city experienced rapid post WWII growth, Albuquerque's once wild arroyos and streams were all but erased and replaced by concrete canals and storm drains designed to remove stormwater as quickly and efficiently as possible. These systems, though serving a function to regulate stormwater flow and prevent flooding, have ended up causing other problems as a result. First, Albuquerque's aquifer has been depleted due to over withdrawal without adequate recharge. Second, during storm events, surface pollutants are discharged directly to the river, skipping any natural filtering that living arroyos provide. The Embudo Arroyo and North Diversion Channel Watersheds have been chosen as a study area because there is little in the way of aquifer recharging and filtering facilities in these areas. The goal of this project is to determine the best location for ephemeral bioretention basins to capture, retain, and filter stormwater in the Albuquerque Metro Area by retrofitting existing AMAFCA (Albuquerque Metropolitan Arroyo Flood Control Authority) infrastructure within the study area.

Stevens, Mallory: *How Do Invasive Plant Species Affect Native Ecosystems?*

Over time, as more and more humans migrated to North America, the biogeographic barriers were breached and more invasive plant species were introduced to the varied North American ecosystems. These non-native invasive plant species range widely from grasses to weeds and trees. The impact of these invasive non-native species on native forest ecosystems is acknowledged, but little is known on how these plants truly impact the native forest ecosystems of North America. With the widening spread of invasive species there is room to assume that they could be out-competing the native species to thrive. Alternately, the invasive species could be evolving to fill in the gaps left by the native flora and fauna, the invasive plant species may be hybridizing to better acclimate to their new geographical regions, and with so many exotic non-native plant species moving across different ecosystems the relationships between different native plant species could be disrupted.

Vivier, Alix: *Arroyos of Albuquerque: 1930s and Today*

This project is a comparison of the natural and agricultural arroyos that existed in the mid-1930s, before the city's post-war growth, and the arroyo system of today. It seeks to discover what percentage of modern-day arroyos are within 100m of the arroyos and acequias that existed in the mid-1930s.

Zengerly, Brittany: *Relationship Between Elevation and Scale Size in the genus Sceloporus of New Mexico*

Knowing how animals are changing in response to climate change is an important aspect of conservation biology. Certain Species are easily affected by changes in abiotic factors of climate such as changes in temperature (Shine, 2013). Lizards are an example of a species that can exhibit variable characteristics depending on the temperature of their habitat (Shine, 2013). Body-size is a characteristic that can determine what kind of habitat certain species are usually found in (Shine, 2013). For example, lizards found with-in cooler habitats are going to be smaller in size when compared to the same species of lizard found in warmer and dryer habitats (Shine, 2013). The reason that lizards found in cooler environments are smaller is because lizards are ectotherms and need external heat for growth; if the average temperatures are low the rate of growth could be slowed (Shine, 2013). With climate change occurring and habitats changing, it is important to know if animals are changing along with it. In this study, I looked at the genus *Sceloporus* to see if there was a correlation between scale size and elevation. I used specimen from three different elevations: Santa Fe County for my high elevation, Socorro County for my mid-elevation, and Eddy County for my low elevation.

Table presentations by: Earth Data Analysis Center, UNM Libraries, UNM Global Education Office, Central New Mexico Community College, New Mexico Geographic Information Council, Mid Region Council of Governments, Merrick & Company, Souder Miller & Associates, USGS, UNM Geography & Environmental Studies

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