

2017 MS-GIST Masters Project Presentations

[ENR2 Building](#)

Haury Lecture Hall (S107)

December 11 -12

Monday, December 11

6:00	Mercedes McPherson	Auto-Generating Maps Using Open Source GIS and Python
6:20	Bianca Ramirez	Tucson Water GIS, Valve Turn Request, Collector Application, GPS Coordinates Valves
6:40	Jarret Baker	Minimizing Time Cost of Tucson Construction Inspections through the use of A Network Dataset
7:00	Thomas Jones	Using Geometric Networks to Model the Fiber Optic Network in the City of Tucson
7:30	Carly Herndon	Spatial analysis of community development from seed grants
7:50	Vanessa Ricigliano	A Study on Debris Flow Susceptibility in the Coronado National Memorial Region Following a Severe Burning Event
8:10	Devesh Khosla	Climate Landscape Response (CLaRe) phenometrics for southern AZ and CA using Prism and MODIS data and leveraging the PICO

Tuesday, December 12

6:00	Christopher Bertrand	<u>City Birds: Effects of the changing Tucson urban landscape on bird species</u>
6:20	Alex Ruff	<u>Building a Web Application and Land Navigation Course to Help Develop Military Relevant Informal GIS Education</u>
6:40	Rob Hastings	<u>Rapid expansion of an introduced grass, Lehmann lovegrass (<i>Eragrostis lehmanniana</i> Nees.), to the Sonoran and Chihuahuan Deserts in the United States</u>
7:00	Zhiyuan Xu	<u>Develop a model to identify and test hierarchy of archaeological sites on the Madaba Plain in Jordan</u>
7:30	Logan Wagner	<u>Habitat Suitability Modeling for the Elegant Trogon in Southern Arizona</u>
7:50	Clarissa Sarabia	<u>Modeling Standing Water in Santa Cruz and Pima Counties, AZ</u>
8:10	Mitchell Brown	<u>Lidar Feature Extraction: A Property Assessor's Tool</u>
8:40	Jonathan Mather	<u>Using Elevation Models in GIS to Quantify Spatial Impacts of Rising Sea Levels in Honolulu, Hawaii</u>

Title: Auto-Generating Maps Using Open Source GIS and Python

Author: Mercedes McPherson, mam2448@email.arizona.edu

Keywords: Fund for the Arts, Louisville, arts funding, Open Source, QGIS, auto-generated maps, Python

Abstract: Fund for the Arts is the oldest arts fund in the country. Since its formation in 1949, the organization has raised over 170 million for the community, which includes Kentucky and southern Indiana. This project will focus on one of the organization's programs entitled 5x5. The goal of 5x5 is to expose elementary school students to five art experiences before they finish the fifth grade. Several years' worth of data has been compiled, including school names, performance names, performance type, number of students served, and total cost, among others. Using a combination of these parameters maps will be auto-generated using CSV templates. The auto-generated maps will show a variety of data, including: the amount of art funding per zip code, per program type, per grade, per art group, per school, and per student. The maps will serve as visual evidence of the program's progress and will be shared with Fund for the Arts Board of Directors and CEO, internal staff, as well as other community stakeholders such as community liaisons, participating schools, current and potential donors and the Louisville Metro Council. Fund for the Arts is a nonprofit that does not have access to ESRI products. This project combines cartography and scripting to create a functioning deliverable using open source GIS software that enables the organization to auto-generate maps at will and forego the need to request maps from the local university once a year.

Title: Innovative GIS Technology: Integration of GIS into Tucson Water Valve Turn Request

Author: Bianca C Espinosa, bramirez80@email.arizona.edu

Keywords: Tucson Water GIS, Valve Turn Request, Collector Application, GPS Coordinates Valves

Abstract: Tucson Water has spent a tremendous amount of time processing valve turn request through the use of a paper processing system. However, recent technological advancements in GIS have prompted the city to re-evaluate the way they process valve turn requests. So why incorporate GIS technology, if the current paper process already works? Incorporation of ArcGIS Desktop, GIS Online and the Collector application have the ability to significantly reduce processing times, eliminate redundancies and improve response times for field crews, while also providing them with the capability to upload valve and GPS coordinate location data in the field. ArcGIS Desktop will enable Distribution Design with the ability to provide Planner/Schedulers with unique GIS point layer information related to each valve request. GIS Online gives Planner/Schedulers the capability of numbering routes themselves. Collector will enable field crews to collect valve data and GPS coordinates through the use of a smart phone with an Android, iOS or Windows operating system utilizing the Collector application. Tucson Water is utilizing the desktop procedure process and has established training material for the use of collector and GPS applications. The final process will include the use of Collector application to collect valve data that consists of a geodatabase for capturing pre-established text, numerical and photos. Incorporating GIS capabilities, the City will improve data collection, time

efficiencies and overall data collection. This application also has the potential to benefit the city for other uses and requirements.

Title: Minimizing Time Cost of Tucson Construction Inspections through the use of A Network Dataset

Author: Jarret Baker, jmb7@email.arizona.edu

Keywords: vehicle routing problem, network analyst, inspections, workforce, network dataset

Abstract: Any profession that requires travel across a network of roads will face the issue of how to minimize travel in order to complete the work at hand in the fastest time possible. This is a task though that can become much more daunting as the amount of work to be done increases across space. With a small set of stops, the route to reach them all can be figured simply by distance from the origin. The addition of more stops and more workers to reach these points though complicate this matter. The job of allocating this work in an efficient manner can be become impossible without the right tools. The City of Tucson completes over a hundred daily construction inspections throughout the city every day and this work must be split up among a team of inspectors every morning. This is a task that only drains the precious time the inspectors need to complete their work. This task though can be completed with maximum efficiency within the fraction of the time through the use of a GIS Network Dataset and an algorithm called a Vehicle Routing Problem. These tools efficiently allocate all daily inspections to the inspector's starting locations to minimize time. These results can then be shared to the inspectors in an easy to use web interface to completely streamline daily workflows for a time and monetary saving for the Tucson's citizens and each of the inspectors to make their demanding jobs just a little easier.

Title: Using Geometric Networks to Model the Fiber Optic Network in the City of Tucson

Author: Thomas Jones

Keyword: Fiber, Network, Geometric, Splice and Connectivity

Abstract: As fiber optic infrastructure is installed throughout a city its location, attributes and connectivity need to be recorded. Over time the size and complexity of the network continues to increase. Unfortunately accurate records of additions and changes are not always maintained. How then is this information stored, updated and maintained? In particular how do we model and represent fiber optic network connectivity? One of the solutions to this problem is the use of GIS software. However how do you represent the complexity of a fiber optic network in a GIS platform? This study attempts to use geometric networks to model fiber optic network connectivity. It also attempts to address the use of maps and databases to accurately update and maintain fiber optic data. Primarily this study assesses the suitability of geometric networks in comparison with 3rd party software as a management tool. The results of this study show that geometric networks can only model limited aspects of fiber connectivity. The inherent complexity within fiber optic networks precluded the possibility of modelling individual fiber connections. A geometric network connectivity model was only able to model connections at the bundle level. It is clear and perhaps not surprising that software designed specifically for managing a fiber optic, integrated with GIS is the most efficient at addressing this issue.

However in regards to data visualization and management GIS solutions offer significant advantages.

Title: Spatial analysis of community development from seed grants

Author: Carly Herndon carlyherndon@email.arizona.edu

Abstract: Crop diversity in the southwest has diminished significantly over the past hundred years. A local non-profit by the name of Native Seeds/SEARCH (NS/S) aims to increase southwestern crop diversity for the sake of keeping indigenous culture alive, food security, and to nourish a changing world. One way NS/S distributes seeds is through their Community Seed Grant program. Community Seed Grants are a program that supports educational, food security, and community development projects in the Greater Southwest through targeted donations of seeds. This study measures the outcomes of each seed grant and places this in maps. The measure of success with the seeds will be compared to the demographics of the project receiving the seeds and analysis will be conducted to find patterns in order to perform more targeted marketing and/or targeted assistance. It is important to find if we are reaching our target audience of underprivileged groups and to see if there is a relation between the demographics of our Community Seed Grant recipients and the successfulness with the seeds in order to show potential funders the successfulness of this grant program. Lastly, a script in ArcGIS online will be created to allow Native Seeds/ SEARCH to continue to generate maps of Community Seed Grants.

Post Fire Debris flows: A Study on Debris Flow Susceptibility in the Coronado National Memorial Region Following a Severe Burning Event

Author: Vanessa Ricigliano, vrigliano@email.arizona.edu

Key Words: Debris Flows, Arizona,

Abstract: Debris flows are a major problem in the state of Arizona. While there are various methodologies in place for predicting debris flows likelihood, the rapid and unpredictable nature of debris flows warrants the need for efficient ways predict the debris flow volumes. In doing so, precautions can be taken to reduce/eliminate the destruction associated with these natural processes. The purpose of this project is to modify an existing lahar mudflow modelling tool and tailor it to generate debris flow inundation volumes in post fire environments. The objective is to increase the efficiency of generating useful information in terms of treatment plans to minimize the destruction associated with this hazard. This efficiency is crucial given the high likelihood of debris flows following high burn severity environments.

Title: Climate Landscape Response (CLaRe) phenometrics for southern AZ and CA using Prism and MODIS data and leveraging the PICO

Author: Devesh Khosla

Keywords: Buffelgrass, CLaRe, Prism, Modis.

Abstract: A major threat to the Sonoran Desert is the persistence and expansion of buffelgrass, an invasive perennial grass that out-competes native vegetation and changes fire regimes. Native desert landscapes are typically composed of widely-space plants that do not carry fire. Buffelgrass introduces a blanket of highly flammable fine fuels into this landscape, carrying fire

broadly and killing non-fire adapted cacti and native plants. The impacts of buffelgrass are expected to accelerate given global climate change. The focus of this research project is to promote buffelgrass management in the southwest, specifically the states of Arizona and California. Our research builds on previous work (Wallace et al., 2016) that coupled Moderate-resolution Imaging Spectroradiometer (MODIS) imagery, PRISM precipitation data and ground observations of buffelgrass phenology to map the presence and phenological status of the invasive species. The previous research produced Climate Landscape Response (CLaRe) metrics, which capture the strength of the landscape greenness response to lagged precipitation and expose buffelgrass due to its more rapid green-up following precipitation events when compared to native vegetation. We extend the temporal mapping of CLaRe metrics from 2010 to 2016 regionally across the southwest to identify nascent (new) infestations of invasive buffelgrass by examining the temporal patterns of CLaRe values. If successful, this research will allow managers to treat infestations when they are smaller and prioritize treatment in areas that are spreading most rapidly.

Title: City Birds: Effects of the changing Tucson urban landscape on bird species

Author: Christopher Bertrand

Keywords: birds, bird survey, urbanization, Tucson, citizen science

Abstract: Bird watching is consistently one of the most resilient hobbies in North America with millions of birders and southern Arizona is a crossroads of biomes that bring a diversity of bird species through. In the heterogenous mix of the urban environment bird species will differentially prefer to use different environments in the city. Even within cities changes continue to take place. Areas are rezoned, or the previously undeveloped is developed. The Tucson Bird Count was established to measure and document how birds respond to changes in the Tucson landscape. As residents make changes, with efforts to share their city space with native birds, we need a baseline to inform our choices to provide habitat for native birds within our own habitat. Some bird species in particular have acclimatized well to the urban structure of cities. In this paper I analyze the changes in the utilization of the Tucson landscape by species and correlate these to changes in landcover over the 16 years of the bird count. Simple spatial patterns of use and changes in use, will be established using hotspot analysis. Using classified landcover created from remote images at intervals, I compare the changes in land cover around each survey point of the metropolitan area of Tucson to a species abundance. **Results.** With this we can offer a basis on which to provide informed recommendations on what Tucsonans can do within their yards, neighborhoods, and communities to make Tucson a better place for birds.

Title: Building a Web Application and Land Navigation Course to Help Develop Military Relevant Informal GIS Education

Name: Alex A. Ruff, ruff.alex@gmail.com

Keywords: Military, Mobility, Navigation

Abstract: Throughout history military officers have relied on maps to provide spatial information and make informed battlefield and other problem solving decisions. Today's officers can put even more spatial information at a soldier's fingertips if they are made aware of the power of geographic information systems and software. This paper makes the argument that today's military officers are not introduced on the military uses for geographic information systems during their participation in reserve officer training corps (ROTC) or provided a basic understanding on how they can impact their ability to solve problems on the battlefield or in humanitarian aid crisis with these technologies. This project created a web application using python and based on military mapping manuals that allows a user to interact with prepared terrain data to create a model of how quickly that user would be able to move over a given terrain. This web application was given to military officers in ROTC training at the University of Arizona prior to participation in a land navigation exercise to help them plan and prepare their path. Students using the app prior to the exercise are able to see how the information provided by GIS can help them make decisions. This tool, and the subsequent exercise, provided increased awareness in military applications of GIS for those future military officers and helps inspire them to pursue more information on the technology.

Title: Rapid expansion of an introduced grass, Lehmann lovegrass (*Eragrostis lehmanniana* Nees.), to the Sonoran and Chihuahuan Deserts in the United States.

Author: Rob Hastings, bikoaldo@gmail.com

Keywords: Arizona, invasive species, environmental variables, overgrazing, ArcGIS, predictive modeling, permanent vegetation plots, slope, aspect, elevation, soil type, temperature, precipitation

Abstract: Lehmann lovegrass (*Eragrostis lehmanniana* Nees.) was introduced from South Africa to southeastern Arizona in 1937 to replace slower growing native grasses, to provide livestock fodder that could grow faster than native shrubs, and to mitigate extensive erosion created by centuries of livestock overgrazing. Since its introduction, Lehmann lovegrass has spread beyond all expectations from the areas in which it was seeded. Reasons for its success are its rapid germination and growth potential and its ability to outcompete other perennial grasses. In 2007 the Sonoran Desert Network of the National Park Service began vegetation surveys in national parks in the Sonoran Desert. The Chihuahuan Desert Network began these same surveys in 2010 and the U.S. Fish & Wildlife Service used the same protocol in the Sonoran Desert starting in 2013. The data collected at these permanent vegetation plots was examined to determine if there was a change in the amount of Lehmann lovegrass found between survey visits, and to ascertain if an environmental variable or variables were responsible for the change. These variables are elevation, slope, aspect, temperature, precipitation, and soil type. Many of these plots were surveyed twice, and of these revisited plots, those with Lehmann lovegrass found on at least one of those visits provided the data for this project. Of the plots where Lehmann lovegrass was detected on multiple visits, 58 showed an increase in its presence, 5 showed no change in number, and 7 showed a reduction in its numbers.

Title: Develop a model to identify and test hierarchy of archaeological sites on the Madaba Plain in Jordan

Author: Zhiyuan Xu zhiyuanxu@email.arizona.edu

Keywords: topographic prominence, landscape research, archaeological sites, geographical information systems, Digital elevation model

Abstract: Topographic prominence can be considered as one of the solution to indicate the social hierarchy in archaeological studies. Topographic prominence can be defined as the erection of the individual compared with its surroundings within a certain area. With the ascending of the topographic prominence, the individual that lived on this area will be deemed as higher social hierarchy and rank because of the increase of visual/political control. Therefore, the idea of this paper is to create a model to show topographic prominence, the application of the model to archaeological sites on the Madaba Plain in Jordan by using ArcGIS software, and a statistical analysis of the distribution of these sites within this model. The resulting product of this project is a model that can analysis topographic for certain area to supporting current social hierarchy research.

Title: Habitat Suitability Modeling for the Elegant Trogon in Southern Arizona

Author: Logan Wagner, loganwagner@email.arizona.edu

Keywords: suitability model, Arizona birds, ebird, Elegant Trogon, habitat modeling

Abstract: The Elegant Trogon's habitat is in constant danger from wildfires, urban development, and climate change. This project aims to highlight important habitat areas for the Elegant Trogon in Southern Arizona mountain ranges to aid in conservation efforts. Using citizen collected bird data, NDVI imagery, and geospatial analysis this project identifies preferred nesting habitat for the Elegant Trogon, and creates a suitability model based on those findings. The final cartographic products can be used in conservation efforts by ranking the habitat from lowest to highest suitability in each analyzed mountain range. A statistical analysis of the model against known nesting locations is conducted to test its strength.

Title: Modeling Standing Water in Santa Cruz and Pima Counties, AZ Clarissa Sarabia

Author: Clarissa Sarabia

Abstract: Arizona deals with a number of issues and concerns that are unique due to its location. One of the main concerns includes immigration affairs and the obstacles that can be derived from it. Every year, thousands of people cross or attempt to cross the Arizona - Sonora border illegally. Unfortunately, many people die in their pursuit of a better future; therefore, multiple organizations have arised on both sides of the border, who have different operations and goals concerning immigration. The main task of some of these organizations is to identify migrant bodies and determine time and cause of death. In order to do this, an abundance of other issues come into being. One of them is standing water in Southern Arizona, which can accelerate the decomposition process and interfere with forensic examinations, causing autopsies to be less precise or accurate. This project will use elevation and rainfall data to create a hydraulic model in the Pima and Santa Cruz counties that will determine where standing water areas are located. Consequently, forensic pathologists can determine the degree of decomposition acceleration due

to water contact in order to conclude an accurate date and time of death. A Digital Elevation Model will be built using LIDAR elevation data, and USGS rainfall data will allow us to predict where standing water areas may be.

Title: Lidar Feature Extraction: A Property Assessor's Tool

Author: Mitchell W. Brown, mwbrown@email.arizona.edu

Keywords: LIDAR, Pima County, feature extraction, building footprints, property taxes

Abstract: Currently, county tax assessors use subscription based imagery services among other paid services to audit resident property to discover untaxed improvements. This process entails an analyst to use aerial oblique imagery to inspect property parcels one by one, then cross-referencing the findings with records on file. The utilization of an automated Geographical Information System scripting tool to comb through millions of data points derived from Lidar results could save the user resources in finding precise inspection areas to prioritize. This study's tool will take in account geometric shapes extracted from a point cloud and classifying it as either a building or not. In an effort to save resources, both county employee labor hours and subscription based fees, the tool will allow a user to input LIDAR data and be given a resultant building footprint map that can be compared to records on file. Examining the relationship between the records would give the assessor a targeted inspection area. Implications of an automated tool to discover unrecorded property improvements could lead to an increase in collected tax revenue for Pima County.

Title: Using Elevation Models in GIS to Quantify Spatial Impacts of Rising Sea Levels in Honolulu, Hawaii

Author: Jonathan Mather jonathanmather@email.arizona.edu

Abstract: Rising sea levels pose a threat to millions of people worldwide. Land loss due to inundation may eventually force the relocation of large populations, and will affect the function of coastally proximal infrastructure providing essential services relied on by those far removed from directly impacted areas. As a heavily developed, densely populated, low-lying coastal area urban Honolulu County provides an important case study regarding SLR impacts, which are further exacerbated by this island's remote location. Research reflected in models focused on contributions from Antarctic and Greenland ice sheets combined with tidal gauge data collected in the study area underlie this paper's prediction of a 1 – 2 meter rise in local sea levels by century's end. Digital elevation models produced using lidar data collected by FEMA and USACE provide a high-quality vehicle for visualization and analysis of this threatened coastal region and, when coupled with other GIS tools, aid in quantifying impacts to the immediate area and the archipelago overall. RMSE analysis of these models as compared to DEMs published by NOAA using similar data sources was employed to validate their quality. Islands with developed coastlines will be impacted most immediately by rising sea levels, and processes highlighted in this project could be used by regulatory agencies in preparation and planning. Effectiveness of adaptation strategies adopted in these regions will ultimately inform development of those employed by larger coastal cities in the future.

