

MS-GIST
 Master Projects 2018 Cohort
 Thursday April 18th, 2019 – ENR2 Room S107

Time	Title	Person
6:00-6:20	<u>Tucson Fire Department – Readiness and Incident Predictability</u>	Brian St. Denis
6:20-6:40	<u>Eureka! Modern Treasure Hunting with Geographic Information Systems</u>	Christy Elzey
6:40-7:00	<u>Introduction of Nitrate in Ground Water via Center Pivot and Flood Irrigation Methods</u>	Bailey Hesson
7:00-7:20	<u>Canopy Structure and Southwestern Willow Flycatcher: A LiDAR-derived Habitat Suitability Model</u>	Ryan Gillespie

Title: Tucson Fire Department – Readiness and Incident Predictability

Author: Brian E. St. Denis, StDenis.GIS@gmail.com

Keywords: Tucson Fire Department, coverage analysis, incident predictability, urban fire predictability, Arizona

Abstract: Tucson Fire Department (TFD) is continually looking for ways to improve their service to the City of Tucson community. Specifically, TFD wants to ensure their emergency vehicles can respond to a call anywhere in the city within five minutes. The purpose of this project was to provide TFD better situational awareness so they could improve decision making and service capabilities. GIS tools were used to create a map with multiple layers showing current status of their vehicles and near real time analysis of the city with respect to coverage and incidents. Statistical probability tools were used to create and test multiple models in order to find the most accurate one to predict future incidents. The final map gives TFD several layers to toggle on and off to give them the situational awareness they are looking for. The layers include a service area coverage map showing any gaps in coverage and the GPS location and status of their vehicles. It also has an emergency service zone map for move-up analysis in case one station needs to cover the area for another station and a heat map showing the highest density of calls over a period of time. The last layer is an incident predictability layer to help with pre-staging vehicles for better coverage and a quicker response.

Title: Eureka! Modern treasure hunting with geographic information systems

Author: Christy Elzey, christyelzey@email.arizona.edu

Keywords: treasure hunt, Forrest Fenn, Rocky Mountains, habitat suitability

Abstract: In 2010, Forrest Fenn published his memoir “The Thrill of the Chase.” Mixed among the pages are clues and a poem leading to a bronze box of gold and jewels worth over a million dollars. Some three-hundred and fifty thousand treasure hunters have journeyed to the Rocky Mountains of the United States searching for the box since the book was published, but none have laid claim to the treasure at the end of the poem. This paper explores the use of geographic information systems (GIS) to model treasure habitat suitability as determined from Forrest’s clues. A model of GIS tools was created to explore ways to reduce the search area of the treasure hunt. Tools such as Euclidean distance, slope, reclassify, and weighted sum were added to the model to study the varied inputs and how they affected the outcome of the treasure habitat. The final model resulted in a treasure habitat suitability layer measuring only nine percent of the original study area. The final cartographic products will provide treasure hunters with more information about where the treasure could be hidden. Combined with the poem and other clues from Forrest, treasure hunters should be able to inform their search areas.

Title: Introduction of Nitrate in Ground Water via Center Pivot and Flood Irrigation Methods

Author: Bailey J. Hesson, BaileyJHS@gmail.com

Keywords: Center Pivot, Flood Irrigation, Nitrate-nitrogen, Fillmore County, Phelps County, Kearny County, Hamilton County, Nebraska.

Abstract: Because of the continuation of population growth, agriculture has become increasingly adaptive because of the introduction of innovative irrigation techniques that allow for less input of water to produce higher yields of crops. One technique, in particular, the center pivot irrigation system has revolutionized how water is distributed. The center pivot irrigation system has rivaled the older conventional way of irrigation—Flood irrigation. With the increasing demand for certain crops, agricultural pollutants have become a problem to groundwater in areas of heavy farming activity.

This study will look at well data between 2010-2018 to see if there is a substantial difference in nitrate-nitrogen concentrations between the center pivot and flood irrigation techniques. The study is based on four counties in Nebraska: Fillmore, Phelps, Kearny, and Hamilton. All four counties were chosen because of the high percentage of land cover used for agriculture. The classification of 3,000 wells was performed to see which fall in one of these two irrigation methods. The frequency distributions of nitrate concentration will then be looked at, and a hotspot analysis will be compared to a landcover type to see if there are similarities in places of high nitrate-nitrogen concentrations. Final analysis helps to understand if there is, in fact, a noticeable difference in concentrations between the two irrigation methods.

Title: Canopy Structure and Southwestern Willow Flycatcher: A LiDAR-derived Habitat Suitability Model

Author: Ryan S. Gillespie, ryangillespie@email.arizona.edu

Keywords: habitat suitability, forest structure, LiDAR, Gila River

Abstract: The Southwestern Willow Flycatcher (*Empidonax traillii extimus*) is a Federally-endangered migratory songbird that breeds in riparian forests in the desert Southwest. Historic loss of breeding habitat and declining habitat quality were significant factors in the flycatcher's decline. Recovery efforts now focus primarily on protecting and restoring habitat, and these efforts rely on an understanding of the factors impacting habitat suitability. Canopy structure is a major component of forest songbird habitat, and the recent advent of Light Detection and Ranging (LiDAR) imaging technology has made extensive measurements of forest canopies possible. In this study, small-footprint, discrete-return LiDAR data were used to characterize the vertical and horizontal structure of the riparian forest along the Upper Gila River near Safford, Arizona. Canopy metrics were calculated in a 10-meter grid, and neighborhood statistics for 30- and 50-meter square areas were also developed. The relationship between these data and known flycatcher breeding locations were then analyzed using logistic regression. The resulting model shows a strong association with three variables: availability of dense foliage from 3 to 5 meters in height in the breeding area, high canopy closure of dense foliage, and high canopy height within a 50-meter neighborhood. These findings largely confirm prevailing ideas about flycatcher habitat suitability criteria and underline the need for relatively mature, unfragmented riparian forest with a dense mid-canopy layer.