2019 Virginia GeoCon
Poster and Web Map App Showcase Abstracts
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Harrisonburg, VA

Author: Lorrie Coiner (VA Dept. of Mines, Minerals, & Energy)
Category: Professional
Presentation Format: Web Map App
Title: Mineral Resources & Geologic Hazards in Virginia

Abstract: Geologic resources are the raw materials that directly support physical growth and development in local communities. The Department of Mines Minerals and Energy (DMME) is in a unique position to help the citizens of the Commonwealth make wise use of our mineral, water, and energy resources. While planning can effectively channel most industrial business to areas set aside for such activities, mining operations that supply construction aggregate and crushed stone, architectural stone, energy resources, industrial and other specialty minerals can only be situated where there are known geologic resources. Conserving these resources for sustained physical and economic growth requires that potential sites be identified, adequately characterized, and protected from preemptive uses that might otherwise result in lost economic opportunities. Additive costs associated with transporting raw materials from distant sources can be substantial, even possibly prohibitive, and are likely to increase with the rising cost of energy. The importance of planning at the local level for the future of mineral, water, and energy resources cannot be overstated. Our goals are : (1) to ensure timely access to up-to-date information on mineral production statistics, value, and location of geologic resources in the planning jurisdictional areas; (2) to provide the capability of accessing spatial data in digital formats that can be readily integrated into the localities' geographic information systems (GIS); and (3) to provide a platform for adding new informational services that will include public safety and environmental concerns (e.g. locations of abandoned mines), geologic hazards (e.g. maps of areas prone to landslides), and water conservation issues (e.g. locations of sinkholes, abandoned water-filled quarries, etc.). We create customized mineral and energy resource district maps, narrative summaries for inclusion in comprehensive plans, graphs and technical data for water supply planning & protection and characterization of environmental, abandoned mine-related, and geologic hazards.

Authors: Isaac Davis (Roanoke College) and Dr. Katherine O'Neill
Category: Undergraduate Student
Presentation Format: Web Map App
Title: Visualizing environmental history and landscape change in the southern Piedmont of South Carolina using Esri Story Maps

Abstract: Maps are foundational facilitators of colonization (Hollis 2012; Probasco 2014). Colonial settlement within the South Carolina Piedmont was transformed by a simplistic map sketched by George Hunter in the 1730s. In the course of several decades the European population quadrupled, significantly impacting Native American populations, and gradually transforming the

landscape. Research suggests that not only were indigenous populations fundamental to the production of the early maps that brought settlers to the South Carolina Piedmont, but also that their alterations of the landscape facilitated settlement and dictated settlement patterns. In a case of tragic irony, the same Native American communities that aided settlement became the target of violence, disease and displacement. By the turn of the century, maps of South Carolina depict a transformed landscape.

A review of publications by Nelson and Coughlan (2018), this educational module highlights some of the driving factors behind early colonial settlement within the South Carolina Piedmont and addresses the potential role and significance of cartography as a driving force behind colonial migration. Utilizing publications from Coughlan and Nelson on the Calhoun Critical Zone Observatory (2017), visual representations in Esri Story Maps are used to frame a discussion of land transformation as new populations and market forces were introduced. This project explores Coughlan and Nelson's conclusions (2018) through the medium of GIS, converting academic findings into a case study for educators.

Author: Shari Davies (MAO Kenya), Camilla Buchannan, & Sachi Picchu
Category: Professional
Presentation Format: Poster
Title: Community Health Partners Facility Locations in Narok, Kenya
Abstract: Community Health Partners is an NGO whose mission is to "...to provide accessible, quality and affordable health service for all people" located in Narok County, Kenya. Fundraising was hampered by a lack of a map showing Narok county and the locations of the facilities. I volunteered to make a map using data collected from a student who had taken GPS tracks to the different facilities. Using that information and Google earth, I developed a functional map which can be used to show perspective donors. The map will also be available on their website.

Author: Lore DeAstra, SR/WA (VDOT)
Category: Professional
Presentation Format: Web Map App
Title: Moving Colonial Heights (Temple Ave & I-95 Interchange)
Abstract: A solution was needed in Colonial Heights to greatly reduce the 250+ vehicular accidents over the past five years on a busy interchange. With foresight of 25-years, the Virginia Department of Transportation and the City of Colonial Heights determined a roundabout was the best solution to reduce accidents by improving the Interstate-95 Interchange at Temple Avenue. Will the results compare to Federal studies, especially since there are accidents within roundabouts?

Moving Colonial Heights is an interactive geospatial presentation providing solutions for the general public with:
- annual aerial maps of accident data before, during, and after construction that allows the user to visualize the location of accidents and traffic patterns
- a humorous instructional video of proper roundabout etiquette

- a comparison of national accident statistics with the results after completion, and
- the successful traffic volume and flow provided to future travelers.

Authors: Jenni Ellsworth (GeoDecisions), Will Allen, Michael Kolonay, and Brittany Lebel
Category: Professional
Presentation Format: Web Map App
Title: Conservation Fund - National Land Protection Programs At A Glance
Abstract: GeoDecisions staff developed a Storymap and embedded web mapping application on the main Conservation Fund website to display an interactive view of their Land Preservation Programs. The "Where We Work" applications showcase TCF efforts to advance conservation and economic goals, through both a national map and highlighted state selection maps. The application utilizes a Mapbox basemap and interactive selection icons symbolized on a handful of program types.
- Storymap: https://www.conservationfund.org/our-work/conservation-fund-partnerships/federal-conservation-partnerships/national-park-service
- Where We Work map: https://www.conservationfund.org/where-we-work, https://www.conservationfund.org/where-we-work/virginia

Author: Daniel Fourquet (VDOT)
Category: Professional
Presentation Format: Web Map App
Title: Web Map Survey
Abstract: This is a simple survey app that asks the user to identify on a map where they were born, where they live now, and where they would like to travel. It also asks for their favorite color (which is used for the map marker) and their favorite animal (which is used to create a graph). The results of the survey are stored in a database and are displayed on a web map.

The application's purpose is to demonstrate the use of python to create a simple data collection and viewing app via Flask.

Authors: Matthew Franklin (University of Richmond), Griffin Walsh, & John Scrivani
Category: Student
Presentation Format: Poster
Title: A Comprehensive Aerial Overview of Topography and Vegetation in Ivy Creek Natural Area
Abstract: At the request of the park administrators of Ivy Creek Natural Area (ICNA) in Charlottesville, Virginia, we created a collated spatial dataset of vegetation and elevation within the park. This dataset will provide key insights for park administrators as they seek to make short and long-term decisions about the use and management of the land. To begin, we obtained detailed aerial imagery of the park through National Agricultural Imagery Program (NAIP). Additionally, we sourced vector data from the Albemarle County online GIS repository, including shapefiles depicting physical attributes within the county. Finally, we acquired highly detailed LiDar data from the Virginia Geographic Information Network LiDar database. We combined these data

components to create an integrated dataset for detailed analysis and visualization of the park. We then applied a normalized difference vegetation index (NDVI) filter to the imagery through the analysis tools of ArcGIS Pro. We produced two main deliverables consisting of a printable map and a spatial dataset for the Ivy Creek Natural Area. Datasets have been made available to both the public and ICNA park administration through the the ESRI ArcGIS Online platform. This map is our cartographic representation of the topography and vegetative cover of the park.

Authors: Valerie Galati (University of Richmond), Lesley Bulluck, and Elizabeth Schold
Category: Student
Presentation Format: Poster
Title: Mapping the distribution of the Golden-winged Warbler through occupancy probability in southwestern Virginia
Abstract: For species of conservation concern, the ability to monitor and predict occupied habitats is important in informing management actions for the benefit of the species. By applying knowledge of its ecology and habitat use, a model can be built which allows for the prediction of occupied areas based on landscape metrics. The Golden-winged Warbler (Vermivora chrysoptera) is a species of North American warbler whose populations have in the past few decades undergone rapid declines, particularly those in the Appalachians. Here, we present a map of the probability of occupancy based on previously defined habitat associations for the Golden-winged Warbler. The model is applied using a moving window analysis at the 100-meter scale for four counties in southwestern Virginia. This application of the model can be overlaid with a probability of occupancy map at other ecologically relevant scales to produce a more accurate estimate of local distributions.

Authors: Regan Grimmett (Roanoke College), Dr. Katherine O'Neill, & Mr. Dan Cohen
Category: Student
Presentation Format: Web Map App
Title: Renewable Energy Potential on a College Campus: ArcGIS 3D Analysis using LiDAR
Abstract: Colleges and Universities have the capacity to set an example for future generations in sustainable living through implementation and exploration of renewable energy technologies. Remote sensing data such as LiDAR along with tools in ArcGIS Pro allow for a cost-effective, detailed analysis of rooftop solar energy potential that can be used to determine potential energy offsets from renewable energy. Using Local Government Tools and Lidar data in ArcGIS Pro, I generated textured buildings, vegetation, and extracted the rooftops of Roanoke College's campus to conduct a solar radiation analysis. NASA Surface Meteorology and Solar Energy global data sets were then used to map and analyze the effects of the sun over a geographic area across one-year span. Using the year 2015 as a baseline, solar radiation on campus rooftops will be used to quantify total potential generation on the selected roof in kWhday-1 m-2. These data can be combined with existing energy conservation programs at Roanoke College to estimate the percentage of electricity use that could be offset by solar.

Authors: Linwood Hoffman (VA Dept. of Military Affairs) & Christopher Parr
Category: Professional
Presentation Format: Poster
Title: Improving energy efficiency and readiness of the State Military Reservation (SMR) at Virginia Beach
Abstract: The US Army awarded the Virginia Army National Guard (VAARNG) the Secretary of the Army Environmental Award for Cultural Resources Management's " Small Installation Category for Fiscal Year 2016". The award recognized the VAARNG's efforts to improve energy efficiency

and readiness of the State Military Reservation (SMR) at Virginia Beach, which is a Historic District listed in the National Register of Historic Places. SMR is a 328-acre training facility with approximately 130 contributing properties including buildings, structures, landscapes, and road networks.

Most of these properties date to a World War II-era expansion, when the War Department federalized the facility for coastal defense. Using the National Register documentation and LiDAR data, Linwood Hoffman and Christopher Parr created this map to illustrate the cultural resource environment displaying the areas that led to this award being received.

This product was finalized in March 2019 and will be used as an interpretive resource for VAARNG personnel at SMR, as well as those at the new Joint Force Headquarters near Richmond.

Author: Timothy Kropp (York County, VA)
Category: Professional
Presentation Format: Poster
Title: GIS Uses for Emergency Management: A Look at York County, Virginia
Abstract: Geographic Information Systems (GIS) are very versatile in the way its data can be employed and this versatility is especially useful for Emergency Management. The County's critical infrastructure, such as fire hydrants, fire stations, and hospitals are stored in the GIS to allow for geospatial analysis which reports structures' distances to their closest emergency resources. This information aids the Fire, Life, and Safety (FLS) Department in planning, grants and specific challenges such as quickly locating fire hydrants when responding to emergency calls, as well providing homeowners information often required for home insurance.

These analyses utilize raster datasets and various ArcGIS toolsets. Roads and paved areas are converted to a raster so a Cost Distance can be calculated to the Hydrants, Fire Stations, and Hospitals, separately. This generates a grid where each cell stores the distance from the nearest feature. The data is then transferred to address points and shown on the County's Property Information Website for public use. LiDAR data is used in conjunction with FEMA Flood and Storm Surge Zones to constrain Evacuation Zones during hurricane events. These analyses, along with the County's GIS data, including AED locations, building and property data are used to populate a web application for emergency responders that provides detailed information about structures they are responding to for use in the field.

It was found that there are no areas of York County that would lack emergency response with the exception of one section in the northern County where municipal water supplies are not available. Working closely with Fire, Life, and Safety provides accurate and up to date GIS information for responders as well as the public which keeps the community safer.

Author: Adam Lynch (Friends of the Rappahannock)
Category: Professional
Presentation Format: Poster
Title: Using VGIN Land Cover Data for Small-Watershed Analysis in a River Report Card

Abstract: The Virginia Geographic Information Network (VGIN) statewide 1-meter resolution land cover dataset, released in 2016, has revolutionized small watershed analysis in our state. The dataset's superior resolution and precise land cover classifications establish a clearer picture of land use patterns in both urban and rural environments. Friends of the Rappahannock, a watershed stewardship nonprofit based in Fredericksburg, used the VGIN dataset extensively during production of our Middle Rappahannock Report Card in 2018. The Report Card assesses 11 Rappahannock River tributaries on 16 different quantitative indicators, using the VGIN data to evaluate each tributary's watershed factors such as impervious surface area, forest canopy cover, and open spaces. The results helped Friends of the Rappahannock craft specific, quantitative goals for riparian reforestation and open space protection on a watershed-by-watershed basis. We also used the data to create attractive and informative maps to present the results to the public as well as local leaders hoping to strategically leverage scarce resources.

Authors: Christina Mauney (University of Richmond), Claudia Lombard, & Kelly Stewart
Category: Professional
Presentation Format: Poster
Title: Spatial Distribution of Natural and Relocated Leatherback Sea Turtle Nests at Sandy Point National Wildlife Refuge, St. Croix

Abstract: The Sandy Point National Wildlife Refuge (SPNWR), located on the southwestern tip of St. Croix, USVI, is a critically important sea turtle nesting area that was specifically designated for protection of leatherback sea turtle (Dermochelys coriacea) nesting habitat in 1984. Since its designation, it has become an important site for leatherback research, monitoring, and management.

The conditions that influence nesting habitat favorability relate to the basic geography of the beach; its peninsular shape creates three distinct environments. The north side is large and sandy, the western portion has a highly changing morphology due to longshore current erosion, and the southeastern stretch is often covered in dried seagrass and algae and experiences some annual erosion. Due to the dynamic nature of certain sections of the SPNWR beach profile, washout during nest incubation poses a significant threat to leatherback hatch success. As such, nest relocation based on a knowledge of past erosion patterns is an integral tool in leatherback conservation and management, and increasing hatchling production through nest relocation is one of the principal goals of the Comprehensive Conservation Plan for SPNWR.

The goal of this study was to determine the distribution of natural and relocated leatherback sea turtle nests at the refuge during the 2018 leatherback nesting season, and to examine trends in nest washout to provide recommendations for future management. To address these questions, we conducted nighttime nesting patrols to encounter nesting females and triangulate nest

positions with respect to standardized beach marker stakes. Clutches were relocated when they were laid too close to the high-water mark or were on the western beach. We then did hatchling emergence surveys to determine the fate of each natural and relocated nest by beach zone marker. Global Positioning System coordinates were collected and processed in ESRI's ArcGIS. Throughout the 2018 season, 28 of 130 total nests were relocated. Preliminary results suggest a higher prevalence of both nest relocations and washouts on the western side of the beach. Results from this study could inform future relocation decisions. By looking at the nest distribution patterns over several years and the hatching success of all nests by beach zone, we can identify the best sections of beach on the refuge to place future threatened egg clutches. Analysis of several nesting seasons is necessary to determine long-term historical trends in nest relocation and beach erosion.

Author: John McGee (Virginia Tech), Chris Carter, Cherie Aukland, David Webb, and Fred Coeburn
Category: Professional
Presentation Format: Poster
Title: Enhancing the Workforce of the Future- Small Unmanned Aircraft Systems
Abstract: Small Unmanned Aircraft Systems (sUAS) are providing professionals with increased opportunities for data acquisition and more efficient decision making. By delivering 'data on demand', these platforms represent a transformative technology that is changing the way that local governments, state / federal agencies, other non-profits, and the private sector acquire and process information to support their day-to-day business operations. Application areas that can utilize sUAS cut across different disciplines and industry sectors, which include, but are not limited to: agricultural production, conservation management, forestry, public safety, disaster planning and mitigation, infrastructure inspection, construction management, surveying, and natural resource management.

The UAS industry is rapidly maturing, and the projected economic benefits are nothing short of astounding. The Association for Unmanned Vehicle Systems International (AUVSI) projected that economic impacts associated with UAS integration in the National Airspace System (NAS) could exceed $82 billion by 2025. It has been stated that the UAS industry is "potentially as revolutionary as the introduction of the Internet". Virginia has made aggressive investments to take advantage of economic opportunities associated with sUAS. The Virginia Unmanned Systems Commission recently identified UAS as one of the most important drivers of Virginia's New Economy. In order to support industry needs, the educational community must be fully engaged.

Authors: Darlette Meekins (VDOT), Dwayne Altice, & Wendy Jenkins
Category: Professional
Presentation Format: Poster
Title: Transportation Initiative: CoalFields Expressway
Abstract: None

Authors: Megan Miller (James Madison University), Amber Swindells, Ian Dunton, Alexander Davis, & Zachary Czekalski
Category: Undergraduate Student
Presentation Format: Poster
Title: Combining Geographic Science Techniques with Intelligence Analysis Methodologies
Abstract: The purpose of this project is to utilize both geospatial and intelligence analysis techniques to overcome obstacles with targeting Middle Eastern terrorist groups and cyber threat actors. Addressing threat actor case studies using these methodological integrations will allow for a deeper understanding of how the crossovers between the two disciplines can be applied to real-world threats. We will be using two different threat actors as case studies for this analysis: the Islamic State (ISIS), and the allegedly Russian cyber threat actor Dragonfly 2.0. This analysis will emphasize the use of geospatial targeting procedures, including the use of evidence from overhead platforms, in concert with analytical techniques using open source data. Further, we will apply intelligence analysis methodologies, such as Red Team analysis and futures analysis techniques, to these case studies to gain insight into the potential futures of these actors and the threats they impose on the United States.

Author: Emily Routman (University of Richmond)
Category: Undergraduate Student
Presentation Format: Web Map App
Title: Immigrants in Richmond, VA
Abstract: I will analyze clusters of immigrant populations in Richmond, Virginia, and their life outcomes based on indicators such as median household income, educational attainment, unemployment, and more.

Authors: Linnea Saby (University of Virginia), Michelle Fults, & Jonathan Goodall.
Category: Graduate Student
Presentation Format: Poster
Title: Design and Implementation of a Decision Support System to Enable Standardized Environmental Compliance Procedures for Virginia's Nutrient Credit Exchange
Abstract: The Virginia Nutrient Credit Exchange (The Exchange) is a policy initiative designed to help achieve the water quality standards outlined in the Clean Water Act by establishing a market for nutrient offset credits. The Exchange includes provisions that permit nutrient offset trading between agricultural entities and organizations responsible for construction projects. Such transactions have dominated The Exchange and are increasingly frequent. Nutrient credits are created when the amount of nutrient runoff from agriculture is reduced and the reduction is estimated based on an early version of the Chesapeake Bay Model. Resulting credits may only be sold to construction projects located within scientifically-guided spatial restrictions, so achieving compliance for transactions requires spatial analysis to identify the restrictions for a given project site. Procedures to complete this analysis vary across market participants, and regulators are not equipped with resources to review the validity of each transaction. Variable or absent

spatial analysis procedures for transactions make the environmental outcomes of The Exchange unclear. We present a Decision Support System (DSS) to enable standardized and programmatic transaction compliance for The Exchange. Our DSS comprises a web form linked to feature services that provide spatial information about a construction project based on the coordinates and a web application that facilitates the identification of banks within spatial restrictions. The DSS is developed using ESRI's ArcGIS Online, WebApp Builder, and Survey 123 (a data collection and analysis software toolbox). We have also classified the Total Maximum Daily Load (TMDL) implementation plans by relevance to trading restrictions in The Exchange. Environmental compliance managers at the Virginia Department of Transportation (VDOT) have supported and collaborated on this research and will implement our DSS for all VDOT nutrient credit purchases statewide in 2019. We are working with The Virginia Department of Environmental Quality and the U.S. Army Corps of Engineers to make a similar DSS available for use by any potential nutrient credit buyer. Our proposed system will simplify implementation of The Exchange, enable improved compliance verification, and optimize use of regulatory resources.

Author: Jen Thomas (University of Richmond)
Category: Professional
Presentation Format: Web Map App
Title: RICHMOND RENT ON THE RISE: Median Rent in Richmond, Virginia: 2000 & 2009
Abstract: Richmond rents are on the rise. Using Census data gathered from The National Historical Geographic Information System (NHGIS), these maps show specific neighborhoods that have experienced larger rent increases from year to year. Availability of affordable rental housing is on the decline across the city. Where will that leave Richmond renters?

Authors: Amanda Waggoner (University of Richmond), Dr. Mary Finley-Brook, & Stephen Metts
Category: Graduate Student
Presentation Format: Web Map App
Title: Environmental justice & shale gas: spatial intersections between energy development and vulnerable rural populations
Abstract: Environmental justice is an important discussion in our country; it relates to participant-observation, cartography, legislation, activism, and community. Environmental justice (EJ) communities - areas where a specific majority of the populace are disproportionately impacted by environmental factors relative to the national or state populace - are prolific throughout the United States. Increasingly, EJ communities are subject to intensive energy extraction and transportation activities such as the Atlantic Coast Pipeline (ACP), a 600-mile pipeline designed to transport shale gas. The proposed pipeline involves the addition of new compressor stations in West Virginia, Virginia, and the Carolinas. Compressor stations push fracked gas downstream enabling gas to travel through the pipeline; they emit hazardous toxic air pollutants through this compression which relies on combustion. According to recent research, this pipeline, the compressor stations, and its extraction of chemicals and pollutants pose risks to nearby communities due to close proximity of exposure. In terms of locality, these compressor stations are often placed in EJ communities. This research aims to identify the types of land use classification and demographic conditions under which compressor stations are being built. After establishing 2 mile buffer zones around the compressor stations, we will then overlay census

block group areas to track the percent majority/poverty areas and see what compressor stations could be in proximity of EJ locations.

Authors: Amanda Waggoner (University of Richmond), Dr. Mary Finley-Brook, & Stephen Metts
Category: Graduate Student
Presentation Format: Poster
Title: Environmental justice & shale gas: spatial intersections between energy development and vulnerable rural populations in Union Hill

Abstract: GIS can play a pivotal role in analyzing environmental justice. The Atlantic Coast Pipeline (ACP) is a proposed pipeline being established by Dominion Energy. GIS has been a pivotal tool in mapping the ACP's changing route, compressor stations and territory it will encompass. GIS has also been beneficial in mapping the potential hazards that come from the ACP, as well. The proposed pipeline involves the addition of new compressor stations in West Virginia, Virginia, and the Carolinas. Compressor stations push fracked gas downstream enabling gas to travel through the pipeline; they emit hazardous toxic air pollutants through this compression which relies on combustion. According to recent research, this pipeline, the compressor stations, and its extraction of chemicals and pollutants pose risks to nearby communities due to close proximity of exposure. This research will analyze the proximity of compressor stations, in conjunction with environmental justice communities. Environmental justice (EJ) communities are described as areas where there are disproportionate levels of exposure to environmental hazards increased vulnerability to hazards via demographic backgrounds of inhabitants in the community. (USEPA) Union Hill, a historic African-American community in Buckingham County, VA, is one of the main sites for a proposed compressor station to be built. This form of rural EJ showcases a larger-scale issue about the level of slow violence from the emittance of noxious gases to the residents in the area. GIS can display the demographic context of the area surrounding Union Hill, in comparison to the rural land cover classifications of each compressor station site. The research will compare clusters of block group data using the proximity analysis near function via ESRI's ArcGIS platform. The values of land cover classifications will be tabulated by percentage of each zone of land cover classes within the boundaries of the proposed compressor station site in Union Hill and compared to trends of race and income within the area. Mapping these demographics provides context in resolving whether or not Union Hill is housed under this newer definition of rural EJ, and how the populace will be affected by the ACP.