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Student Poster and Web Map App Showcase Abstracts
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Category: Graduate student / Poster
Coauthors and other acknowledgements: W. Cully Hession (VT BSE), Laura Lehmann (VT BSE), & Jonathan Resop, Department of Geographical Sciences (University of Maryland)
Title: Assessing Spatial Complexity of Riverscapes using Drone-Based Laser Scanning
Abstract: Light detection and ranging (lidar) is a form of remote sensing using laser pulses to measure distances. Recent advancement in lidar technology has made units small enough to mount on drones, which makes high-quality data more accessible. Recent studies have utilized drone-based photogrammetry to measure characteristics of streams and rivers, as well as their associated riparian areas. These areas have been referred to as riverscapes. The physical characteristics of riverscapes are traditionally difficult to measure due to ever-changing characteristics across space and time. Drone-based laser scanning (DLS), is uniquely positioned to measure changing physical characteristics as it allows for increased temporal (daily, monthly, seasonal flights) and spatial (more than 400 pts/m2 at 30-m flight elevation) resolutions. It has more upfront costs compared to photogrammetry, as a DLS system (large drone and lidar) is vastly more expensive than a small drone with a digital camera payload. However, lidar can penetrate through vegetation, allowing for high-quality ground data, as well as vegetation points, which is a limitation of photogrammetry. One use of this ground and vegetation data is to analyze small changes of the topography to estimate complexity (an important habitat variable), as well as obstructions to flow such as vegetation. These obstructions to flow result in increased roughness, which is an important metric in biological studies and hydraulic modeling. In previous studies, estimating roughness was limited to visual observations or back-calculating from flow measurements, which can be time consuming and does not produce continuous spatial data. Using DLS-derived ground and vegetation, we will monitor small changes in vegetation and topography over the course of the stream both longitudinally, laterally, and through time. We will test various methods of computing roughness from detailed lidar point clouds to determine roughness. Some possibilities estimating roughness and complexity include the standard deviation of the elevation change, the variation between maximum and minimum elevations in a pixel, slope variability, surface roughness factors, and others. These values can be compared to a calibrated 2D hydraulic flood modeling (HEC-RAS), DLS has the potential to change the way we map and understand spatial complexity and habitat characteristics of riverscapes.

Author: Sara Cerv
Affiliation: Virginia Tech / Forestry and Forest Products
Category: Graduate student / Poster
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Title: Predicting Seasonal Evergreen Vegetation Growth
Abstract: The phenology of terrestrial vegetation is highly sensitive to climate variability and integrates many of the feedbacks between terrestrial vegetation and the climate system. Satellite based remote sensing can provide global coverage of vegetation phenology, however, this remote

sensing cannot depict vegetation changes in smaller areas. The PhenoCam Network allows for analysis for a small area of study at a high temporal resolution. The network was used to measure the evergreen vegetation at a loblolly pine site located at the Sweetbriar College. The PhenoCam records time-lapse images of a fixed area, over the course of a year, and used these images to extract quantitative color information from the area of study, specifically, the green chromatic coordinate (GCC) and normalized difference vegetation index (NDVI). The GCC and NDVI quantify the vegetation index and patterns in the analysis can be associated with vegetation growth. Remote detection of evergreen vegetation growth is difficult to detect due to the low variability of color indices. The analysis will determine the best method to detect the evergreen seasonal cycle.

Author: Nicholas Christensen
Affiliation: Virginia Tech / Biological Systems Engineering (VT BSE)
Category: Undergraduate student / Poster
Coauthors and other acknowledgements: Johnathan Czuba (VT BSE)
Title: Effects of vegetation on floodplain channel geometry
Abstract: Floodplain dynamics are closely related to vegetative cover and lidar data on the East Fork White River floodplain in Indiana, the geometry (aspect ratio: width/depth) of floodplain channels can be related to the type of vegetation cover. Vegetative cover of floodplain channels include row crop agriculture, grass, or forest. Initially, the aspect ratio was calculated on 227 cross sections of floodplain channels of a range of sizes, using both the average and maximum depths of the channel segments. Using this method, the mean aspect ratio of farmed and grassed channels was found to be very similar, 108 and 97, respectively, using the average depths and 50 and 49 using the maximum depth. The aspect ratio of more densely vegetated channels (containing bushes or trees) was found to be nearly half that at 51 using the average depth and 25 using the maximum depth.

It was expected that the roots of the grassed floodplain channels would stabilize the channel, resulting in sediment deposition and widening and shallowing the channel -- thus increasing the aspect ratio when compared to farmed channels that are bare soil during high flows in Spring (this expectation was counter to what was observed from all 227 channel segments). Instead, it was possible that these differences only manifest for the largest floodplain channels, so the five largest farmed and grassed channels were located and compared. The aspect ratio of these cross sections was calculated and each cross section was plotted. Using this method, grassed cross sections were found to have an average aspect ratio of 140, while the farmed cross sections had an average aspect ratio of 86. Visually, the largest grassed channels were found to be wider, more shallow, and more complicated, while farmed channels were more well defined, deeper, and narrower.

Future work aims to better understand the processes at work in forming floodplain channels and the differences (or lack thereof) in channel geometry depending on size and vegetative cover.

Author: Jill Derwin
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Category: Graduate student / Poster
Coauthors and other acknowledgements: Dr. John W. Coulston, Dr. Valerie A. Thomas (VT FREC), & Dr. Randolph H. Wynne (VT FREC)
Title: Sampling methods for assessing the accuracy of the 2011 and 2016 NLCD Tree Canopy Cover products

Abstract: Accuracy assessment is an important part of the modeling and validation process as it provides the user with essential information on the quality of model predictions. Accuracy assessment is typically performed on a sample of the total modeled population. In remote sensing, this population may represent all of the pixel values in the wall-to-wall study area.

There are extensive guidelines and standards for sampling and accuracy assessment of categorical variables in remote sensing, but the literature provides little information on best practices for sample site selection and evaluation of continuous variables. Additionally, recent improvements in computational abilities have enabled advanced methods for the sampling of remote sensing models for the purpose of accuracy assessment, resulting in better samples to provide higher quality estimates of accuracy. This study demonstrates one such methodology to select a sample for the accuracy assessment of Tree Canopy Cover datasets for 2011 and 2016, developed as part of the National Land Cover Database. This method applies a stratified random sample with optimal allocation using the 2016 model uncertainty to define 32 strata. Model uncertainty was calculated using the variance in predictions from the 500 random forest models estimated using different bootstrapped samples of training data. We select 2000 sample plot locations, balancing distribution by uncertainty value and prevalence.

We compare the sampling method described here to other common sampling protocols, and demonstrate how an accuracy assessment would be performed using the mean of 5000 simulated tree canopy cover measurements at each plot location.

Author: Seth Dorman
Affiliation: Virginia Tech / Department of Entomology (VT ENT)
Category: Graduate student / Poster
Coauthors and other acknowledgements: Roger Schurch (VT ENT); Anders Huseth, Department of ENT, NC State; & Sally Taylor (VT ENT)
Title: Predicting tarnished plant bug (Lygus lineolaris) infestations in cotton systems using landscape and climate models
Abstract: Economically damaging populations of the tarnished plant bug (Lygus lineolaris) have been documented since 2013 in Virginia, the northernmost cotton-growing region in the country. To better understand the sudden increase in L. lineolaris infestations in Mid-Atlantic cotton, 56 representative commercial cotton fields in Virginia were scouted weekly in 2017 and 2018 for a nine-week sampling period throughout the growing season. Insect density was recorded for each field using sweep net and drop cloth sampling, targeting adult and nymphal populations respectively. The National Agricultural Statistics Service (NASS) CropScape and Daymet weather raster datasets were used to measure the composition and proximity of land use and weather patterns within concentric rings surrounding focal cotton fields. Generalized linear models (GLM) and generalized linear mixed models (GLMM) were developed to investigate the potential significance of landscape composition and climatic factors increasing the risk of L. lineolaris infestations in cotton systems throughout Virginia.

Author: Samantha Fried
Affiliation: Virginia Tech / Science, Technology, and Society
Category: Graduate student / Poster
Title: Knit the World: A Landsat Knitting Project
Abstract: In this project, I turn Landsat imagery into Fair Isle knitting patterns. Fair Isle is a knitting technique that originated in northern Scotland. It typically involves two to five colors of yarn, basic

knit and purl stitches, and techniques for carrying yarn colors that aren't presenting in the pattern. In knit-speak, we refer to these techniques as catching floats. In addition to familiarizing you with some basic knitting techniques, I will explain Chart Minder, a software that I'm using to convert Landsat imagery into Fair Isle knitting patterns. Furthermore, I will discuss the ethos behind this project, which involves: (1) an interdisciplinary mixture of already-interdisciplinary fields: remote sensing, philosophy of technology, and fiber art; (2) an exploration of the relationship between fiber art and digital imagery. The origins of modern computing can be traced back to the Jacquard Loom. The history of fiber art holds within it our earliest form of binary code and discrete, pixel-based imagery. In this sense, I hope to convince you that Landsat imagery -- and the corresponding Fair Isle knitting patterns I'm creating -- have more in common than this corresponding likeness. Additionally, as I stand by my poster, I will be knitting a sample of a Landsat Fair Isle pattern.

Author: Regan Grimmett
Affiliation: Roanoke College / Department of Environmental Studies
Category: Undergraduate student / Poster
Coauthors and other acknowledgements: Dr. Katherine O'Neill (Roanoke College, Department of Environmental Studies); Mr. Dan Cohen (Department of Environmental Studies)
Title: Renewable Energy Potential on a College Campus: ArcGIS 3D Solar 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 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 a 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 kWh day-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.

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Title: Conceptual Plan for an Equitable Greenway through Metro-Atlanta Leveraging the Chattahoochee River to Increase Social & Ecological Connectivity
Abstract: The US Census Bureau estimates the Metro-Atlanta population to be approximately 5.7 million people in 2016 (US Census Bureau, 2017). The history of Metro-Atlanta is rich and diverse, a melting pot of cultures and influences. Every year, Civil War History, Civil Rights legacy, museums, art, industry, recreation, music, film, sports, fashion, food, trade and tourism attract millions of people to this region. Yet, despite the success of the metropolis, the sprawling landscape is oppressive for those with fewer resources. There are over 100 food deserts across the metro-region (The Atlanta Journal-Constitution, 2018). Lack of connectivity across the region creates barriers for the free movement of its peoples. In the poorest of communities there are few public green spaces

or opportunities for outdoor recreation, which begs more questions about the overall quality ofl ife for individuals living in these places.

Yet, through the center of the metropolis runs the Chattahoochee River and 15 Chattahoochee River National Recreation Area land units managed by the National Park Service. This project describes a vision beyond the Atlanta Beltline (2018), the conceptual plan proposed here imagines a more inclusive and biodiverse greenway that connects more of Metro-Atlanta to key destinations and natural capital.

This is a landscape architecture project which utilizes ArcGIS Pro software, open source GIS data, and Carl Steintz' Geodesign framework to develop a conceptual greenway plan to increase equity for the citizens of the Metro-Atlanta Region.

Author: Matthew House
Affiliation: Virginia Tech / Department of Forest Resources and Environmental Conservation
Category: Graduate student / Poster
Title: Leveraging the Landsat archive using Google Earth Engine to evaluate LAI trajectories for their utility in identifying differences between intensively and extensively managed loblolly pines in the Southeastern United States.
Abstract: This is an initial data query and methods development seeking to identify distinct diagnostic indicators between intensive and extensive management practices used on pine plantations in the Southern United States. We used Google Earth Engine (GEE) to extract leaf area index (LAI) values derived from the model by Blinn et al. to evaluate trajectories over time. We accessed all available Landsat scenes from 1995 through 2018 using Landsat 5 Thematic Mapper (TM), Landsat 7 Enhanced Thematic Mapper (ETM), and Landsat 8 Operational Land Imager (OLI) and took the maximum winter LAI (December through February) per year. Compositing in GEE for the years mentioned, we created a time series with which to evaluate known intensively and extensively managed pines in Virginia and North Carolina for differences in trends after fertilization applications. Fertilization applications dates were extracted from a dataset of known pine stands that had been filtered to display only loblolly pines. As a first step, selected shapefiles were used as a mask to select only pixels for the stands they represented. Then each was independently converted from pixels to ascii format to create a vector of values for each pixel within the stand for the years selected. Those values then were used to create graphs and histograms for the time series and evaluated for differences between the extensive stands and the intensive stands. Next steps are to extract values for every available Landsat scene regardless of season and look for more subtle differences in the trajectories with which we could create a model to separate stands on a large scale.

Author: Cameron Houser
Affiliation: Virginia Tech / Department of Forest Resources and Environmental Conservation
Category: Graduate student / Poster
Coauthors and other acknowledgements: Randy Wynne, (VT FREC); Val Thomas (VT FREC).
Title: Time-varying parameter sensitivity analysis of the Two Source Balance Model clarifies model behavior over a gradient of canopy complexity
Abstract: Evapotranspiration (ET), which includes evaporation and vegetation transpiration, is an important component of the earth's energy balance that influences water availability and energy partitioning at the land surface. Two-source energy balance (TSEB) models are widely used for

estimating ET, however selecting an appropriate modeling scheme often depends on the understanding of the system, data availability, and modeling objectives. Therefore, understanding how the development of TSEB models influences their process-level behavior is a necessary next step to advance the field. To this end, I developed a comprehensive exploration of the dominant parameters in the TSEB model structure. Model controls are isolated using time-varying Sobol's Sensitivity analysis over time series data accounting for spatial and temporal variability environmental conditions in order to assess the time-dependent nature of parameter sensitivity. Sensitivity indices are visualized along gradients to identify key behavioral differences between TSEB models and to connect these back to the models underlying assumptions. The results highlight model differences in performance controls. Understanding the links between model formulation and behavior can be an important diagnostic approach in applications where dominate model controls change over time.

Author: Md Sariful Islam
Affiliation: Virginia Tech / Department of Geography
Category: Graduate student / Poster
Title: Detection of urban heat island intensity of a mega city using Sentinel 3 data
Abstract: This paper examines the seasonal urban heat island intensity in Dhaka, a megacity in Bangladesh. LST band of Sentinel 3 data were used to calculate land surface temperature ultimately the urban heat island intensity at different neighborhood of Dhaka city. Both summer and winter data were used to detect the seasonal change of urban heat island intensity. Correlation of UHII with population size, NDVI and NDBI has been assessed in this study. The results indicate that it has strong relation with the population size and built up area of each neighborhood for both seasons. The results of this study along with the previous researches are evident that the mega cities like Dhaka are highly impacted by the urban heat island intensity and need to pay more attention to minimize the impacts.

Author: David Jensen
Affiliation: Virginia Tech / Department of Geography (VT GEO)
Category: Graduate Student / Poster
Coauthors and other acknowledgements: Lynn Resler (VT GEO); Andy Mahoney, Geophysical Institute, University of Alaska Fairbanks
Title: The Landfast Ice Annual Cycle in the Alaskan Bering Sea Region from 1996 – 2008
Abstract: Seasonal sea ice – ice that freezes in late fall and melts in early summer –is becoming increasingly variable in Arctic and Subarctic seas. This trend is particularly consequential for coastal zones, where sea ice freezes into a stationary position against coastlines. This stationary, or "landfast", ice affects how energy, sediment, and water transport and interact, and therefore governs interactions between land, ocean, and atmospheric processes in polar environments. Therefore, changes in the spatial distribution and seasonal duration of landfast ice can influence broader changes in biogeophysical processes. Understanding the extent of this influence is limited by a lack of comprehensive landfast ice research in the Bering Sea. Here we present the creation and analysis of the most comprehensive landfast ice datasets to date in the Alaskan Bering Sea region, through the analysis of satellite imagery from 1996-2008. Results show unique spatial distributions and seasonal durations to be influenced by bathymetric conditions and coastal morphology in our study area. Further, there is increasing interannual variability in the seasonal duration and spatial distribution of landfast ice throughout our study area. The present study characterizes the landfast

ice regime in the Bering sea and will inform future research addressing broader changes in biogeophysical processes.

Author: Ian MacNaughton
Affiliation: Virginia Tech / Department of Geography (VT GEO)
Category: Undergraduate student / Poster
Coauthors and other acknowledgements: Sean Barron, (VT GEO); Shane Coleman, Data Curator
Title: GeoSpatial Data Collections - Data Transformation Studio
Abstract: The Data Transformation Studio at Virginia Tech, centered in Newman Library, is a space that was created for the transformation and archiving of data acquired by the university over time. One of the recent projects started by the studio is the cataloging of the VT map collection. This project is broken up into two pieces: the map digitization program and the web mapping program. The ultimate goal of this project is to preserve maps in the collection using a digital archive and web mapping application.

Author: Wyatt McCurdy
Affiliation: Virginia Tech, Department of Forest Resources and Environmental Conservation (VT FREC)
Category: Graduate student / Poster
Coauthors and other acknowledgements: Quinn Thomas (VT FREC); Randolph Wynne (VT FREC); Valerie Thomas (VT FREC)
Title: Factors influencing remotely-sensed LAI regeneration in Loblolly pine stands within the state of VA
Abstract: Canopy leaf area index (LAI) is a significant factor in the inference of forest carbon exchange. As the terrestrial C stock is an important and dynamic component of the global C cycle, and forest carbon stocks are a significant portion of the terrestrial C stock, forest C exchange should be taken into account when modeling the contribution of LULC to terrestrial C exchange. Planted and managed loblolly pine canopy dynamics are a significant part of forest C exchange in the Southeast, and are therefore important to understand and model in relation to environmental variables. Regeneration in Loblolly pine stands, and relating to site variables has been studied extensively and rigorously on the ground. This study, then, plans to add to this knowledge base by examining effects of regional environmental variables on the regional variability of LAI regeneration across the state, using LAI time series modeled using remotely-sensed indices.

Author: Molly McKnight
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Category: Graduate student / Poster
Coauthors and other acknowledgements: Dr. Bill Carstensen (VT GEO), Diana Simpson (VT GEO), and VT Sustainable
Title: Renewable Energy Siting Project (SRES)
Abstract: One barrier to implementing renewable energy facility siting projects is public resistance as many people consider renewable energy infrastructure unsightly and intrusive. Some people also feel these projects impinge on their rights to the views to which they are accustomed. However,

once the construction begins, community members tend to increase their support for the renewable energy site (Pew Research Center, 2016).

This project aims to address public concern about renewable energy facilities by creating an interactive web application hosted on ArcGIS Online. The web application allows the public to type in their address and view how the renewable energy facility siting project impacts the views near their homes. Our hope is that this web application can help the public understand the actual effects on their views, and perhaps in some cases, convince the public that renewable energy is not as unsightly as they might think, allowing developers to overcome this initial barrier.

GIS software provides the ability to generate 3D scenes. GIS data sets, which are widely available on servers, provide basic layers that can be draped over a terrain. However, 3D objects on the terrain are not included in these data, so buildings and trees must be generated or collected for the scenes. In this project, we attempted to generate individual trees through extraction from LiDAR data to promote realism. This LiDAR-based methodology appeared to identify individual trees better areas with less dense tree cover than in heavily forested areas. Future plans include determining the accuracy of our individual tree extraction from LiDAR data method, comparing the LiDAR tree-extraction method to a raster-based approach, and creating a fully-functional model of one of our renewable energy facility project sites.

Author: Rachel Melton
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Category: Undergraduate student / Poster
Coauthors and other acknowledgements: Verl Emrick, Conservation Management Institute at Virginia Tech (CMI); Scott Klopfer, CMI
Title: Geographic Analysis of Priority Areas on Private Land with Conservation Need in Virginia
Abstract: Virginia is home to a diverse range of terrestrial and aquatic species throughout the mountains, piedmont, and coastal plain. Public lands across Virginia, which include national parks, state parks, national forests and wildlife management areas (among others), comprise only 16% of the total land area of Virginia, and only 6% of the New River Valley. Private land is often overlooked in conservation planning but it represents land that is crucial for species that are native to Virginia. The objective of this research was to identify high priority habitats on private lands that are important for conservation but are not well represented on already protected public lands. Species of birds that were identified as Tier One and Tier Two Species of Greatest Conservation Need (SGCN), identified in the State Wildlife Action Plan (SWAP), were used as a surrogate for identifying lands and habitat crucial for the conservation of terrestrial and aquatic species in Virginia. The geographical extent of the SGCN range/habitat was acquired from publicly available SWAP data and, using Geographic Information Sciences (GIS), was overlaid across the region of the New River Valley, Virginia. The cross-sectional surface area of the species range/habitat and publicly owned lands was compared and the total area of each species range occurring on public land and private land was calculated. This data was used to determine which SGCN bird species ranges occurred primarily on private land (i.e. < 60%) and to evaluate the importance of private land that is critical to biodiversity. Results indicate that grassland/shrubland habitat is the least represented habitat by public land, with 99% of grassland/shrubland habitat occurring on private land.

Author: Allison Mitchell
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Category: Undergraduate student / Poster
Coauthors and other acknowledgements: Lonnie Hamilton III, Virginia Tech Department of GEOG/School of Public and International Affairs; Joe Newman, Virginia Tech Center for Geospatial Information Technology
Title: Exploratory Analysis of Car Accidents Involving the American Black Bear in Virginia
Abstract: The primary focus of our research endeavor centers around standardizing the spatial attributes of police-reported crash records in the Commonwealth of Virginia. The Center for Geospatial Information Technology at Virginia Tech (CGIT) is working in support of the Virginia Department of Motor Vehicles Highway Safety Office's mission to improve public safety. This data will be used by highway safety officials to identify particularly dangerous intersections and road segments across the commonwealth.

We evaluated the crash factors and characteristics present in the dataset to better understand the potential that geospatial techniques can provide to the highway safety community. We elected to analyze crashes involving the black bear (Ursus Americanus) to see what observation could be made. To start, it was necessary to define the criteria to identify crashes involving bears. This was initially done manually by using an SQL request to obtain all records from 2018 crash data where the word 'bear' is referenced in the officer's narrative. From there, we conducted a manual sort of the remaining data to help craft future, more efficient SQL requests for other years

Once all records involving bears have been found, the data will be rendered in ArcGIS. Some exploratory analyses we plan on conducting involve identifying routes with high incidences of bear-related crashes, overlaying the crashes with known Wildlife Urban Interfaces (zones where housing density >6.17 housing units/km2 and vegetation cover >50%), and overlaying the crashes with the known habitats of the black bear in the commonwealth to observe if and how they may differ.

Author: Snehal More
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Category: Graduate student / Poster
Coauthors and other acknowledgements: Dr Randolph Wynne (VT FREC), Dr Anuj Karpatne (Virginia Tech Department of Computer Science)
Title: Deep Learning for Land cover Land use change in Godavari districts of Andhra Pradesh, India
Abstract: Studies have shown that there has been a decrease in forest Indian state of Andhra Pradesh, while area under forest plantations has shown significant increase in recent years. These plantations were through conversion of degraded agricultural land. Our aim is to monitor such plantations through remote sensing methods. Information obtained would later be used to study social science aspects of village-based economic model. Study area consists of two districts East Godavari and West Godavari in Andhra Pradesh a state of India. We are looking at the plantations outside forests, primarily Casuarina and eucalyptus tree plantations. Aim is to identify trees outside forest from Landsat and Sentinel images using deep learning methods. Yearly NDVI from greenest-pixel value for

10 years using Landsat 7 has been extracted and analyzed for given training data points from google earth engine. Preliminary analysis has shown that the natural forest and plantations are challenging to separate with given training dataset, whereas agriculture and forest areas are comparatively more separable. Forest mapping in India has presented some difficulties like small plantation size relative to pixel resolution of Landsat (30m), surrounding cropland area with comparable spectra features and newly established plantations. Further, we intend to improve accuracy and precision in remotely sensing these tree plantations as an output by using harmonized multi-temporal data over multiple years, using high resolution dataset as Hamornised landsat and sentinel (10m), and using improved training datasets for deep learning methods.

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Coauthors and other acknowledgements: Dr. Dalton Lunga, Geographic Information Sciences and Technology Group, ORNL; Dr. Lexie Yang, Geographic Information Sciences and Technology Group, ORNL
Title: A Multinet Approach to Semantic Labeling In Satellite Images Utillizing CNNs & FCNs to Assist with Disaster Relief
Abstract: Classification within satellite images has many applications. One such role is aiding in disaster response by locating high risk living structures such as mobile home parks and finding where people are congregating by detecting cars in parking lots. This leads to pixel and patch level classification problems. This research tests the feasibility of using a Multinet approach that utilizes CNNs and FCNs to reuse information learned in one classification model to aid in the learning of the remaining models. The research found that the Multinet approach appears to be feasible but further research is needed to match the accuracy of the traditional decoupled models.

Author: Oluwatosin Ogunmayowa
Affiliation: Virginia Tech / School of Plant and Environmental Sciences
Category: Graduate student / Poster
Coauthors and other acknowledgements: Meredith Steele, VT School of Plant and Environmental Sciences.
Title: Response of nutrient concentrations in stream to gradients of urbanization and agricultural development.
Abstract: Urbanization and agricultural development are frequently linked to increased nutrient concentration in streams. Urbanization and agriculture are the leading cause of stream impairment. With more than three-quarter of the United State's population living in urban areas, there is increased risk of stream impairment nationwide. This study investigated the response of phosphorus (P) and total nitrogen (TN) concentrations in stream to urbanization and agricultural development in humid and dry climates of the United States. Nutrient concentrations from watersheds in four regions (Mid-Atlantic, Ohio, Upper Mississippi and Missouri) of the U.S. were quantified using USGS concentration data. Results showed that in humid climates, P and TN concentrations increased with increasing urban and agricultural land cover in the watersheds; however, in dry climates only TN concentration increased with increasing urban and agricultural land cover. A pattern of no or slow increase in P concentration up to 40 percent urbanization and agricultural development followed by

large variation and an increase in concentration at higher percentages of urban and agricultural land cover was observed in humid climates. Similar pattern was observed for TN concentration with increasing agricultural land cover in humid climates. However, with increasing urban land cover, there was an initial increase in TN concentration followed by large variation and a plateau at higher percentages. In dry climates, P concentration did not change while TN concentration increased with increasing agricultural land cover; however, there were considerable variations at both lower and higher percentages of agricultural land cover. These results indicate that P and TN concentrations in streams should be managed at both lower and higher levels of urbanization and agricultural development. Cumulatively, these relationships provide a unique insight into nutrient concentrations in streams across gradients of urban and agricultural development.

Author: Ryan O'Reilly
Affiliation: Virginia Tech / Department of Agriculture and Applied Economics (VT AAEC)
Category: Graduate student / Poster
Coauthors and other acknowledgements: Dr. George Norton (VT AAEC)
Title: Agriculture Technology Adoption Use and Limitations of Remote Sensing Data.
Abstract: A significant portion of agriculture technology adoption literature take place in the global south where poverty has a dynamic relationship with farmer decisions to adopt. Household isolation, geological qualities, and climatic conditions all have a spatial component that can be assessed using GIS. These factors idiosyncratically effect the decision maker and contribute to their decision to adopt or reject a technology. Due to budget limitations of research projects, issues with survey design (memory recall bias, framing effects, etc.), and operation in low-income countries remotely sensed data should be incorporated into the current adoption literature as a utility to circumvent these challenges.

Remotely sensed data can serve as a low-cost method to check spatial data collected from surveys (farmers distance from household to market, input supplier, nearest town, etc.). Additionally, other than the ability for the technology to serve as a robustness check for survey responses it can also serve as a low-cost tool that gathers spatial covariate shocks over time. Specifically, maximum and minimum daily temperatures, soil moisture content, and average precipitation data. The climatic data all impact crop yield and as a result farmers income; which acts as an explanatory variable for farmers production decisions. By not accounting for the variance from the average of the climatic variables presented above the models generated to predict adoption could be biased.

For example, suppose a pest resistant tomato variety was released in 2010 in two identical counties, Bomet and Nyeri, that are located in different regions in Kenya, ceteris paribus. Years 2010 and 2011 had lower than average monthly precipitation for Bomet and above average rainfall for Nyeri, ceteris paribus. While 2012 and 2013 had above average rainfall for both counties. The lower than average monthly precipitation for Bomet caused lower comparative crop yields (incomes) than Nyeri and as a result many of the Bomet farmers reduced consumption in the following years. Due to Bomet farmers uncertainty in income variation farmers invested less into their farm until year 2013 where they had additional savings that could make them resilient to covariate weather shocks. While initial adoption of the variety started occurring in Nyeri at the end of 2010 with an increasing percentage of utilization annually, the bulk of Bomet farmers did not begin adopting until 2013.

Suppose farm-level surveys were conducted in the two counties in December of 2012 and 2014. Both surveys would identify little difference in annual incomes between the two counties yet a stark difference between adoption rates. The researchers would tell the story of adoption between the counties the best that they could however, we know that the story would be incomplete. The factor that precipitation played in the difference of adoption rates between the two counties is the missing factor that would complete the narrative.

It is my objective to present the value remote sensed data has for agriculture adoption models and present the sources and techniques needed for some basic analysis.

Author: Julie Paprocki
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Title: Use of Satellite Imagery for Determination of Moisture Content
Abstract: Moisture content is one of the many properties that impact the strength of sediments. In a coastal environment, the moisture content can vary on spatiotemporal scales in response to wave run up, tides, rainfall, inundation, and sea level rise. Moisture content is measured through the use of hand-operated moisture meters or through carefully obtained sediment samples. However, these methods are only feasible for a limited size of test areas and samples. This leads to the need for novel approaches for the determination of moisture content through remotely sensed data. Models for determining moisture content using synthetic aperture radar (SAR) and optical imagery have been developed in the agricultural industry, but have not been applied for coastal settings. This research has focused on the applicability of these models for sandy beaches.

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Coauthors and other acknowledgements: Robert Severynse (VT GEO) & James B. Campbell (VT GEO)
Title: Likely Effects of Debris Flows on Distinctive Stream Diversions in Northwest Virginia
Abstract: This poster describes various elbow-like diversions of river courses in northwestern Virginia that may have been the result of prehistoric debris flow events. Heavy rains, which are well-documented in our current era, have created heavy debris flows. These events are relatively common in the mountainous regions of Virginia and can be strong enough to block the entire floodplain. The debris flow will deposit lots of sediment, and may dam water flow long enough to divert the river's pathway in elbow-like river courses along the valley. These diversions can create as much as 100 feet of relief within the floodplains. Using Google Earth and other GIS software, I illustrate potential landslides and debris flows that may have led to the unusual patterns sometimes seen in rivers.

Author: Josh Starner
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Category: Graduate student / Poster
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Title: Spatial Variability in Convenience of Battery Electric Vehicle Routes Reliant on DC Fast Chargers

Abstract: Consumer interest in alternative fuel vehicles continues to grow while auto manufacturers work to introduce battery electric vehicle models more palatable to a larger number of consumers. Despite advancements within the battery electric vehicle market, the charging infrastructure remains fragmented by both geography and brand compatibility. There are currently over 2,600 DC fast charger locations open to the public in the U.S., less than 2.5% of the number of gasoline fuel stations available. According to the National Renewable Energy Laboratory, only 16% of the population are aware of charging locations along routes they regularly travel. Consumers that do not have the ability to charge at home or work, as well as those that wish to meet 100% of their travel needs with a single vehicle may be more likely to continue to purchase combustion engine vehicles until the U.S. DC Fast charging infrastructure becomes more evenly distributed. This work will identify spatial patterns in the discrepancy between routes available to combustion engine vehicles and those currently supported by the DC Fast charging infrastructure. The results from this study will support the development of a consumer-oriented model for the optimal placement of future battery electric vehicle charging locations.

Author: Megan Stevenson
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Category: Graduate student / Poster
Coauthor and other acknowledgements: Korine Kolivras (VT GEO)
Title: The Effects of Land Cover Change on the Spatial Distribution of Lyme Disease in Northern Virginia Since 2005

Abstract: Lyme disease has been a growing problem in the United States over the last few decades, and is currently the most common vector-borne disease in the country. This research evaluates the land cover within specified counties of northern Virginia to find a correlation between forest fragmentation, suburbanization, and cases of human Lyme disease; as has been demonstrated in other Lyme endemic regions in the United States. Few studies have focused specifically on northern Virginia when considering the impacts of land cover change on Lyme disease. Discovered through the use of GIS and Geospatial Modelling Environment software, the cluster of Lyme disease cases in northern Virginia could be attributed to the forest fragmentation within the study region, which creates an ideal habitat for black-legged ticks and allows for an increase in Lyme disease transfer from vector to humans. The goal is for the research findings to be applicable to other regions with similar land cover types. Regions with similar characteristics would then be able to recognize the potential risk of human Lyme disease and implement ways to reduce the Lyme disease risk associated with suburban development.

The purpose of this study is to answer the following research questions: 1) How has the spatial distribution of Lyme disease in Northern Virginia changed since 2005 with respect to land cover? 2) Which suburban communities are more at risk for Lyme disease when considering their land cover types and the increasing spatial distribution of Lyme disease?

Author: Yanshen Sun
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Title: Evaluating the quality of ground surfaces generated from Terrestrial Laser Scanning (TLS) data

Abstract: Researchers and GIS analysts have used Aerial Laser Scanning (ALS) data to generate Digital Terrain Models (DTM) since the 1990s, and various algorithms developed for ground point extraction have been proposed based on the characteristics of ALS data. However, Terrestrial Laser Scanning (TLS) data, which might be a better indicator of ground morphological features under dense tree canopies and more accessible for small areas, have been long ignored. In this research, the aim was to evaluate if TLS data were as qualified as ALS to serve as a source of a DTM. To achieve this goal, there were three steps: acquiring and aligning ALS and TLS of the same region, applying ground filters on both of the data sets, and comparing the results. Our research area was a 100m by 140m region of grass, weeds and small trees along Strouble's Creek on the Virginia Tech campus. Four most popular ground filter tools (ArcGIS, LASTools, PDAL, MCC) were applied to TLS data. The output ground point clouds were then compared with DTM generated from ALS data of the same region. Among the four ground filter tools employed in this research, the distances from TLS ground points to the ALS ground surface were no more than 0.06m with standard deviations less than 0.3m. The results indicated that the differences between the ground extracted from TLS and that extracted from ALS were subtle. The conclusion is that Digital Terrain Models (DTM) generated from TLS data are valid.

Author: Kristen Swedberg
Affiliation: Virginia Tech, Department of Agricultural & Applied Economics
Category: Graduate student / Poster
Title: Geospatial Analysis of Photovoltaic Capacity and Land Value of U.S. Farmland
Abstract: Considerable research has been done regarding the capacity of photovoltaic (PV) systems throughout the United States. Much of this research evaluates the efficacy of policies that promote new installation of solar panels for both residential and industrial purposes. One component that is not always present in the literature is the role of land, a key input for large PV operations. Rural areas not only have substantial acreage of available cropland and pasture, but often have lower land values than nearby urban and suburban regions. Understanding the spatial variation of land value may help develop insight on factors that impact farmer adoption of PV systems. This poster will present a geospatial representation of state-level combined cropland and pasture values, as well as the PV generating capacity per acre on farms throughout the United States. This data will be utilized in a future analysis of the relationship between farmland value and farmer adoption of PV systems throughout the United States.

Author: Hoa Tran
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Category: Graduate student / Poster
Coauthors and other acknowledgements: Iris Fynn (VT GEO); & James B. Campbell (VT GEO)
Title: Geospatial Education: Geospatial reasoning at the undergraduate level
Abstract: In colleges, universities and other institutions of higher learning, GIS (Geographical Information Systems), Remote Sensing, GPS (Global Positioning System), Mapping, the Internet, and other emerging technologies have been introduced to students outside of the general geography discipline. K-12 programs introduce pupils to spatial thinking and geospatial technologies like GIS and Remote Sensing, providing a strong foundation and background information for addressing and using geospatial solutions for local, national, and global problems. In this research, we investigate students' performance and responses on geospatial reasoning given their academic levels (freshman, junior, sophomore, and senior). Students' answers to questions in quizzes, assignments, and

midterm exams are assessed and evaluated. The questions probe students' understanding of spatial concepts, terminologies, and computations such as map scale and area measurements. Our aim is to compare the responses of students in specific academic levels to establish whether academic progress influences student's understanding of geospatial concepts. Specifically, we (1) assess pre-requisite backgrounds of the students before class registration; (2) evaluate the effectiveness of the class in enhancing spatial thinking and reasoning among students; and (3) identify ways to improve class materials and exercises based on the progress performance of students. This research is useful in serving as a template to improve the outcome of geospatial science courses at Virginia Tech.

Author: Lyndee Weaver
Affiliation: Virginia Tech, Department of Urban Affairs and Planning
Category: Undergraduate student / Poster
Coauthors and other acknowledgements: Christiana Hoff; Kelly Burdette; Stewart Scales (Department of Geography)
Title: Douglas County, Colorado Outdoor Recreation Guide
Abstract: This guide contains a map and a brochure on recreational sites in Douglas County, Colorado. It was created as a study of implementing principles of effective cartographic design. The map depicts public lands, trails, and other recreational sites in the county. Locations include mountain peaks, trail heads, campgrounds, lakes, hotels, and other recreational and administrative facilities. The public lands range from National Forest Service land to small municipal parks. Base layers of the map contain the hillshade, roads, municipalities, and waterways. On the back of the map, the brochure provides details of all the trails, peaks, parks, and activities within the county. This project introduces an accessible way for tourists and stakeholders to visualize the area and navigate to recreational spaces.

Author: Paige Williams
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Coauthors and other acknowledgements: Randolph Wynne (VT FREC); Valerie Thomas (VT FREC); & Snehal More, Department of FREC and CS
Title: Mapping Smallholder Forest Plantations in Andhra Pradesh, India using Multitemporal Harmonized Landsat Sentinel-2 S10 Data
Abstract: Comparatively to other Indian States, Andhra Pradesh's overall forest cover has decreased (Forest Survey of India 2013), though there are apparent increases in forest plantation area (Forest Survey of India 2017) predominantly through conversion of agricultural lands to forest plantation establishment. Unfortunately, there are constraints to accurately mapping forest plantations using remotely-sensed data due to their small (2 ha median) size, short rotation ages (often 3-5 years), and spectral similarities to croplands. Our goal is to use remotely-sensed data to map (smallholder) forest plantations. Cloud-free Harmonized Landsat Sentinel-2 (HLS) S10 data was acquired over six dates. The six resulting image dates, from different seasons, are as follows: December 28, 2015; November 22, 2016; November 2, 2017; December 22, 2017; March 1, 2018; and June 15, 2018. In situ data on forest plantations, provided by collaborators, was supplemented with additional training data representing other land cover classes (agriculture, water, aquaculture, mangrove, palm, forest plantation, ground, natural forest, scattered forest/shrub, sand, and urban) in the region. Land cover

classes were aggregated to three classes: non-forest, natural forest, and forest plantations. Classification used the Julia Decision Tree package on a thirty-band stack, including VNIR bands and NDVI images for all dates.

Author: Augustine Yellu
Affiliation: Virginia Tech
Category: Graduate student / Poster
Coauthors and other acknowledgements: Listed on the final poster.
Title: Observations of Second Harmonic Stimulated Electromagnetic Emission Generation during Ionospheric Heating
Abstract: Report is made here of first results from stimulated electromagnetic emissions (SEE) observed during an ionosphere interaction experiment that was conducted using the High Frequency Active Auroral Research Program (HAARP) facility. SEE refers to secondary radiation that is produced from the interaction between a high-power high-frequency pump wave transmitted from a ground-based transmit station and plasma in this case ionospheric plasma. Ionosphere plasma characteristics such as electron temperature, turbulence state and other important diagnostic information can be gleaned from SEE spectra. The HAARP transmitter power was maintained at 80% of its maximum installed capacity of 3.6 MW during the entire duration of the experiment. The frequency of the transmitter was stepped near the third harmonic of the electron gyrofrequency. All other parameters were kept constant during the experiment. The results compare the temporal evolvement of the characteristics of SEE that exist within 1 kHz of the reflected pump wave frequency known as narrowband SEE (NSEE) with that of wideband SEE (WSEE) which exists within 10 kHz of the reflected pump wave. Although parametric decay instabilities involving ion acoustic wave decay modes are known to produce the SEE observed in both wide and narrow frequency bands around the pump frequency, the results show the evolution of the characteristics of NSEE and WSEE with time progression into the heating cycle are principally different. Also significant advantages of NSEE over WSEE can be seen for further development of useful aeronomy diagnostics.