

2010 VT-GIS Symposium

April 9, 2010

Poster Presentations

1

An Analysis of Poverty in the Los Angeles PMSA using GIS and 2000 U.S. Census Data

Tammy E Parece, Department of Geography, College of Natural Resources, Virginia Tech

The United States Government determines which families or persons live above or below the poverty threshold. The threshold was developed by Mollie Orshansky in 1965 for the Social Security Administration. Orshansky defined the poverty threshold as “the dollar cost of the U.S. Department of Agriculture’s economy food plan, for families of three or more persons, multiplied by a factor of three” (U.S. Department of Health and Human Services). The U.S. Census Bureau develops statistics as to the number of people estimated to live below the poverty threshold throughout the United States as a whole and in different regional census tracts and publishes this information as part of its decennial report.

Included in the collection of data from the U.S. population each decade are statistics on education levels, housing costs, rates of public transportation use and labor force participation, and numbers of households on public assistance. Data from each of these categories can be extracted from the census report and spatially analyzed with GIS. This poster will analyze the data from the 2000 Census on the Los Angeles, California Primary Metropolitan Statistical Area (PMSA) to determine if there is a correlation between the different categories and the locations of high rates of poverty.

2

Expanding the Spatial and Temporal Scope of Soil Resource Assessment

Baojuan Zheng, baojuan5@vt.edu James B. Campbell, jayhawk@vt.edu and Kirsten de Beurs kdebeurs@vt.edu, Department of Geography, College of Natural Resources, Virginia Tech

This study outlines strategies to systematically monitor agro-ecosystems (surface soils, land surface phenology and agricultural practices) at broad spatial and temporal scales. An important resource for this approach is the extensive archive of Landsat 5 Thematic Mapper (TM) imagery, beginning in 1984. This archive will permit use of time series analysis to extract information about ways that humans use soil resources (changes in management practices), as well as the response of surface soils and crops to these practices. The decadal perspective of agricultural management can give insight in how the changes in management practices influence soil resources. The temporal scope of the TM archive provides opportunities to observe landscapes in spring, before planting, and after harvest, when surface soils can be directly observed without plant

cover. During the growing season, land surface phenology patterns can be extracted from the time series of Landsat imagery. This strategy will be developed and evaluated in two distinctive agro-ecosystems within the Eastern Corn Belt and the Atlantic Coastal Plain. Results will be validated using field and inventory data. Information from these analyses will allow broad-scale examination of how humans have used soil resources over years, or decades, thereby enhancing the ability to identify areas subjected to unsustainable agricultural management.

3

Terrestrial Laser Scanning for In-stream Rock Delineation and Deriving Habitat Metrics from Complex Forested Stream Topography

Jonathan P. Resop, Jessica L. Kozarek, and W. Cully Hession, Biological Systems Engineering, College of Agriculture and Life Sciences and College of Engineering, Virginia Tech

Accurate stream topography measurement is important for many environmental and ecological applications, such as hydraulic modeling and habitat characterization. Topological surveys are commonly created from point measurements using methods such as total station or global positioning system (GPS) surveying. However, surveying can be time intensive, limited by poor spatial resolution, and difficult to use when measuring complex morphology such as boulder filled mountain streams. These problems can lead to measurement and interpolation errors, which can propagate to model uncertainty. Terrestrial laser scanning (TLS) has the potential to create high-resolution topographic maps, although it is still in early stages of research. Two methods, total station surveying and TLS, were used to measure the topography of a 100-m forested reach on the Staunton River in Shenandoah National Park, Virginia, USA. The 2,701 surveyed points were directly compared to the TLS point cloud (approximately 9.5 million points). Post-processing was performed on the TLS dataset to remove vegetation, fill in small data gaps, and create a 2-cm digital elevation model (DEM) of the stream reach. The position and volume of random boulders were calculated and compared for each method to quantify the spatial uncertainty involved with complexity in habitat modeling. An algorithm was developed for delineating the location and size of rocks within the stream channel from the TLS DEM. Ecological metrics based on topographic information, such as the percentage of in-stream area consisting of protruding rocks, were then derived from the TLS dataset.

4

Utilizing Repeat Aerial and Ground Photographs to Assess the Impacts of Disturbance on Fraser fir (*Abies fraseri*) in the Black Mountains, North Carolina from 1954 to 2006.

Rachel H. McManamay and James B. Campbell, Department of Geography, College of Natural Resources, Virginia Tech

The decline in foundation tree species due to the introduction of exotic pests and pathogens has become a problem worldwide. Over the past several decades, the Fraser fir (*Abies fraseri* (Pursh.) Poir), a foundation species of Southern Appalachian spruce-fir forests, has experienced devastating mortality rates due to the invasive pest balsam woolly adelgid (*Adelges piceae* Ratz.). The decline of Fraser fir is particularly concerning because its naturally occurring range is limited to seven disjunct mountaintop regions. The purpose of this study was to use repeat aerial photographs, in conjunction with historical ground photographs and field work, to characterize spatio-temporal changes of Fraser fir forest cover within the Black Mountains, North Carolina. We manually digitized Fraser fir cover > 60% within a region of interest across photographs of the following dates: 1954, 1964, 1988, and 2006. Total area of Fraser fir cover > 60% was as follows: 1954: 1401 ha, 1964: 1306 ha, 1988: 616 ha, and 2006: 738 ha. The reduction of Fraser fir forest cover from 1954 to 1988 can be attributed primarily to balsam woolly adelgid induced mortality. A subsequent increase in Fraser fir cover from 1988 to 2006 resulted due to Fraser fir regeneration and recovery. A diameter distribution of recently sampled Fraser fir resembling a 'reverse- J' validates the trend of recovery. Our results call attention to the significant impact an invasive pest has had on a foundation tree species, but also provide evidence for the ability of an imperiled ecosystem to recover from such activity.

5

Digital Elevation Models, a Comparison of High Accuracy GPS and LiDAR Elevation Datasets.

Emily K. Smith and Laurence W. Carstensen Jr. Department of Geography, College of Natural Resources, Virginia Tech

Depending on the scale of study, high resolution digital elevation models are an important component when characterizing land surfaces, and deriving topographic variables in a GIS. Smith's thesis research, conducted in the alpine treeline ecotone (ATE), involved spatial analysis of detailed landscape information, and required a finer resolution DEM than was currently available (USGS 10 meter DEM). While a highly accurate LiDAR-derived DEM would be optimum for this study, LiDAR data was not available within the research area. An alternative is a high accuracy DEM derived from a GPS, a useful tool in high altitudinal areas free of canopy (such as the ATE). We conducted a pilot study to test and develop a technique to create a DEM. GPS positions were collected at 3 different "testing" grounds (flat, irregular, and steeply

sloping terrain) in open areas with good GPS collection conditions in Blacksburg, VA. To validate the technique, elevations were compared between GPS and LiDAR first return points covering the same area. Terrain surfaces derived from GPS and LiDAR were highly correlated with low RMSE values, and elevation differences were within 1 meter. The GPS method resulted in submeter resolution DEMs. Creating a high resolution DEM using GPS proves to be a better alternative to a USGS DEM if finer detail of the topography is required. Since LiDAR is one of the most accurate methods of representing terrain, results of this study show a GPS-derived DEM provides a viable terrain model, and at a much lower cost than flying LIDAR.

6

Land Abandonment in Russia: Understanding Recent Trends

Ioannis Kokkinidis and Kirsten M. de Beurs, Department of Geography, College of Natural Resources, Virginia Tech

Agricultural reform has been one of the most important anthropogenic change processes in European Russia that has been unfolding since the formal collapse of the Soviet Union at the end of 1991. Land abandonment continues to this day, but is not occurring randomly or unexpectedly. However, it has been difficult to monitor and quantify the level of abandonment due to a lack of reliable government statistics. Synoptic remote sensing can help in quantifying land cover change because of its uniformity and reliability. In this study we have first used MODIS land cover data at 500m spatial resolution to quantify general changes in the oblasts of Chuvash, Kostroma, Samara and Stavropol between 2000 and 2009. In addition, to track land cover change over a longer time period and at higher spatial resolution Landsat images were used for the Kostroma oblast which will be visited for field work in summer 2010. The images revealed that during the 1990's 330,000 ha have reverted to forest while other 296,000 ha were cleared for agriculture, the construction of roads and lumber harvesting.

7

Photographic Assessment of Productive Ground Cover

Maria Bravo-Vinaja, Fisheries and Wildlife Sciences, Abid A. Mirza, Civil and Environmental Engineering, College of Engineering, Virginia Tech; Marissa Duff and Lubna Shihadeh, Biological Systems Engineering, College of Agriculture and Life Sciences, Virginia Tech; Link Elmore, Tara McCloskey, and Baojuan Zheng, Department of Geography, College of Natural Resources, Virginia Tech; Andrew Mendel, Urban & Regional Planning, Virginia Tech

The objective of this study was to assess the accuracy using digital photography to estimate productive ground cover (PGC) at the Whitethorne farm near Blacksburg, Virginia. A comparison of visual methods to color and near infrared (NIR) photographs was used to determine the effectiveness of photography for this task. A fallow plot of land with various types of ground cover was chosen for the location of 17 test plots.

Each plot was first assessed for PGC through visual means. The DARFOR scale was applied to each plot. A color and NIR photograph were taken for each plot. SAS was used to obtain correlation coefficients between each method. A paired t-test was performed to test the differences between each method. The null hypotheses are as follows:

H_{01} : There is no difference in PGC estimates between visual assessment and NIR aerial photographs.

H_{02} : There is no difference in PGC estimates between visual assessment and color aerial photographs.

Results:

- Failed to reject H_{01} for VA/COLOR paired t-test of alpha 0.05. Reject H_{02} for VA/NIR.
- Linear Regression
- For plot 4, visual assessment yielded PGC of 50%, Color photo estimated 48.46% and NIR estimated 42.9%.

Based on the computed correlation coefficient, it is concluded that color method is closest to visual assessment. Factors which would have possibly influenced the results include the practical restrictions on image capture, e.g., camera's verticality and proper illumination. For future work, a study that employs sophisticated techniques for data generation and meaningful statistical approaches may prove helpful.

8

Comparison of Coarse Grain Source Data at a Comparably Large Spatial Scale for Delineating Extent of Forested Area Around Virginia Vineyards

Timothy A. Jordan and Douglas G. Pfeiffer, Department of Entomology, College of Agriculture and Life Sciences, Virginia Tech

The abundance and distribution of wild grape vines, *Vitis* species, in close proximity to vineyards is a common concern to grape growers because of the close relationship between insects and diseases that migrate from wild to cultivated vines. Wild grape vines are abundant around Virginia vineyards in areas such as tree rows, fencerows, and forest stands that provide the structural support to which vigorous climbing vines are adapted. However, the geographical extent of wild grape habitat at local and regional scales varies much in response to anthropogenic and environmental factors such as land management, species distributions, and suitable habitat. To determine the extent of wild grape habitat around vineyards, forested areas around vineyard blocks (n=12) were evaluated at three search distances (50-m, 100-m, 200-m) from the vineyard edge using photo-interpretation of 2002 VBMP aerial imagery. The digitized forest polygons were then converted to 0.6-m, 10-m, and 30-m grid cell raster maps and compared to three 30-m raster map products available from the web, including NLCD, DOF, FIA-GAP data sources. All resultant maps were obtained from imagery collected within the time frame of 1999-2002. While there was little difference of estimated forest area between the three aerial raster maps, the aerial maps provided a lower approximation of forest area at all search distances compared to the 30-m map products. Upon comparison of all 30-m maps to the 0.6-m aerial raster maps, DOF

source data was the most variable with the highest root mean-square error at all search distances.

9

A Cluster-Based Framework for MODIS Land Cover Classification and Change Detection

Evan Brooks, Dong-Yun Kim, Department of Statistics, College of Science, and Valerie Thomas, Department of Forest Resources and Environmental Conservation, College of Natural Resources, Virginia Tech

The study of land cover change is of great interest to climate scientists, ecologists, and government planners. In this paper, we develop a simple method using hierarchical cluster analysis for generating land cover maps and apply it to a region of East Africa based only on the Normalized Difference Vegetation Index (NDVI). Using these yearly land cover maps, we apply a way of testing and estimating change points for categorical data.

10

Soil Charcoal Patterns in a Rare Montane Pine Barren of the Southern Appalachians

Glen Gibson and Stewart Scales, Department of Geography, College of Natural Resources, Virginia Tech

This research examines patterns of soil charcoal in the Warm Springs Mountain Nature Preserve in southwest Virginia. Our Virginia Tech "Paleoenvironments" course participants (students, teaching assistant, instructor) carried out this project in a globally rare montane pine barren on the broad flattened top of Bald Knob (peak at 4225 ft.) in the Southern Appalachians. The forest is a mosaic of plant associations, dominated variously by stunted pitch pine or northern red oak with a nearly impenetrable shrubby understory, or by canopy height red oak. We speculate that vegetation patterns may relate to fire history and soil depth. To assess the potential for soil charcoal, and soil depth, to produce useful information on fire and vegetation patterns, we collected 18 soil cores in 5-cm increments to bedrock using soil augers and extracted 2mm charcoal from the samples. Cores were from three different vegetation associations: stunted oak-dominated, stunted pitch pine/heath, and oak forest reaching normal canopy height. Soil depth to bedrock never exceeded 50cm, but was deeper in oak stands. We subsampled the well-mixed soil samples material to 150 ml, weighed them, sieved through a 2mm sieve to separate the charcoal and verified it through low power microscopy. We then removed it to preweighed vials, dried it at 100°C, and reweighed to determine g charcoal/1000cc soil. Charcoal was more abundant in the pitch pine/heath association compared with the stunted oak-dominated forests, possibly indicating more frequent fires. However, canopy height oak-dominated forests had the greatest amounts of charcoal, possibly an effect of elevation.

11

Classification of a Mixed Hardwood Forest Using Hyperspectral and Lidar Data

Jessica Walker, Department of Forest Resources and Environmental Conservation, College of Natural Resources, Virginia Tech

A robust, accurate method of classifying complex forest areas characterized by high numbers of similar tree species is a sought-after goal. Support vector machines (SVMs) are a set of non-parametric classification algorithms that have been successfully applied to hyperdimensional feature spaces. In this research the effectiveness of an SVM algorithm was evaluated for the classification of a complex, mixed hardwood boreal forest area using hyperspectral (CASI) and light detection and ranging (lidar) data. The effect on the classification accuracy of incorporating different lidar-derived height and density parameters and different combinations of lidar and hyperspectral data was evaluated. The research showed that the SVM algorithm produced a higher overall accuracy than the more traditional classification methods tested, and the incorporation of lidar parameters played a critical role in the distinction of tree species. The favorable ability of the SVM algorithm to produce results based on small training sample sets was also demonstrated.

12

Feasibility Analysis of *Ailanthus altissima* in Five Western Virginia Counties

Steven M. Gaines, Department of Forest Resources and Environmental Conservation, College of Natural Resources, Virginia Tech

Invasive species is a topic of growing trepidation. Concern centers around the proliferation of invasive species associated with the continual development and disturbance of urbanization. *Ailanthus altissima* is an invasive tree species native to Asia, and is strongly affiliated with disturbance in the Eastern United States. *Ailanthus* is thought of as the vegetative powerhouse of pioneer tree species. Not only is this invasive extremely efficient in reproducing both sexually and asexually, but it is also quite tolerant to adverse growing conditions. These traits allow *Ailanthus* to successfully colonize disturbed areas and out-compete native vegetation. At present, the best methods of control for this invasive is through the use of herbicides (foliar and basal applications). The goal of this research project is to estimate what would be involved in eradication efforts for *Ailanthus* in five counties in western Virginia (Rockbridge, Augusta, Rockingham, Frederick, and Shenandoah). This would start with the estimation of *Ailanthus* infestations from data collected through Forest Inventory and Analysis and from the Virginia Department of Transportation. Estimations will include levels of per acre infestation ratings, radiating from urban disturbance centers in 10, 25, and 50 mile increments. The second area of interest in this study deals with expenses associated with *Ailanthus* eradication efforts in terms of labor and herbicide costs. Estimations of expenses will be projected from past eradication projects that took place on smaller land tracts, but similar infestation scenarios.

13

Expanding the Spatial and Temporal Scope of Soil Resource Assessment

Baojuan Zheng James B. Campbell, and Kirsten de Beurs, Department of Geography, Virginia Tech

This study outlines strategies to systematically monitor agro-ecosystems (surface soils, land surface phenology and agricultural practices) at broad spatial and temporal scales. An important resource for this approach is the extensive archive of Landsat 5 Thematic Mapper (TM) imagery, beginning in 1984. This archive will permit use of time series analysis to extract information about ways that humans use soil resources (changes in management practices), as well as the response of surface soils and crops to these practices. The decadal perspective of agricultural management can give insight in how the changes in management practices influence soil resources. The temporal scope of the TM archive provides opportunities to observe landscapes in spring, before planting, and after harvest, when surface soils can be directly observed without plant cover. During the growing season, land surface phenology patterns can be extracted from the time series of Landsat imagery. This strategy will be developed and evaluated in two distinctive agro-ecosystems within the Eastern Corn Belt and the Atlantic Coastal Plain. Results will be validated using field and inventory data. Information from these analyses will allow broad-scale examination of how humans have used soil resources over years, or decades, thereby enhancing the ability to identify areas subjected to unsustainable agricultural management.

14

Identifying Reclaimed Mined Lands Through Time by Using a Landsat Chronosequence from 1984 to 2008

Susmita Sen¹, Carl E. Zipper and Patricia F. Donovan, Crop and Soil Environmental Sciences, College of Agriculture and Life Sciences, Virginia Tech; Randolph H. Wynne, Forest Resources and Environmental Conservation, College of Natural Resources, Virginia Tech

This study uses a 23 year Landsat chronosequence (1984 to 2005) to identify reclaimed mines through time, in the coal mining belt of southwestern Virginia. The classification approach involves the use of temporal trajectories to distinguish mines from the un-mined background. The rapid loss of vegetation during mining and its subsequent regrowth by reclamation activities produces a trajectory that is unique to reclaimed mines and serves as a diagnostic of the mining activity. Three vegetation indices, Normalized Difference Vegetation Index (NDVI), Tasseled cap-Angle Index and Landsat Band 3 are tested. The classification is a two step process. The first step involves the separation of all disturbances (mining and urban development) from the undisturbed forests, while the second step differentiates within the disturbances, thereby separating mines from urban developments. The classification scheme is applied on pixels as well as objects (groups of spatially adjacent pixels that are spectrally homogeneous and represent a particular landcover class) and their classification

accuracies compared. Results suggests that objects have higher classification accuracies than pixels for all three vegetation indices. In the object based strategy, Tasseled cap-Angle index proves to be the best predictor of mining (89.05% accuracy) followed closely by the NDVI (87.9% accuracy). Overall, the classification accuracies are fairly high for all the three indices, suggesting the competence of the trajectory approach in identifying reclaimed mines thorough time.

15

Assessing Urban Tree Canopy in Virginia Localities

Jennifer McKee, John McGee, and Randy Wynne, Department of Forest Resources and Environmental Conservation, College of Natural Resources, Virginia Tech; Jim Pugh, Virginia Department of Forestry

Urban forests can be defined as the sum of all woody and associated vegetation in and around dense human settlements (Miller 1997). The people living in and around urban forests receive many direct and indirect benefits, such as the cooling effect of strategically placed trees around a house or the reduced costs of stormwater management (Konijnendijk et al. 2005). In order to estimate the benefits being provided by an urban forest, the amount of tree canopy cover must first be estimated.

The Urban Tree Canopy (UTC) project is a partnership between the Chesapeake Bay Program, the Virginia Department of Forestry (VDOP), the Virginia Geospatial Extension Program (VGEP) at Virginia Tech, and the localities participating in the project. The goal of the project is to assist partnering localities by providing them with the tools and technical infrastructure to assess urban tree canopy coverage.

16

Synergistic Use of Very High Frequency Radar and Discrete- Lidar Return for Estimating Biomass in Temperate Hardwood and Mixed Forests

Asim Banskota and Randolph H. Wynne, Department of Forest Resources and Environmental Conservation, College of Natural Resources, Virginia Tech; Patrick Johnson and Bomono Emessiene, Zimmerman Associates Inc

The objective of this study was to determine whether biomass in temperate hardwood forests is better estimated using VHF radar data (from BioSAR) alone or in combination with small-footprint discrete-return lidar data (both profiling and imaging). The study area was in the Appomattox-Buckingham State Forest, Virginia, USA (78°41'W, 37°25'N). In Situ data consisted of 131 BAF 10 plots from which standard allometric equations were used to develop plot-level biomass estimates. Due to the 30x300 m BioSAR ground resolution cell size, these plots were averaged within each of the 28 current stands in which aboveground tree biomass data were collected and used as the dependent variable in a multiple linear regression. Each stand was buffered inward to ensure co-registration between the field and remotely sensed data, and descriptors of the lidar distributions (both profiling and imaging) in each of these buffered stands were used as independent variables. Normalized radar cross-sections

from 18 angle bins (spanning -45 to 45 degrees) were averaged to obtain the stand-level BioSAR independent variables. Regression results revealed the following: (1) BioSAR data alone are not good predictors of stand biomass ($R^2=0.32$, RMSE= 26.1 tonnes/ha), (2) BioSAR data combined with small-footprint discrete lidar data (either profiling or imaging) are the best predictors of stand biomass ($R^2=0.78$, RMSE= 15.2 tonnes/ha), and (3) when used with BioSAR data for stand biomass estimation, less costly profiling lidar data convey the same information as more costly imaging lidar data.

17

GIS-based Model to Assess Riparian Forest Buffer Effectiveness in the Chesapeake Bay Watershed

Courtney Reijo, Department of Forest Resources and Environmental Conservation, College of Natural Resources

The Chesapeake Bay has been heavily altered by human practices and landscape change. The most persistent problem is excessive nutrient loading from the basin tributaries, which has created a state of eutrophication in the Bay and its lower tributary reaches. Past programs have spent millions of dollars in planting over 10,000 miles of riparian forests along streams within the Bay Watershed alone. Despite these plantings, there has not been corresponding reduction in nutrient loading to streams. Few guidelines, other than buffer width, have been created to direct groups in targeting specific areas of the stream network for improvement. Riparian plantings have largely been voluntary and opportunistic at most, and development of specific guidelines is needed for watershed-scale planning and decision-making efforts. A GIS-based model will be developed to assess riparian buffer characteristics that support high potential for nutrient removal in the Bay watershed. These analyses will determine at which scale (e.g., stream order) these attributes are most significant, at what scale geospatial techniques can be used, and will test predictability changes over different scales. Determined riparian zone types will be tested in the USGS SPARROW (Spatially Referenced Regressions On Watershed attributes) model to determine if they have a detectable and statistically significant impact on in-stream water quality at multiple basin scales with various land uses. This information will be used to create a set of recommendations for most effective buffer placement to be incorporated into investments and planning of Bay riparian planting projects.

18

Patterns in the Spring Phenology of High Elevation Western United States National Parks from 2000 to 2009

Allisyn Hudson-Dunn and Kirsten de Beurs, Department of Geography, Virginia Tech

Monitoring and understanding plant phenology is becoming an increasingly important way to identify and model global changes in vegetation life cycle events. Although numerous studies have used synoptically sensed data to study phenological patterns at the continental and global scale, relatively few have focused on characterizing the land surface phenology of specific ecosystems or of National Parks

and other protected natural systems. Within the western U.S., fourteen of these parks include high elevation and mountainous environments. In order to understand future natural and anthropogenic impacts on these protected areas it is essential that we first capture the spatial and temporal patterns and processes that are occurring there. One vital step in this process is the understanding of vegetation phenology throughout. Here, we use two MODIS/Terra satellite 16-day products, Vegetation Index and Nadir BRDF Adjusted Reflectance, to assess the spring seasonality of these western United States National Parks for the years of 2000 to 2009. Independent data for elevation, slope, aspect, solar radiation, and temperature as well as longitude and latitude were related to the seasonal outputs for start of season (SOS), maximum photosynthetic activity (MPA), and growing season length (GSL). Preliminary results of these analyses show that the seasonal vegetation pattern within these zones is primarily controlled by elevation, aspect, latitude, and temperature.

19

Forest Cover Dynamics in the Lake Victoria Crescent, Uganda

Daniel Waiswa, Stephen P. Prisley, Randolph H. Wynne, Phil J. Radtke, Carolyn A. Copenheaver and Marc J. Stern, Department of Forest Resources and Environmental Conservation, Virginia Tech

Despite the various roles played by forests, including providing livelihoods for millions of people worldwide, forest cover loss through deforestation and forest degradation continues, especially in tropical countries such as Uganda. Attempts to address forest cover loss focusing on promotion of sustainable forest management have unfortunately been ineffective due to among other issues inadequacy of information at sub-national (local) scale. This study therefore sought to provide local scale information about forest cover dynamics. The objectives were to: (i) stratify and quantify land use and land cover in Uganda's Lake Victoria crescent since 1980s, and (ii) explore land use and land cover change dynamics, focusing on forest cover, in Uganda's Lake Victoria crescent since 1980s. Landsat Thematic Mapper and Enhanced Thematic Mapper Plus imagery for 1989, 1995, 2002 and 2006 each covering 1,509,328 hectares were pre-processed and classified using unsupervised techniques followed by GIS spatial analysis. Mean overall accuracy was 97.8% while mean kappa statistic was 0.96. Forest cover varied from 11.4% in 1989 to 5.8% in 2006 in comparison with non-forest cover that varied from 55.9% in 1989 to 61.7% in 2006 while open water generally remained constant averaging 32.6%. Between 1989 and 2006, land use and land cover conversions from non-forest to forest decreased while conversions from forest to non-forest increased. Mean annual deforestation progressively declined with weighted mean annual deforestation estimated at 3.1% between 1989 and 2006. It was concluded that forest cover in Uganda's Lake Victoria crescent decreased between 1989 and 2006 despite declining rates of deforestation.

A Geographic Annotation Service in SuperIDR

Nádia P. Kozievitch, Ricardo da Silva Torres, Thiago Falcão, Evandro Ramos, and Felipe Andrade, Institute of Computing, University of Campinas, Brazil; Marques Allegretti, Marlene Tiduko Ueta, and Rubens Riscala Madi, Institute of Biology, University of Campinas, Brazil; Uma Murthy, Eduard A. Fox, and Yinlin Chen, Department of Computer Science, Virginia Tec; Eric Hallerman, Department of Fisheries and Wildlife Sciences, Virginia Tech

In scientific studies of biodiversity, the number and variety of stored data about the species and their habitats is extremely important. Effective information management is a key to the success of the research. SuperIDR, a superimposed image description and retrieval tool, developed at Unicamp State University, Brazil, and at Virginia Polytechnic Institute and State University, allows users to associate parts of images with text annotations. Later, they can retrieve images, parts of images, annotations, and image descriptions through text- and content-based image retrieval.

As an enhancement to SuperIDR, the geographic annotation service was added, to allow users to create geographic annotations for species studied. Annotations with point marks, lines, and regions in a map, can be combined with the other contents, providing optimized searches and better conditions to analyze the scenarios of study. Using this new feature, researchers can register the places where they visit during a camp study, and associate these places with the catalogued species as their habitat, for example. The initial geographic annotation service was developed at Unicamp, using parasite information, but has been integrated with other enhancements made at Virginia Tech.

Exploring Approaches to Extracting Lidar Points for LAI Estimation

Nilam Kayastha, and Valerie A. Thomas, Department of Forest Resources and Environmental Conservation, Virginia Tech

Leaf area index (LAI), defined as the total one sided area of green foliage per unit ground surface, is a key vegetation structural characteristic driving many ecosystem functions. Empirical relationships between LAI and spectral information derived from optical remote sensing data have been widely used as a technique for LAI estimation. Recently, many studies have utilized three dimensional structural information derived from lidar to derive estimates of LAI with varying degree of success. Hemispherical photos have been widely used to provide ground estimates of LAI. Most studies using lidar to estimate LAI first derive an average ground estimate of LAI from hemispherical photos taken in a plot and establish empirical relationship with various lidar metrics for the corresponding spatial area. However, the exact plot size capturing the view of a hemispherical photograph is variable and undefined. Therefore, the question emerges as to the optimal subset of lidar point clouds that best correspond to the ground

estimate of LAI from the hemispherical photo. The objective of the study was to extract lidar points that simulate various view zenith angles of hemispherical photo and assess their effectiveness in LAI estimation. The study showed little correlation between LAI derived from the center ring (i.e., directly above the camera) and corresponding lidar points. Strongest correlations occurred when utilizing the first 5 hemispherical rings and corresponding lidar cones.