2010 VT-GIS Symposium
April 9, 2010
Presentations Abstracts

2:30-2:45 pm

MEASURES (Management-Scale Ecosystem Assessment using Remote Sensing): Phase II

Randolph H. Wynne, Ralph Amateis, Christine Blinn, John McGee, Phil Radtke, Rupesh Shrestha, Valerie Thomas, Jessica Walker Department of Forest Resources and Environmental Conservation, College of Natural Resources, Virginia Tech; Buck Kline, Virginia Department of Forestry; Gene Yagow, Biological Systems Engineering, College of Agriculture and Life Sciences, Virginia Tech; Paige Baldassaro, Conservation Management Institute, Virginia Tech; Seth Peery Center for Geospatial Information Technology, Virginia Tech

Our overall project objective is to build on existing interagency efforts at state and federal levels to develop web-based ecosystem service credit calculators using remotely-sensed data and vetted best-of-breed models for both farms (tracts) and watersheds at the 6th-order (12-digit) hydrologic unit level. We are focusing on the following ecosystem services: (1) carbon sequestration in woody biomass, (2) water quality (sediment and nutrient loading), and (3) habitat/biodiversity as an undergirding element. Our initial implementation area is the Commonwealth of Virginia with explicit attention on scalability to enable an eventual rollout to other states in the region. This presentation consists of an overview of MEASURES as a whole, details on specific tools, and information on the InVEST interface to MEASURES developed by the Virginia Department of Forestry in partnership with Timmons Group and Virginia Tech.

2:45-3:00 pm

Terrestrial Laser Scanning Applications in Civil Engineering

Joseph E. Dove, Via Department of Civil and Environmental Engineering, Virginia Tech

Terrestrial Laser Scanning (TLS) offers high resolution point clouds at reasonable operational costs. tLiDAR is attractive for geotechnical engineering applications because the equipment is easy to operate, can acquire data in almost any lighting condition, digitally stores field data which can serve as a permanent site record, and provides an ability to gather data in areas that are inaccessible or are too dangerous for humans. However, drawbacks to wider use in practice include high initial equipment cost, large data file size, relatively high analysis software costs, and surfaces of low reflectivity can be difficult to scan. Low reflectivity surfaces include soils, some rock types, and wet areas. Two engineering applications are described below. A field study was conducted to assess the accuracy, repeatability and influence of point cloud

point spacing on the dip direction and dip angle of rock fracture and bedding planes measured from TLS. Discontinuities at four road cut sites and an abandoned railroad tunnel were measured with a hand compass and then imaged with an Optec, Inc. ILRIS 3D laser scanner. Intensity returns were used in the unlit tunnel. Point clouds of the outcrops were visualized using our software package, geotechnical Visualization Tools (*gVT*). A fast Delaunay triangulation algorithm creates a triangulated network from the scanned points. Virtual measurements of discontinuity orientations are then made from the triangulated network. The coefficient of variation with respect to hand measurements of dip angles determined from the point clouds at one site increased from 2.0 percent to 6.6 percent as spot spacing increased from 10.7 mm to 106.5 mm. However the coefficient of variation of dip direction only increased from 0.35 percent to 0.68 percent using the same data set, indicating that dip direction is insensitive to changes in resolution. Repeatability of measurements from the point clouds rivals those made with a hand compass. Laser scanning techniques were used by a contractor in the excavation for the Devil's Slide tunnels constructed by CALTRANS along Highway 1 in Northern California. TLS and *gVT* were used to verify the excavation profile, check the shotcrete lining (profile, smoothness, and thickness), and for geological documentation and rock mass characterization. It was found that visualization: 1) Gave improved understanding of why certain ground behaviors (convergence, water, face instability) occurred; 2) Permitted remote evaluation of discontinuities and their orientations; and 3) Gave clear definition of potential block fallouts, greatly improving worker safety.

3:00-3:15 pm

The Fragmentation, Isolation of Traditional Culture Landscape Space and Its Mechanism

Funded by China National Nature Science Foundation

Wang Yuncai, Department of Landscape Studies, College of Architecture and Urban Planning, Tongji University, Shanghai, China. (visiting scholar at School of Architecture and Design, Virginia tech) and Patrick Miller, School of Architecture and Design, Virginia Tech.

China has a long and rich history that has resulted in world renown cultural landscapes. Rapid development is incrementally destroying (fragmenting) the historic integrity of many cultural landscapes. In order to plan for the conservation of important cultural landscapes, landscape architects need a way of monitoring and assessing the extent of the impacts of development on historic integrity. This research on traditional cultural landscape fragmentation tries to provide a tool for doing this and draws on the experience of natural ecological space fragmentation theory and utilizes ideas and methods from those fields. It takes the total human ecosystem into account by examining the traditional cultural landscape as a local habitat of humans, researching the spatial-temporal process and landscape patterns of the traditional culture landscape.

Based on the researches of theory, methods, classification and characteristics of sample spaces, we choose four areas as case study and use the images and GIS to set

up a database of cultural landscape space, and evaluate the traditionality and fragmentation of cultural landscape space, which are done at Macro(region), Meso(Town) and Mico(village) level for each case area. As a result we try to do further research on patterns, models and dynamics especially in driving forces which caused the fragmentation and isolation of traditional cultural landscape. With the orientation of integrity, connectivity and authenticity of cultural landscape space and based on fragmentation analysis and evaluation, we can degrade the fragmentation level and promote the itegritation in order to conserve the traditional cultural landscape space through the patches controlling, buffer system establishing and corridor system connecting.

So, at all levels the pattern is in the dynamic spatial–temporal process that results in an historical mosaic. In the long term it reaches a balance among many different factors which are the result of human needs, and represent the typical culture landscape. This is the existing landscape that we see today. But in the short term the landscapes change too rapidly because of economic development and massive construction that is sometimes uncontrollable. So, the patches are not able to reach a balance and the integrity of the cultural landscape is lost. In this case the landscape must be managed according to different space and different attributes, conserve the landscape and its pattern controlling system at the village level. Secondly, based on the rational and scientific deduced patterns of individual village, it is possible to establish corridors and eco-steps to connect individual villages together, thus and forming the traditional culture landscape space network. Thirdly, buffer space is critical to the conservation of all kinds of traditional culture landscapes. A buffer system can be established based on different characteristics of length, width and importance, which are part of natural landscape, farmland, man-made lakes, green belts and city or rural parks. The preserved village as a central knot of the traditional network must be surrounded by enough buffer which will also serve as the basis of a network. So, this research demonstrates that the traditional culture landscape network, the modern landscape network and buffer system network can exist together in an interwoven network.

3:15-3:30 pm

Uncertainty in remote-sensing data may confound the results of telemetry studies

Daniel S. Stich and Brian R. Murphy, Department of Fisheries and Wildlife Sciences, Virginia Tech

Impacts of coordinate system on interpretation of movement data from radio-tagged animals are poorly documented. Distance measurements in telemetry studies are generally made in the coordinate system in which the data were recorded. Minimum distance traveled is defined as the straight-line distance moved by radio-tagged animals between consecutive telemetry surveys. Movements of grass carp were used to determine minimum distance traveled from geographic (lat/long) and projected (UTM) coordinate systems. The effects of season and stocking location on minimum distance traveled calculated by each coordinate system were evaluated. Use of lat/long generally underestimated minimum distance traveled when compared to

UTM. Significant impacts of coordinate system on the results of statistical tests were observed. A significant effect of season, but not stocking location, was observed on minimum distances traveled using lat/long; conversely, significant effects of stocking location, but not season, were observed on minimum distances traveled using UTM. These results indicate that the same study could yield contradictory results depending on the coordinate system used. Most published telemetry studies do not report the coordinate system used for distance measurements, making it difficult to draw meaningful comparisons between studies, even for the same species. Few fisheries professionals are adequately prepared to make distinctions between coordinate systems in GIS platforms. For these reasons, we recommend that coordinate systems used in telemetry studies should be reported in research methodologies. Furthermore, it is necessary to subject these methods to critical review through the same peer-review processes used to evaluate other methodologies employed in data collection and interpretation.

3:30-3:45 pm

Ghosts of the Forest: A detailed look at Virginia's role with Eastern Golden Eagles.

David Kramar, Department of Geography, Virginia Tech

The Eastern Golden Eagle population is not widely understood. Whereas, birders have reported sitings of these raptors for years, little research has been conducted as it relates to migration patterns. Researchers from the National Aviary, the Carnegie Museum of Natural Science, the Virginia Department of Game and Inland Fisheries, and myself have recently started trapping and outfitting this species with GPS transmitters. Traditional techniques have implemented the use of satellite GPS units. However, in some cases the individuals have “chewed of the antennas”. Currently, we are using a new transmitter that relays data via the use of cellular technology. Data points are collected every fifteen minutes in most cases. In an effort to collect more detailed information in particular geographic regions, geo-fences have been implemented in the units. Once a golden eagle passes beyond a specified latitude and longitude, data points are collected every 30 seconds. These data are dumped via wireless technology and are immediately available via the use of Google Earth. Therefore, this presentation will provide a unique look, from a geographic perspective, of the movement and patterns of Eastern Golden Eagles.

3:45-4:00 pm

Geospatial Analyses for Watershed Science and Engineering: From Instream Boulders to the World

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

Geospatial analyses across a range of scales are essential tools in watershed science and engineering research. Our purpose here is to share our experiences and activities related to geospatial analyses in order to initiate conversations and collaborations across disciplinary boundaries at Virginia Tech. We begin with a discussion of our use of terrestrial laser scanner (TLS) for measuring individual boulders in streams, as well as measuring streambank retreat at high resolutions over time. Next, we will scale up the stream-reach and describe our efforts to understand in-stream fish habitat using spatial analyses and hydraulic modeling. Scaling up to the watershed, we describe our efforts to quantify the impacts of urbanization on stream channels using extensive GIS analyses. We finish with a discussion of our efforts to develop a global-scale sustainable water-use model for corn. We are currently utilizing a detailed corn-growth model at 0.5° resolution, with a goal of increasing the spatial resolution to at least we 0.25° resolution and possibly as low as 5 minute (or 1/12°).

4:30-4:45 pm

Integrations of Geospatial Technologies and Google Earth Application as a Tool for Scenic Assessment and Management: A Study of Claytor Lake, Southwest Virginia

Partick A. Miller, Fcela Fasla, Shamsul. A. Bakar, Landscape Architecture, Virginia Tech; Song Liu, Department of Landscape Studies, College of Architecture and Urban Planning, Tongji University

The use of geospatial technology in assessing scenery management has long been known by researchers. These technologies for example have been used widely to assist in data collection, spatial analysis and visualizing complex spatial information for the researchers and stakeholders enabling them to understand the integration between different landscape elements. However, without proper thought and facilitation, data visualization can exacerbate management problems in certain situations. For instance, even with the increased and advance use of this technology, it is surprisingly often presented to the users or stakeholders in the same manner. Extensive and exhaustive hardcopy reports normally acts as the most frequent medium of visual communications between both researchers and stakeholders. With increasing amounts of data and information, traditional reports rarely become accessible to stakeholders, especially in situations that lacks of capability to present real time data visualization. Since complex digital information is less intuitive, stakeholders often find it difficult to understand information such as on site photography, seen areas, landform and land cover that need to be reviewed simultaneously. Therefore, this study intends to explore and provoke

new ideas of scenery management and visualization through available open source applications. The underlying concept of these ideas is primarily to promote greater representativeness in visual interactions between stakeholders and the researchers in using open source visualization systems. The focus is on Claytor Lake in Pulaski County, Virginia. The study area is known as an important water-oriented recreation and popular retreat destination in Southwest Virginia.

4:45-5:00 pm

Deforestation and the Transformation of the Landscape of North China

Alan Moore, Department of Geography, Virginia Tech

Studies of deforestation often cite modern China as a notable case to follow – either as an extreme example of deforestation out of control, or as a primary example of government policies on a massive scale to combat the problem - or both. However, these studies tend to leave two opposing but related questions unanswered: (1) What was the natural condition of the landscape and how did it become so disturbed?; and (2) How effective have been the countless reforestation attempts? This study focuses on the primary area of human environmental impact – North China – and undertakes an examination of archaeological, climatic, historical and other descriptive data to define the natural state of the North Chinese landscape and its transformation up to modern times. Subsequently, satellite remote sensing, statistical and other mapping methods are employed in attempt to determine whether or not the goals of afforestation methods are being realized. An initial analysis reveals that deforestation has played an important role in Chinese history and prehistory, resulting in very significant transformations of the landscape. A large scale examination of vegetation trends coupled with closer examination of several study areas shows that some success has been achieved by government policies, especially in the past decade.