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Poster Abstracts

Using LiDAR and Field Data to Analyze Canopy Structure in a Sand Pine Forest

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Abstract: LiDAR (Light Detection And Ranging) is a high-resolution, active remote sensing technology that can potentially provide cost-effective and highly accurate measurements of the three-dimensional structure of forest canopy over a broad spatial scale. In this study, small-footprint (≈ 0.1 m horizontal resolution) LiDAR technology was used to characterize the canopy structure of a predominantly sand pine scrub forest system of approximately 3 km^2 in the Archbold Biological Station, located on the Lake Wales Ridge of central Florida. Canopy height and other field measurements from transects established within recently-burned and unburned forest units were used to validate the LiDAR data, and strong relationships between the field-based measurements and the LiDAR-derived metrics were found. Detailed vertical canopy profiles were created with the LiDAR data and a statistically significant difference ($P < 0.05$) was detected between the average canopy height of the burned and unburned transects. The LiDAR data was also used to generate canopy structure signatures for sand pine scrub habitat and southern ridge sandhill (turkey oak), the second most predominant vegetation type in the study area. The canopy profile signature of the sand pine scrub was found to differ significantly from that of the southern ridge sandhill habitat, suggesting that LiDAR can facilitate the identification of major vegetation types on a landscape scale. The findings of this study point to an important future role for LiDAR data in habitat suitability analysis.

Nature and Extent of Land Use and Land Cover Changes of Eldama Ravine Catchment, Kenya using Remote Sensing and GIS Techniques

Chege, Moses

Abstract: Land use and land cover changes in catchment areas are of global and national concerns. They are subjected to diverse human use due to increase in population with time leading to alteration and destruction. Despite this, restoration of altered catchments takes long time and may involve intensive investment of resources through re-afforestation and afforestation programs (UNEP, 1992). In this research land use/land cover changes in Eldama Ravine catchment were assessed. Specific research objectives were; to determine the best method for image classification, to map land use and land cover types, to identify land use and land cover changes in 1975, 1986 and 2005 and to quantify the rates of land use land cover changes in Eldama Ravine catchment in 1975, 1986 and 2005. It involved use of GIS (three Landsat images) of 1975, 1986 and 2005. The study area is a sub-catchment of the Mau complex which also acts as source of other rivers as described by Republic of Kenya (2002). For the study, both primary and secondary data were used, analysed quantitatively and qualitatively and presented in terms of graphs, maps and tables. Field visits were also done before, during and after data analysis for advanced findings. Data preparation, analysis and presentation were done using GIS Software; Research Systems ENVI 3.5, CartaLinx, Idrisi 32 release 2 and ArcView GIS Version 3.3. The main landcover changes that have been observed within the study area from 1975 to 2005 include the loss of riverine vegetation, and an expansion of small scale agriculture and the rapid expansion of built-up area. There was a 23.39% natural forest decrease between 1975 and 1986 and a 5.56% decrease between 1986 and 2005 according to maximum likelihood supervised classification. Agriculture reduced by 5.56% between 1975 and 1986 perhaps due to shift from large scale agriculture to small scale types. Between 1986 and 2005, there was an increase in agriculture activities by 14.44%. The man forces were thought to be the rapid population and the changes in agricultural policies. These changes have caused tremendous stress on the forests, water quality and quantity and land. The study recommends that: policies should be developed to control natural and artificial resource possession and use and to promote natural resource conservation and management initiatives. This can be integrated with community based and participatory approaches. There is need to have a reliable database and a good system for updating it by the local authority. This would ensure that environmental problems are noted, examined and planned for.

Mapping Eastern Hemlock (*Tsuga Canadensis*) in Southeastern Kentucky using Remote Sensing and a Classification Model

Clark, Josh, Nicole Kong, Songlin Fei, Lynne, Rieske-Kinney, and John Obrycki

Abstract: The Hemlock Woolly Adelgid (HWA), *Adelges tsugae*, has been spreading throughout the eastern United States since its introduction in the 1950s. The resulting damage to eastern hemlock trees (*Tsuga canadensis*) has been devastating. The first observed infestation of hemlock woolly adelgid in the state of Kentucky occurred in late 2006, and state officials and researchers soon focused much attention toward controlling the spread of the insect. In order to make those efforts as productive as possible, a current mapping of eastern hemlock in Kentucky forests needs to be produced. In this project, we mapped eastern hemlock stands in Bell County, KY, which currently has infestations of HWA. Bell County is located in southern Kentucky and shares borders with Tennessee to the south and Virginia to the east. Both Landsat and ASTER satellite images were used to create a masked summer-time image showing areas of evergreen/conifer stands. To overcome radiance variation due to topographic relief, a C correction was applied. The resultant image was then analyzed to delineate eastern hemlocks from other evergreen and coniferous tree species. This was done using the Normalized Difference Vegetation Index (NDVI) and also with a classification workflow model built using ArcGIS. This model takes into account the various abiotic factors (such as moisture, slope, aspect, elevation, and soil type) which define the fundamental niche of eastern hemlock. These techniques produced an acceptably accurate map of current eastern hemlock stands in Bell County, KY.

Landscape Ecological Analysis of an Historic Trail using GIS

Ford, Kyle, David L. Kulhavy, Sarah Richardson, and Daniel R. Unger

Abstract: The Ghosts of Nacogdoches Historic Trail was created and is maintained by the East Texas Areas Council of the Boy Scouts of America. The trail traverses through the many historical areas of the oldest town in Texas. The goals of the analysis of the Ghosts Trail using 6 inch resolution imagery were to: increase the safety of trail users; revise the trail for better flow and inclusion of new sites; and to update both the trail manual and map using GIS. Most of the problematic issues with the trail were solved with GIS. RazonTek six inch resolution imagery tiles were combined into a single mosaic. The current route of the trail and the proposed route were mapped with a Trimble ProXRS GPS unit and changes made to simplify both the route of the trail and to improve safety for users. Using GIS, a new route was designed that increased the safety and reduced backtracking on the trail. Improvement goals for the Ghosts Trail include updating the manual and adding ArcGIS images and corresponding documents. These changes will enhance the use and promote awareness of the trail through both a "fly through" video and posting of images on websites for visitors to the oldest town in Texas.

An Analysis of Burn Severity Patterns Following a North Central Florida Sand Pine Scrub Wilderness Fire

Godwin, David R.

Abstract: The Juniper Prairie Wilderness, a 56 km² United States federally designated wilderness area in north central Florida represents one of the largest and best protected tracts of sand pine scrub in the state. Threatened by development and cleared for agriculture, sand pine scrub exists only in small protected pockets, a diminutive legacy of a once vast landscape. A stand replacement, fire dependent ecosystem, sand pine scrub is maintained through infrequent high severity fires. As a wilderness area, the Juniper Prairie Wilderness (JPW) is subject to federal access and management limitations designed to preserve certain ecological and natural qualities for the benefit of future generations. In August of 2006, a prescribed fire escaped initial prescription and ultimately burned an unprecedented 44 km² across the JPW. This project examines the patterns of burn severity following the August '06 burn. Previous studies in peninsular Florida sand pine scrub burn scar mapping have focused on methods quantifying fire extent, while little work has been done to map burn severities. Sixty field plots were established to collect quantitative burn severity data in the months following the burn. These data will be used to determine the effectiveness of burn severity maps produced from two different remotely sensed sources: a low cost, highly adaptable mosaic of digital images collected from an immediate post-fire aerial survey and a high cost, multi-spectral SPOT 4 satellite scene collected one month following the burn

Investment in Forestry with Consideration for Carbon Credits

Khajuria, Rajendra P.

Abstract: The emergence of carbon trading in international market under Kyoto protocol of United Nations forum on climate change (UNFCCC) is likely to provide new opportunities for investment to forest managers. Under the new emerging scenario, the managers have additional option to choose between harvesting a given stand or preserve it for carbon sequestering. The relevant decision for the investors is to decide which one is financially beneficial for them. The analysis of option values is done using trinomial lattice and binomial lattice techniques for the Geometric Brownian Motion and Mean Reverting processes respectively. For carbon (C) estimation, we use two different models: the Carbon budget model of Canadian forest sector (CBM-CFS3) and the carbon estimation model of Wageningen, Netherlands (CO2Fix). The option values under carbon credits consideration are far higher for both the processes. Forest owners can benefit from the emerging carbon trade. The paper emphasizes the need for estimation of similar non-market forest values and incorporate the same in investment decision making. This will help compensating environment friendly investors and attract more investments in forestry sector thereby encouraging land-use conversions to forestry.

Land Cover Classification and Digital Image Processing at Stephen F. Austin State University

Unger, Daniel

Abstract: Graduate course work concentrating on land cover classification and digital image processing within the Arthur Temple College of Forestry and Agriculture at Stephen F. Austin State University is presented. Product produced from a graduate level two course sequence concentrating on understanding how to create a land cover map followed by an understanding of multidisciplinary digital image processing techniques applied to mapping, monitoring and managing natural resources is presented. Specific map product displayed includes; three land cover maps derived for three distinct geographic regions, an example of contrast and filter enhancement techniques applied to moderate and high spatial resolution digital imagery, map product portraying the application of thermal infrared imagery to delineate thermal characteristics of lakes and forest ecosystem temperature zones, a map displaying the results from a change detection analysis using historical Landsat MSS data with current ETM+ imagery, a map showing high spatial resolution QuickBird Imagery merged with Landsat ETM+ data, maps displaying various topographic map layers derived from DEMs and a map showing the utility of using a DEM to visually analyze topographic map layers in conjunction with viewsheds and flight path imagery.

Assessing the Spatial Accuracy of Applanix Digital Orthophotographs

Weih, Robert C. Jr.

Abstract: During the past decade, Geographic Information Systems (GISs) have become prolific in many disciplines and because of that, it has placed demands on the need for accurate high-resolution digital data, especial digital imagery. Photogrammetry has emerged as one of the most important disciplines employed in the collection of spatially related information for use in GIS databases especial for terrestrial landscapes. This study assessed the horizontal and vertical accuracy of the Applanix Digital Sensor System (DSS™) 301 orthophotographs. The study area was located at the University of Arkansas at Monticello campus and included 950 acres. In order to assess the accuracy of the DSS, 56 Ground Control Points (GCPs) were collected prior to image acquisition using Trimble Surveying grade 4700 Global Positioning Systems (GPS). The 28 stereo aerial photographs used to create the orthorectified mosaic were taken with the DSS™ 301 with approximately a 6-inch pixel spatial resolution. The average horizontal Root Mean Square (RMS) error for the DSS™ mosaic was 0.212 meters using the GPS-aided Inertial Navigation System (INS) and 0.194 meters from the mosaic created using one GCP per photo with the INS. The vertical RMS error was 0.375 meters for the 2-meter DEM created from stereo imagery using only the INS.

The Avenue to Wild Fire Dispatching using GIS

Weih, Robert C. Jr., and James Hartshorn

Abstract: With the use of ArcView 3.3, the Spatial Analysis Laboratory (SAL) in the Arkansas Forest Resource Center (AFRC) at University of Arkansas at Monticello (UAM) created an efficient forest fire dispatch program. This involved developing thousands of lines of Avenue and Visual Basic code. ArcView was used because it doesn't demand the processing power of other GIS packages, and it is easily customizable. It met the needs for dispatching fires. One of the benefits of the program is that the dispatcher does not need to be a GIS expert in order to operate the program. The Fire Program is composed of 15 data layers: county boundaries, section lines, quarter section lines, quadrangle boundaries, county highway maps, airport locations, city boundaries, 1:24,000 digital raster graphics (topographic maps), railroads, one-meter color-infrared aerial photography, airport service areas, landcover type, state boundary, ownership area, and the fire database. When a dispatcher has a fire called in, one of three different ways can locate it: by latitude and longitude, by township, range, and section, or by user point.

Employing a Feature Based Classifier to Develop a High Spatial Resolution Land Cover/Land Use Map for the Buffalo River Sub-Basin

Weih, Robert C. Jr.

Abstract: Landcover classification maps have been derived from satellite imagery for many years and have many applications, including habitat suitability mapping and conservation planning. Typically, digital landcover classification data-layers have a spatial resolution of 30 meters and a minimum mapping unit (mmu) of 100 hectares (ha). An example of such a data set is the Arkansas-GAP Landcover/Landuse classification. Some management/research applications, however, require highly accurate landcover data-layers with high spatial resolutions and small mmu. The Landcover/Landuse Classification (LLC) was developed for an 11-county region in north-central Arkansas for the Buffalo River sub-basin. The base data for our LLC was color-infrared aerial photographs taken from 2000-2002. The LLC consists of six classes: Water, Roads, Urban, Agriculture/Pasture, Conifer, and Oak/Hickory. More than 500,000 features (polygons) represent the six classes in the LLC study area. The spatial resolution of the color-infrared aerial photographs is one meter. The mmu for the study is 0.8094 ha (2-acres). The classification was conducted using Feature Analyst®, Imagine®, and ArcGIS® software. Feature Analyst® employs hierarchical machine-learning techniques to extract the feature class information from the imagery using both spectral and contextual classifiers. The process involves both automated and manual interpretation.

Shade Tree Evaluation in City Parks using GIS

Wu, Di, I-Kuai Hung, David L. Kulhavy, and Daniel Unger

Abstract: Shade trees are appraised to evaluate forest health. Our study evaluated shade tree health and value in city parks in Nacogdoches, Nacogdoches County, Texas. Data collected included diameter at 1.4 m, species, species class and condition based on trunk, growth, structure, insects and disease, life expectancy and location. Replacement value of each tree was calculated. Biodiversity, species richness, Shannon-Weiner Function and species evenness were calculated. Replacement value, density, age structure and diameter distribution were depicted. Results indicate an urban forest low in species diversity and species richness. Future maintenance and replacement are needed based on the results.