6th Southern Forestry and Natural Resources GIS Conference

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Oral Presentation Abstracts (listed alphabetically by first author)

Status of GPS Research at the Whitehall GPS Test Course
Bettinger, Pete

Abstract: In 2004 a GPS test course was installed on the University of Georgia Whitehall forest. Twenty-four monuments (points), located in a predominantly hardwood stand, were surveyed to about 1.3 cm accuracy. The test course is open to the public, and has been used for at least four research studies aimed at determining the quality of GPS data collected with different receiver and antenna configurations, collected at different times of the year, and collected in different physical environments. In addition, one study was designed to delineate the effect of multipath by using a choke-ring antenna designed to filter out spurious signals. This presentation summarizes the studies that have been conducted thus far on the test site, and presents a plan for the future that involves teaching, research, and outreach activities.
Session: *Concurrent Sessions – Forest Management II – Tuesday, 3/25/08, 1:15 PM*

Estimating Forest Volume using LIDAR Data and Multispectral Imagery
Brooks, Richard, Daniel Unger, I-Kuai Hung, and Hans Williams

Abstract: Estimating timber volume from a field perspective, with field plots occasionally falling within remote and inaccessible areas, can be a costly and timely endeavor. Remote sensing, with its ability to record information at both the local and regional scale, offers an alternative to traditional field based measurements. Studies have shown that vegetation biomass indices (e.g. NDVI) derived from mid-spatial resolution digital imagery (e.g. Landsat TM, 30-meters), after being corrected for atmospheric effects, topographical

differences and shadow, were highly correlated with timber volume. With the recent advent of high spatial resolution digital imagery from the IKONOS and QuickBird satellites providing more textural information about a forest canopy, with spatial resolutions of 4 meters and 2.44 meters for multispectral data respectively, the opportunity to assess forest volume from a distance has increased. LIDAR (light detection and ranging) is a relatively new remote sensing technology that can accurately estimate the 3-dimensional structure of forest vegetation which is related to forest volume. This project analyzed the utility of using LIDAR data either as a stand alone commodity, or combined with current high resolution satellite imagery and/or existing vegetation indices, to ascertain the utility of estimating forest volume at Barksdale Air Force Base in Bossier City, Louisiana based on remotely sensed data in lieu of field plots. Results will be presented comparing forest volume estimates using LIDAR data independently and in conjunction with high spatial resolution multispectral data.
Session: *Concurrent Sessions – Forest Inventory – Tuesday, 3/25/08, 9:30 AM*

The Simulation of SPB Spot Growth
Chou, Chiao-Ying, Roy L. Hedden, Bo Song, Tom M. Williams, Kier D. Klepzig, Danny C. Lee, and Carl C. Trettin

Abstract: There are so many models of estimating the stand susceptibility, probability of both infestation and spot growth for the Southern Pine Beetle (SPB), and these models can be predicted sufficiently well to enable management on least cost analysis. However, all of them were limited in the regression and mechanic models themselves, we developed a program to simulate the SPB spot growth into a GIS-based model based on the developed models of SPB spot growth and used the ArcGIS software package. This model of SPB spot growth was developed based on the data of 62 East Texas infestations during the summers of 1975 and 1977. The spot spread probabilities for the loblolly pine plantation were mapped with different SPB management alternatives. Moreover, GIS maps of possible infestations were used as the basis of 3-D visualizations to provide landscape perspectives and full motion movies of selected routes. The simulation result showed that under various silviculture treatments of SPB management, including thinning, species mixture, and different ages of stands, there are significant differences between the before and after treatments. In the future, simulations of SPB infestation will include factors, such as differences in season, initial spot size, and the physical characteristics of the site (topography and soils). The spot initiation and growth data will be combined with ArcGIS and VNS to develop an integrated program to visualize the SPB damage under various sites and stand conditions.
Session: *Concurrent Sessions – Species Composition and Distribution I – Wednesday, 3/26/08, 9:30 AM*

GPS Workshops for Landowners in Mississippi: Acceptance and Lessons Learned
DeLoach, Walter M. III and Adam S. Bailey

Abstract: Recognizing the increasing availability of lower cost GPS receivers and the increased use of GPS across clientele groups, the Extension Forestry Department at Mississippi State University developed an Introduction to GPS workshop. Since 2004, approximately 20 workshops have been conducted across Mississippi with a target audience of nonindustrial private landowners. The focus of this one day workshop is a basic overview of GPS operation, uses of GPS navigation, and basic field operations of a GPS receiver. The course consists of two sections, first a classroom lecture to introduce the topics, followed by a practical field exercise to reinforce the knowledge gained in the classroom. We will examine the effectiveness of this workshop using program evaluations from 2004 – 2007 to determine the knowledge transferred in these workshops. Lessons learned, suggestions for adapting the present workshop, and suggestions for more detailed workshops will also be discussed.
Session: *Concurrent Sessions – Forest Extension and Education II – Wednesday, 3/26/08, 11:15 AM*

Landscape Scale Assessment of Red-Cockaded Woodpecker Habitat in Apalachicola National Forest using Feature Analyst
Jason Drake

Abstract: A landscape scale assessment was conducted to summarize the existing conditions and management opportunities and needs on an 85,000 acre area identified as the Core Red-Cockaded Woodpecker (RCW) Area on the Wakulla Ranger District of the Apalachicola National Forest. A major part of this process involved using high resolution aerial imagery to characterize the current conditions of forest ecosystems in the Core RCW area, particularly with a focus on their suitability for RCW habitat. Field data was collected in the spring and summer of 2006 and used along with guidelines from the RCW Recovery Plan to form three classes of training data (high, medium and low quality habitat). 2004 Digital Ortho Quarter Quad (DOQQ) aerial imagery (1 m) was color-balanced and histogram-matched. The training data sets were then used in Feature Analyst (an extension for ArcGIS that uses an "automated feature extraction" techniques) to identify other similar areas over the landscape. A foveal algorithm with a search window of 27 pixels yielded the best results when compared to a validation data set. A limited field verification exercise was conducted and demonstrated that these techniques correctly identified nearly 90% of the stands visited. These results were used along with other GIS information to provide accurate and timely information to inform land resource management decisions on this landscape.
Session: *Concurrent Sessions – Remote Sensing and Image Analysis II – Wednesday, 3/26/08, 10:15 AM*

An Enterprise GIS Approach to Forest Stewardship Planning on Private Land
Eredics, Peter, Tim Clark, and Dale Loberger

Abstract: The US Forest Service is the sponsor of a project aimed at providing forest stewardship planning support and activity tracking for State Forestry organizations through a web based interface. In addition, state wide analysis projects have been completed by most states to identify priority stewardship planning areas through the use of a GIS model. The results of the spatial analysis and the need for standardized stewardship plans and upward reporting of accomplishments lead the development of a comprehensive Web based GIS solution. A companion desktop application was also developed to support forest stewardship plan writing capabilities for organizations who have limited or no high speed access to the internet. ESRI will present and demonstrate the highlights of the development that is based on the use of ArcGIS server technology.
Session: *Concurrent Sessions – Aquatics / Management – Tuesday, 3/25/08, 2:15 PM*

LiDAR in Natural Resource Assessments
Evans, David

Abstract: Presentation was invited by the planning committee. No abstract at this time.
Session: *Keynote Speaker Session – Tuesday, 3/25/08, 8:10 AM*

Ability of Golf Courses to Provide Landscape Connectivity in Western North Carolina
Extine, Jennifer L., Laura E. DeWald, and Ronald W. Davis

Abstract: Forest fragmentation in the southeast is a major contributor to the loss of habitat for native species including interior forest songbirds. Golf courses are multiple use landscapes often containing large blocks of forested habitat which could provide connectivity across fragmented landscapes if interior forest conditions can be maintained in patches. This study evaluated 14 golf courses in western North Carolina to assess their potential to provide habitat connectivity. GIS was used to identify forested patches for sampling. Presence/absence of interior-forest birds was used as an indicator to of potential connectivity. Vegetation in golf course patches was classified by seral stage and structure and mapped to analyze vegetation patterns. The landscape analysis program Fragstats was used to analyze various patch metrics including: edge to interior ratio, shape, and proximity to adjacent forest. Data analyses showed a negative relationship ($p=0.0039$) between the amount of edge and presence of interior-forest birds. No statistically significant

relationship between presence of interior forest birds and area (p=0.0847) or edge to interior ratio (p=0.1064) was found. The relationship of patch characteristics to interior-forest bird distribution, and the variation in patch characteristics among golf courses will be discussed. This study illustrates how spatial analysis can be used to evaluate the potential of natural features on golf courses to provide landscape connectivity. Designers can use this information to strategically arrange forest patch composition and structure to provide potential connectivity across fragmented landscapes through new and existing golf courses.
Session: *Concurrent Sessions – Landscape Ecology and Land Use Analysis – Tuesday, 3/25/08, 3:30 PM*

Predicting Species Composition in an Eastern Hardwood Forest with the Use of Digitally Derived Terrain Variables within a GIS
Flanigan, Richard D., Michael Strager, and John Brooks

Abstract: This paper addresses the need for improved classification of remotely sensed imagery in the complex hardwood forests of West Virginia. A geographic information system (GIS) was used in conjunction with forest- plot data to develop a model to predict species composition in the eastern hardwood forest of West Virginia. The study area was located on the West Virginia University Research Forest (WVURF) in northern West Virginia. Terrain variables such as aspect, relative moisture index and slope change drastically at fine scale within the forest to greatly influence species composition. Light Detection and Ranging (LiDAR) data was collected for the entire WVURF, which produced an extremely detailed digital elevation model (DEM), with 1 m spatial resolution. Individual tree crown polygons were created from the LiDAR data so that individual trees could be coregistered to the DEM eliminating the bias of misplaced inventory points. Forest-plot data was collected and each individual tree crown polygon that was created from the LiDAR was assigned actual ground data. Terrain variable values were then sampled for each plot. The data was then analyzed using a classification and regression tree (CART) to produce a binomial decision tree that can be used within a GIS to create a prediction grid of species distribution based on terrain variables. With the decreasing price of data acquisition and with new technology this method will become more widespread and useful to various management agencies.
Session: *Concurrent Sessions – Species Composition and Distribution I – Wednesday, 3/26/08, 9:00 AM*

Precision Silviculture in the 21st Century: Linking GIS and Remote Sensing to Develop Site Specific Silvicultural Regimes in Southern Pine Plantations
Fox, Thomas R., Lee Allen, Randolph H. Wynne, and Christine E. Blinn

Abstract: Precision forestry systems are being developed for pine plantations in the Southern United States by the Forest Nutrition Cooperative to improve the sustainability, productivity and profitability of forest management. Precision silviculture requires foresters to develop site specific prescriptions for different portions of individual stands. This presentation will illustrate the applications of GIS and GPS technology using data on soils and stands, including remotely sensed data, to develop and implement precision silvicultural practices in the southern United States. This presentation will also detail the work that has been done to develop the fundamental links between soils, geology, climate and species needed to make precision silviculture a reality. In this approach, climatic conditions (solar radiation, temperature, rainfall) are used along with species specific ecophysiological parameters (photosynthesis, respiration, carbon allocation) to produce spatially explicit, site specific estimates of forest productivity based on detailed land classification systems that integrate geology, topography and soils data. Leaf area estimates obtained from Landsat satellite imagery are input into 3PG, an ecophysiological based process model of forest growth, to predict potential productivity, identify the climatic and soil factors that limit growth and determine the potential response to silvicultural treatments designed to ameliorate these limiting factors. The information is integrated and interpreted using GIS. The work that has been done to develop and test this approach with Pinus taeda in the southern United States will be illustrated.
Session: *Concurrent Sessions – Forest Management I – Tuesday, 3/25/08, 11:15 AM*

Effective Use of Technology to Achieve a Breakthrough in Inventory Accuracy, Precision, and Silvicultural Data
Fulton, George R. and Mark Redlus

Abstract: Using patented software, ImageTree is able to extract key inventory metrics from remote images with a level of accuracy and precision much greater than available through normal, plot-based, labor-intensive forest inventory techniques. After making improvements on the technology for over four years, ImageTree has combined the use of LiDAR and CIR to produce a co-registered, three-dimensional image of every tree crown in the forest which usually represents 80% of all trees. Using minimal ground correlation plots, which observe a true random sampling design, its patented software provides stand-level data for height, DBH, grade, number of trees, volume, etc. The resulting data has a demonstrated accuracy and precision significantly greater than traditional methods. This architectural platform -- a stand-level spatial map of every visible tree crown within the entire forest -- is combined with high resolution imagery during the next four years to show which visible tree crowns have been removed by thinning, harvest, theft, or by natural disaster. This change management platform can also show trends in forest health on a stand by stand basis by using standard vegetative indices. Thus, not only is the quality of the inventory data much more robust, it provides a tool for allowing the forester to be more proactive in forestry management.
Session: *Concurrent Sessions – Forest Inventory – Tuesday, 3/25/08, 9:00 AM*

Changes in mixed deciduous forest from residential development drive native forest bird species to higher elevations
Hepinstall, Jeff

Abstract: Abstract: Predicting future landscape change is essential to informing natural resource management and conservation methods. We applied landscape ecological concepts in developing models of landscape change that link models of urban development, land cover change, and bird species richness to explore potential futures for the Seattle, USA, metropolitan region - a region undergoing rapid urbanization. We combined output from an economic development model (UrbanSim) and measures of composition and spatial pattern of development, land cover, and biophysical elements to develop land cover change models that predict landscape change 25 years into the future. Predicted land cover and land use provide input for predictive models of bird diversity derived from five years of field surveys across the urban gradient. Predictions of future bird diversity indicate that loss of forests in the suburban fringes will negatively affect native forest bird species and push these species to remaining habitats at higher elevations. Development of agricultural lands will negatively affect early successional species. Both landscape changes privilege already abundant synanthropic species. A single landscape composition and configuration objective will not meet the needs of the breadth of species in peril from urbanization. Maintaining habitat for the diverse suite of species found in the region will require planners and policy makers to develop multi-objective landscape plans.
Session: *Concurrent Sessions – Forest Management II – Tuesday, 3/25/08, 1:45 PM*

An Assessment of Geographic Information Technologies in Forest Fire Suppression – an Empirical Analysis
Iqbal, Javed and Hayley Hesseln

Abstract: We assess the efficiency and effectiveness of geospatial tools as they are used for wildfire suppression in Saskatchewan. Specifically, we aim to provide a functional review by identifying and categorizing GIS and remote sensing applications. Our results show that geospatial technology as reflected by map provision has a significant effect on final fire size and total suppression cost although not damage. When a map is provided, fire size is on average 9,989 ha less than for when a map is not provided. Helicopter and aircraft costs are positively related to final fire size. When these terms are interacted with map provision (yes or no), results indicate that costs are negatively related with fire size. This suggests that maps enable fire managers to more efficient allocate resources to reduce total costs. On average, when maps are provided, total suppression costs are $534,000 lower. Also, affecting total suppression costs are distance to fire tower (negatively related) and distance to tanker base (positively related). While the relationship between distance to tanker base and cost is intuitive (increased distance is associated with increased cost), the

distance from an observation tower is not.
Session: *Concurrent Sessions – Forest Management I – Tuesday, 3/25/08, 11:45 AM*

Investigating Domestic Cattle Habitat Selection on South Florida Rangelands
Jobes, Douglas, James A. Martin, Brandee Williams, Ken Lackman, and John P. Carroll

Abstract: We studied resource selection by enclosed domestic cattle (*Bos taurus*) on a private ranch in southern Florida. Little information is available regarding how cattle select and utilize native grazing lands in the southeastern US; knowing how cattle may affect landscapes that are occupied by certain wildlife species is an important concern. During the years 2005 and 2006 cattle locations were collected via a GPS collar, programmed to send position coordinates every twenty minutes from the host cow. Cattle were able to move freely throughout all habitat types of the 2500 ha study area. Positions were then overlaid onto a land cover map in a Geographic Information System (GIS) in order to spatially join locations to the specific habitat types. Other information was incorporated into the GIS such as locations of fences, supplemental feeding stations, and roads. GPS positions that did not meet the pre-defined criteria for accuracy were censored from the data set. Treatments of pasture management were implemented (e.g. roller chopping and prescribed fire) to sustain early successional vegetation conducive to grazing. Cattle utilization relative to these treatments was also evaluated. We hypothesize cattle resource selection will not be random and will change depending on time of year as forage becomes available. Determining resource selection by cattle will allow ranchers to implement management practices that will decrease potential impacts of livestock on ranchlands and increase habitat for certain wildlife species.
Session: *Concurrent Sessions – Wildlife Habitat Analysis and Assessment II – Tuesday, 3/25/08, 10:45 AM*

Application of GIS Model in Evaluating the Red-Cockaded Woodpecker Habitat at Hobcaw Barony
Kale, Atul, Tom M. Williams, Bo Song, Ralph Costa, and Donald J. Lipscomb

Abstract: The red-cockaded woodpecker (*Picoides borealis*) is a listed endangered species endemic in the southern eastern United States. It is cooperatively breeding species preferred to live in an open, mature and old growth pine ecosystem. The restoration and management of red-cockaded woodpecker habitat is a difficult task within both public and private land. The forest management practice may have adverse effect on nesting and foraging habitat. To delist the red-cockaded woodpecker from the endangered species list, the US Fish and Wildlife Service developed the foraging matrix system in the recovery plan. It leads the development of foraging index or score to classify the habitat based on its condition. The foraging matrix standards contain the twelve habitat criteria on the stand level and four habitat criteria on the partition level. These criteria are based on stand characteristics, canopy cover, stand age and prescribed burning. The RCW Foraging Matrix Application (FAP) is the result of the automation of forage matrix in GIS and become valuable tool to evaluate the impact of various forest management practices on RCW habitat. In this study, the GIS foraging matrix application were evaluated using the data from the forest inventory of more than 20 years (1989-2007) at Hobcaw Barony, and the results showed that the criteria of scoring system and the GIS model need critical improvement.
Session: *Concurrent Sessions – Wildlife Habitat Analysis and Assessment I – Tuesday, 3/25/08, 10:00 AM*

Mapping Hemlock Forests using Remotely Sensed Imagery and Environmental Factors in Harlan County, Eastern Kentucky
Kong, Nicole, Songlin Fei, Lynne Rieske-Kinney, and John Obrycki

Abstract: The dispersal of hemlock woolly adelgid (HWA) brings great threats to eliminate eastern hemlock, one of a long-lived, important tree species in the eastern Kentucky forests. The first HWA infestation site in Kentucky was discovered in the spring of 2006. To understand the effects of forest change on HWA spread and model HWA dispersal, we need the basic information of hemlock distribution in eastern Kentucky. However, the large survey area and spectral similarity between hemlock and other coniferous forests bring challenges in hemlock mapping. In this study, we classified hemlock forests based on combined information of medium-resolution multi-spectral satellite imagery (ASTER and Landsat) and environmental factors

derived from different geospatial layers, and tested this classification method in part of Harlan County. First, the winter satellite imagery was used to delineate evergreen forest from the landscape. Then, a supervised classification which integrates both summer remote sensing imagery and related environmental variables such as elevation, slope, landform, soil, and moisture conditions, was applied in the evergreen areas of the study site to identify hemlock stands. The result map was assessed with field observation points where hemlocks were observed and there are about 80% of the points falling into the classification range from this study. The classification model generated in this study also indicates that elevation, infrared and visible bands of satellite imagery, moisture index and distance to streams are key factors in searching for hemlock stands in the specific area.
Session: *Concurrent Sessions – Remote Sensing and Image Analysis I – Tuesday, 3/25/08, 4:00 PM*

Landscape Based Indicators for Nonpoint Source Water Pollution Watershed Categorization
Lee, Brian D. and Collin Linebach

Abstract: Environmental planning and management based on watershed boundaries rather than political boundaries is increasingly advocated to address nonpoint source water pollution. In support of this idea, effective watershed assessment processes are needed that classify watersheds according to ecological landscape scale characteristics. This presentation explores the opportunities and constraints of a descriptive pilot assessment approach for classifying watersheds in the Lexington-Fayette County, Kentucky region. Using a semi-automated process through Modelbuilder of ArcGIS and publicly available data, a dozen landscape indicators are comparatively assessed by Hydrologic Unit Code (HUC) 14 watersheds. Variables include proportion and spatial configuration measures of human population, imperviousness, and agriculture/forest cover characteristics. To understand relative condition better, watersheds are ranked by the values for each indicator, from highest to lowest, and then divided into five groups (quintile). Thus, watersheds can be visualized geographically with a color ramp indicating conditions for each indicator. A quantitative matrix allows for comparisons by indicator across the study area. The analysis provides a guide to relative watershed health both in relation to a specific indicator and amongst all twelve indicators. This enables indicator recombination as needed for particular issues under consideration by planners, policy makers and interested stakeholders for more informed watershed scale land use decision-making.
Session: *Concurrent Sessions – Aquatics / Management – Tuesday, 3/25/08, 1:45 PM*

GIS Contribution to Red-Cockaded Woodpecker Habitat Management: Benefits and Remaining Problems
Lipscomb, Donald J., Atul Kale, and Thomas M. Williams

Abstract: The Red-Cockaded Woodpecker (RCW) is the most notable endangered species of the southern pine forest. Habitat destruction and fragmentation are the primary cause of declining populations. In the 1990s, GIS was applied to mapping habitat in relation to the plans for RCW recovery formulated in the 1980s. The program RCW Forage Analysis Tool mapped foraging habitat and calculated tabular data that could be used to evaluate habitat by criteria of the recovery plan. However, computed habitat criteria showed little correlation to indices of woodpecker fitness. In 2003, a new recovery plan was developed and expanded the criteria of good quality foraging habitat. The habitat Matrix program has been developed to evaluate habitat in relation to the new criteria. Scores of habitat for individual RCW partitions (the habitat within 1/2 mile of the cluster center not used by another group) also do not correlate well with nest data. The cause of this poor correlation is found to be the logical idea that more area of good quality habitat is better. The partition score increases with larger area of good habitat. Unfortunately RCW are attracted to good habitat and the area used by each group declines as the habitat improves. In this paper we propose a simple index of RCW habitat quality: habitat area/active cavity tree. We suggest that nesting is highest with a value of 40-50 acres/active tree, decreases above 80 acres/active tree, and groups tend to disappear above 130 acres/active cavity tree.
Session: *Concurrent Sessions – Wildlife Habitat Analysis and Assessment I – Tuesday, 3/25/08, 9:30 AM*

Imputing Forest Inventory Data to Stands Formed by Image Segmentation in Maryland's Green Ridge State Forest
Lister, Andrew

Abstract: Making stand-based forest management decisions is difficult for large landowners because creating, managing, and updating stand maps is expensive and time consuming. Recently, advances in image processing software, particularly in the area of image segmentation, have made this task easier. In the current study, we seek to use eCognition software with a combination of Landsat ETM+ data from circa 2000, other satellite information, and digital elevation model (DEM)-based topographic indices to construct maps of homogeneous landscape elements on the Green Ridge State Forest in Maryland. We then seek to assign these elements (stands) information collected from a set of forest inventory plots collected by the state of Maryland's Department of Natural Resources. The methodology will be presented, as well as an assessment of the results of the stand attribution process.
Session: *Concurrent Sessions – Forest Inventory – Tuesday, 3/25/08, 10:00 AM*

A Novel Approach to Quantifying the Forest Fuelbed using Ground-Based LIDAR
Loudermilk, E. Louise, Abhinav Singhania, Juan C. Fernandez, J. Kevin Hiers, Joseph J. O'Brien, Robert J. Mitchell, Wendell P. Cropper, Jr., and K. Clint Slatton

Abstract: Ground-based LIDAR is a novel remote sensing technique that may be used to precisely quantify fuelbed characteristics that are otherwise difficult to measure and are important drivers of forest fire behavior. We measured vegetative fuel properties found within the pine woodland understory of the southeastern U.S. A mobile terrestrial LIDAR unit was used to collect sub-cm three-dimensional laser data for individual fuel types (shrubs) and heterogeneous fuelbed plots. Spatially explicit point-intercept field fuel sampling was used to determine fuelbed heights and volume, while leaf area and biomass measurements of whole and sectioned shrubs were calculated from destructive sampling. We used a mathematical code to estimate volume from LIDAR data. This was compared to traditional methods, which assume a volumetric geometry (cylinder or spheroid). We found that traditional methods overestimate volume for specific fuel types due to variation in leaf area distribution. Therefore, the assumed geometry of vegetation may be coarse and unreliable for estimating volume, while LIDAR captures all of the plant's structural complexities. LIDAR volume estimates were highly correlated with biomass and leaf area for individual shrubs when factored by species, size, and plant structural section. A variogram analysis illustrated that fuelbed heights were highly variable among the fuelbed plots, and ground LIDAR was more sensitive to height variations than traditional point intercept sampling. Using ground LIDAR is a new and promising approach to obtaining reliable volume estimates of complex surface fuels that can be applied to important fire behavior modeling variables used in forest fire management.
Session: *Concurrent Sessions – Remote Sensing and Image Analysis I – Tuesday, 3/25/08, 3:30 PM*

Influence of GPS Monitoring Frequency on Understanding Large Mammal Behavior
Maehr, David S. and Songlin Fei

Abstract: The degree to which radio telemetry data reflect actual travel pathways of wildlife across complex natural landscapes is a function of the frequency with which location data are collected and the accuracy of the tracking methodologies. Global positioning systems are now widely deployed on wide-ranging species to reveal previously unobtainable detail regarding movements and other behavior. We examined the movements of a subadult male black bear (*Ursus americanus floridanus*) in south central Florida before, during, and after a dispersal event from its apparent natal range. The tracking system attempted a position fix every 20 minutes and the data were transmitted to a base station in Lexington, KY, USA via GSM (Groupe Spécial Mobile) cell phone technology as text messages. We determined that patterns of habitat use were indistinguishable whether the location frequency was 72 times per day or once per day. Movement patterns, however, were severely influenced by the frequency of position fix attempt. Fix attempts that were spaced greater than 40 minutes apart provided inaccurate records of events such as highway crossings and reaction to habitat edges such as the juxtaposition of forest with open agriculture. We examine the influence of monitoring frequency as related to understanding black bear behavior, and make recommendations for

GPS collar programming that supports conservation planning for wide-ranging mammals in development landscapes.
Session: *Concurrent Sessions – Wildlife Habitat Analysis and Assessment I – Tuesday, 3/25/08, 9:00 AM*

Modeling Northern Bobwhite Abundance at a Landscape Level: A Preliminary Analysis
Martin, James A., William E. Palmer, Adam B. Butler, and John P. Carroll

Abstract: Northern bobwhite populations in Florida have declined precipitously over the last 3 decades. Declines have been attributed to landscape level habitat changes; however, few studies have investigated bobwhite abundance at landscape levels, and most have been in retrospective time using USGS Breeding Bird Survey data. During the years 2005-2007, we estimated bobwhite abundance across central Florida on private and public properties using distance sampling techniques. Locations of the sampling points were assigned at random between two predominate land cover types: pastureland and native grassland. Landsat imagery data (2003) were used to delineate land cover types via a supervised classification system. We created multiple *a priori* hypotheses that could explain the variation in bobwhite abundance across several scales. Example variables that may be included in the candidate set of models include: landscape metrics (e.g. patch size and shape), sampling level vegetation characteristics, and management activities (e.g. prescribed fire and cattle grazing). Normal regression or hierarchical regression models will be constructed to model abundance depending on the presence of spatial autocorrelation in the data. We propose that bobwhite abundance is not only affected by local (i.e. patch) level phenomenon but most likely at larger spatial and temporal scales. Therefore, managers and researchers should consider a more landscape ecological approach for bobwhite conservation. Modeling exercises such as this can and will be useful for identifying areas to focus resources for bobwhite conservation.
Session: *Concurrent Sessions – Wildlife Habitat Analysis and Assessment II – Tuesday, 3/25/08, 11:45 AM*

Improving Imperiled Species Management through Spatially Explicit Decision Tools
McAbee, Kevin and Nathan P. Nibbelink

Abstract: Recovery plans for imperiled species have historically been based on untested assumptions, failing to acknowledge ecological uncertainty behind recovery goals and decisions. In order to account for the many sources of uncertainty, imperiled species should be managed under a decision analysis framework. We created such a decision framework for the management of the federally threatened blackside dace (*Phoxinus cumberlandensis*) by describing the anthropogenic and ecological influences in a Bayesian belief network (BBN). The core network describes how measurable environmental variables influence habitat conditions and subsequently affect probability of local population persistence. This network was then attributed using publicly accessible spatial data for 80 local populations to determine probabilities of persistence for each local population. We then linked GIS (ArcGIS) and decision analysis software (Netica), allowing end users to parameterize this network for individual populations and evaluate specific land management decisions. Sensitivity analysis of the network indicates the relative influence of various environmental variables on population persistence, and therefore can give clear direction as to data needs (e.g. variables which require better field knowledge). Our BBN demonstrates that because environmental gradients vary across the landscape, so do the likely effects of different land uses. Furthermore, variation in land ownership and jurisdiction results in suites of likely land management decisions that also vary spatially. Therefore our spatially-explicit decision framework should lead to optimal decision-making across multiple use landscapes.
Session: *Concurrent Sessions – Species Composition and Distribution II – Wednesday, 3/26/08, 10:45 AM*

GPS Technology: A Management Tool for the Small Woodland Owner
McLaren, Doug

Abstract: Geospatial technology has provided unlimited uses for industries throughout the world during the past decade. Natural resources managers have found very positive results when using geospatial technology in the collection, the processing, the evaluating and the finding of solutions to issues faced in the field of

natural resources. The science and the scientists of geospatial technology continue to unveil answers to some of the most complex issues that confront our wise use of our natural resources. Many woodland owners that own only a small number of acres continue to have questions concerning the management of their properties and have a desire to find the answers on their own. The challenge that has been discovered by the Cooperative Extension Service in Kentucky is that these landowners have the desire to learn about geospatial technologies but do not have the time needed to learn the sophisticated programs nor feel that the expense of learning or purchasing software and hardware is reasonable for the results desired. The attempt at the University of Kentucky's Department of Forestry, through Cooperative Extension, is to provide the woodland owner, with some meaningful level of accomplishment and a means to learn more about geospatial technologies at a much reduced learning curve and a much reduced cost of hardware and software. The University of Kentucky's Department of Forestry has developed a program referred to as One Acre at a Time. The program is provided to the woodland owner who has little or no prior experience of geospatial technologies. These individuals are shown that they are able to accomplish, in a short period of time, how to determine boundaries, acreage, locate existing and future road systems on their properties, and how to delineate forest stand boundaries. The One Acre at a Time has proven successful for the first time user of geospatial technology and also meets the needs of their woodland management objectives.
Session: *Concurrent Sessions – Forest Extension and Education I – Wednesday, 3/26/08, 9:30 AM*

Surveys of GIS Usage and Needs among Natural Resource Managers, Extension Agents, and Land Use Planners
Merry, Krista and Pete Bettinger

Abstract: Over the last year, three separate surveys have been conducted by the University of Georgia to determine the usage and needs of geographic information systems (GIS) by natural resource professionals. The first two studies were conducted to determine the needs of extension agents and land use planners as they relate to landscape visualization and change. These studies included some questions regarding the availability and use of GIS in the extension and planning process. The third study concentrated on determining the extent of use of GIS by natural resource professionals who had recently graduated college. A synthesis of these results is provided. An discussion of anecdotal information related to various phases of the surveys will also be provided, and includes information obtained by the researchers that has not previously presented in the literature. Challenges and opportunities related to the latter observation are numerous. Results suggest that geospatial analysis is needed in today's management, planning, and outreach environment, yet the ability to fully utilize the capabilities of geographic information systems may be limited.
Session: *Concurrent Sessions – Forest Extension and Education I – Wednesday, 3/26/08, 9:00 AM*

Element Distribution Modeling Tools (EDM Tools): A Custom ArcGIS Toolbar to Facilitate Robust Species Distribution Modeling
Nibbelink, Nathan P., Douglas A. Keinath, Gary Beauvais, Andy Cutko, Xingzhi Luo, and Samir Tartir

Abstract: Element distribution modeling (EDM), also called species distribution modeling and species-habitat modeling, is a powerful way to extrapolate spatially-explicit observations to broad-scale predictions of species distribution (predictive maps). Because predictions are mapped, they are directly applicable to environmental evaluation and land management decision-making. Current EDM approaches require substantial time and technical expertise to implement, and there are a growing number of software tools and algorithms being used (some requiring custom programming). However, many management decisions have to be made quickly by biologists with modest access to complex technologies or training. Our goal was to make EDM accessible to natural resource biologists without an expertise in statistics, GIS, and often complex modeling applications. The EDM Tools are organized around an ArcGIS toolbar mimicking the workflow common to distribution modeling including data preparation, data filtering, model choice and implementation, model evaluation and predictive mapping. We have created new tools and taken advantage of existing tools, implementing them from one workflow, making them accessible, user friendly, and properly applied to specific goals of species distribution modeling. The EDM tools are open-source tools with the only commercial software requirement being ArcGIS Desktop and the Spatial Analyst Extension (ESRI, Redlands,

CA). By sharing our code and using free software as feasible, we hope to encourage advanced users to both contribute improvements to and borrow code as needed for other applications. We hope the EDM Tools help to make spatially-explicit modeling a regular, widespread, and efficiently-conducted part of natural resource evaluation and land management planning.
Session: *Concurrent Sessions – Species Composition and Distribution II – Wednesday, 3/26/08, 10:15 AM*

How Certain are You of Your Geographic Information?: Blunders and Breakthroughs in Accuracy Assessment
Pontius, Robert Gilmore Jr.

Abstract: Presentation was invited by the planning committee. No abstract at this time.
Session: *Keynote Speaker – Wednesday, 3/26/08, 8:00 AM*

A Comparison of Pixel-Based and Object-Oriented Image Classification Techniques for Forest Cover Type Determination in East Texas
Raines, Jason, I-Kuai Hung, and James Kroll

Abstract: The forests of east Texas are an extremely valuable natural resource to the economy and the environment of the area. The ability to qualify and quantify this resource through remote sensing techniques has been used as a timely, cost-efficient manner to assist resource managers and policy-makers in planning and decision making. Improved image classification techniques would reduce costs and timelines of resource inventory and analysis as well as increasing the accuracy of cover type maps produced from medium resolution imagery such as Landsat and SPOT. Object-oriented image classification techniques take advantage of the spatial autocorrelation innately present in remotely sensed data, while pixel-based classifiers focus solely on the spectral signature of each pixel. In this study, leaf-off Landsat TM data was used to classify land cover in east Texas into four classes, pine forest, hardwood forest, mixed pine-hardwood forest and non-forest. Object-oriented supervised and unsupervised classification techniques using Feature Analyst™ were compared with traditional supervised and unsupervised pixel-based classification methods using ERDAS Imagine™. Accuracy assessment was conducted through ground truthing to generate error matrices for each method tested. Statistical testing based on each error matrix was performed to determine if one approach is significantly better than another.
Session: *Concurrent Sessions – Remote Sensing and Image Analysis I – Tuesday, 3/25/08, 4:30 PM*

Analysis of New Orleans Landscape Before and After Hurricane Katrina Utilizing Radarsat-1 Synthetic Aperture Radar (SAR) Data
Sartor, Kenneth, Gnana Bhaskar Tenali, Josef Allen, and Samuel Kozaitis

Abstract: Recently, Canadian Space Agency (CSA), in corporation with NASA and USGS, released an International AO for researching innovative approaches to the exploitation of RADARSAT-1 data for subsidence measurement. Using differential Interferometric SAR (IFSAR) techniques, it was discovered that this data was able to accurately measure landscape changes of the New Orleans area before and after Hurricane Katrina. Our team was one of those chosen by CSA from the international pool of applicants to process the data. In this talk, we will give an overview of IFSAR processing and then discuss the results of our analysis of the data.
Session: *Concurrent Sessions – Remote Sensing and Image Analysis II – Wednesday, 3/26/08, 11:15 AM*

Prediction of Leaf Area Index for Southern Pine Plantations from Satellite Imagery using Regression and Artificial Neural Networks
Shoemaker, Douglas A. and Wendell P. Cropper, Jr.

Abstract: Leaf Area Index (LAI) is an important predictor of southern pine forest productivity. In this study several models for estimating LAI values using remote sensing were developed and tested. Of these, a best

model was selected based on performance and potential for operational application. The generalized southern pine LAI predictive model (GSP-LAI) was developed using artificial neural network (ANN) multivariate regression that incorporated important local information including phenological and climatic data. In validation tests the model explained > 75% of variance (R^2 = 0.77) with an RMSE < 0.50. The GSP-LAI model was applied to Landsat ETM+ image of the Bradford forest, north of Waldo, FL. Within the extent are substantial slash (*Pinus elliottii*) and loblolly (*P. taeda*) pine plantations. Based on image and stand data LAI values for 10,797 ha were estimated to range between 0 and 3.93 m^2 m^{-2} with a mean of 1.53 m^2 m^{-2}.
Session: *Concurrent Sessions – Remote Sensing and Image Analysis II – Wednesday, 3/26/08, 10:45 AM*

Trinity River Information Management System: A Stakeholder Driven Resource Management Tool
Snelgrove, Amy and Amy Hays

Abstract: The Trinity River and its tributaries drain an area of over 11.5 million acres in Texas. The Trinity River watershed is highly urbanized within the northern half of the watershed dominated by the Dallas-Fort worth metroplex. Even with this, there are over 32,000 private farms and ranches that cover 75% of the Trinity River Basin. Management of the natural resources in these rural areas is critical to the overall health of the river basin, thus improving the quality of life, economic sustainability, and ecological integrity of the Trinity River basin. Stakeholders in rural areas often have limited access to geographic information systems (GIS) and geospatial information. The Trinity River Information Management System (TRIMS) was developed to address the need of local stakeholders to easily access and use geospatial data for making land use decisions in the Trinity River Basin. TRIMS is an internet based mapping application using the latest in ArcGIS Server technology from ESRI. It is designed as a planning and outreach tool to be used by stakeholders for supporting land management, conservation, and habitat restoration decisions in the basin.
Session: *Concurrent Sessions – Forest Management II – Tuesday, 3/25/08, 2:45 PM*

Visualization of Forest Landscape Dynamics of Different Scales
Song, Bo and Xianli Wang

Abstract: Visualization of forest dynamics at scales from within-stand to landscape level addresses different features of the landscape. This paper introduced methods of visualization of forest dynamics from data preparation, ecosystem design to animation creation at different scales. To visualize the stand level forest dynamics, the FVS model was used. Using the FVS model, we calculated tree sizes and stand age, which were then used to estimate tree height and density for 3-D visualization. At landscape level, remote sensing images were used as an additional data source to visualize the landscape dynamics. This study showed that 3-D visualization can realistically generate virtual landscape/forest whereby people can see a virtual landscape/forest grow into the future.
Session: *Concurrent Sessions – Landscape Ecology and Land Use Analysis – Tuesday, 3/25/08, 4:00 PM*

Spatial analysis of woody biomass for bioenergy production in the Missouri Ozarks
Stelzer, H.E, and C. Barnett

Abstract: Before regional economic and environmental benefits from the combination of renewable energy production and sustainable forest management can be assessed, one must first be able to spatially determine how much woody biomass is located where and its potential availability. We have developed a simple interactive tool for reporting woody biomass availability in the Missouri Ozarks. First, we extracted all live biomass data for pure upland hardwood stands on privately-owned timberland and on Mark Twain National Forest compartments being managed for timber products from the US Forest Service's Forest Inventory and Analysis (FIA) database across a 44-county region in southern Missouri. We then applied a conservative, even-age thinning algorithm that also accounted for a portion of these thinnings going to higher-value wood products. The total biomass yield from these thinnings was then divided by the total number of forested acres within the area queried to produce an average biomass yield per acre. This yield was then applied across the landscape based upon deciduous forest cover data from the Missouri Resource Assessment Partnership (MoRAP). The resolution was a 30m square pixel, but converted into the more

familiar square mile unit of area. Integrating this data layer with other natural resource and demographic data layers within ArcMap allows the user to generate a comprehensive biomass availability report in order to assess whether or not a designated source area could sustainably support a wood-to-energy enterprise. Future iterations of this tool will incorporate additional cover types and silvicultural prescriptions.
Session: *Concurrent Sessions – Aquatics / Management – Tuesday, 3/25/08, 2:45 PM*

Rapid Methods for Estimating and Monitoring Tree Cover Change in Florida Urban Forests; the Role of Hurricanes and Urbanization
Szantsoi, Zoltan, Francisco Escobedo, and Cynnamon Dobbs

Abstract: Florida is experiencing tremendous rates of urbanization. In addition recent and past hurricanes have greatly affected tree cover and perceptions towards trees in cities. This has resulted in a loss of tree cover in Florida's urban ecosystems. Trees in and around urban areas can provide a wide range of ecosystem services. The goal of this assessment was to evaluate rapid methods to quantify, analyze, and monitor spatiotemporal urban tree cover change in 2 Florida urban forests; Gainesville and Miami-Fort Lauderdale from 1984 to 2004 and 2004 to 2005. Simple, accessible, and inexpensive Geographical Information System (GIS) methods that quantify, assess and monitor tree cover change were evaluated. We used ARCGIS, digital orthophotoquads, photo-interpretation, "heads up digitizing", and field verification to evaluate several methods. One method used systematic, random photo-interpretation points overlaid onto the study areas. Another method used random 1/10 acre photo interpretation plots where tree cover was digitized and subsequently quantified using ocular estimates. Photo points, plot covers, and ocular estimates were categorized into six surface cover classes: tree-shrub, building, pervious, impervious, palm, and water. Tree cover will be field verified this winter. Tree cover was substantially reduced in Miami-Dade and remained relatively constant in Ft Lauderdale. Tree cover is recently decreasing in Gainesville. Methods were compared and the role of socioeconomics, biophysical variables, and hurricanes in determining tree cover were explored. This method will provide a rapid and cost-effective method to analyze spatio-temporal tree cover change and as permanent hurricane effects-urbanization monitoring sites.
Session: *Concurrent Sessions – Landscape Ecology and Land Use Analysis – Tuesday, 3/25/08, 4:30 PM*

Landscape Conservation of a Recolonizing Black Bear Population in Southeastern Kentucky
Unger, David, Songlin Fei, and David S. Maehr

Abstract: Identifying available habitat and assessing its connectivity are important for the conservation of large carnivores. Habitat suitability and connectivity across the Eastern Physiographic Province of Kentucky was investigated for a recolonizing black bear population. Due to the expanding nature of this population, presence only techniques were selected over standard presence/absence or use/available methodologies. Suitable habitat was found to contain high forest frequency, large patches, and occurred away from major roads. Ecological Niche Factor Analysis identified 8,522 km^2 of available suitable habitat. Ten-fold cross validation indicated good predictive ability of the habitat model ($P<0.025$). This represents enough habitat for Kentucky to support a viable, self sustaining black bear population. Major roads and resource extraction were the primary causes of fragmentation. Despite this, Least-Cost Path and Zonal Corridor Analysis suggest that the habitat in southeastern Kentucky is well connected and contains landscape linkages able to support both dispersal and expansion of the current population. The methods utilized represent important conservation tools for assessing habitat suitability and relative connectivity in circumstances where accurate absence data are lacking.
Session: *Concurrent Sessions – Wildlife Habitat Analysis and Assessment II – Tuesday, 3/25/08, 11:15 AM*

Wildfire Visualization using GIS and Forest Inventory Data
Williams, Brian J., Bo Song, Jon Hom, and Matthew Duveneck

Abstract: Advances in technology and the collection of remotely sensed data have provided researchers with even more powerful tools for constructing realistic models and visualizations. The goal of this study was to use the Visual Nature Studio (VNS) software to visualize a wildfire in the New Jersey Pine Barrens based

on available GIS and forest inventory data. A digital elevation map was used for base heights for the landform model and digital orthophotographs for visualizing surface features such as roads and buildings. Image models for vegetation were constructed from digital photos of actual species edited in Photoshop. Forest ecosystems were created using the image models linked with the forest inventory data. Fire visualization was done using shapefiles for fire spread and intensity outputs from the FARSITE model. Color maps were created from these shapefiles which served as a guide in VNS to visualize different stages of the wildfire. The resulting visualization provided both still frame and animated views of the wildfire. A protocol for wildfire visualization using the VNS software was also established.
Session: *Concurrent Sessions – Forest Management II – Tuesday, 3/25/08, 2:15 PM*

GIS as a Tool for Assembling Modern Sensor Data into Present Hydrologic Models
Williams, Thomas M.

Abstract: A large controversy has developed over flooding of the Lower Santee River in Coastal South Carolina. The problem began in 1984 when water that had been diverted into the adjoining Cooper River watershed for hydroelectric generation was returned to the lower Santee through a new turbine at St. Stevens, SC. In order to evaluate forest losses, the extent of flooding associated with operation of the turbine had to be determined. We chose the USCOE hydraulic model, HEC-RAS (Hydrologic Engineering Center-River Analysis System), to determine flood extent and water level on this project. This choice presented several problems: HEC-RAS accuracy depends on realistic cross sectional geometry for the entire floodplain at a sufficient frequency to assure correct hydraulic behavior and numeric stability. On the Santee, a cross sectional frequency of 1/ 500m was needed for a river section 120 km long with floodplain from 3 -12 km wide. A LIDAR a mission of approximately 140 km^2 spanned the required floodplain area. River bottom geometry at each cross section was determined by Real Time Kinematic Surveying with sonar depth surveys. HEC-RAS is an older program and can use only 500 data points per cross section to represent the elevation of river bottom and floodplain. This paper outlines the use of ARC-GIS to reduce the large data sets produced by these modern sensors while preserving the important geometric properties for flood prediction and evaluation. This includes a novel use of the LIDAR data and rectified aerial photography in model calibration and validation.
Session: *Concurrent Sessions – Aquatics / Management – Tuesday, 3/25/08, 1:15 PM*

A Web-Based GIS of Virginia Tech's Urban Forest
Wiseman, P. Eric and Jennifer K. Otey

Abstract: An urban forest is an assemblage of trees and associated organisms that exists in an area of dense human settlement. Due to their geographic extent and proximity to people, urban forests can provide substantial economic, environmental, and social benefits. The magnitude of these functional benefits is dependent on the urban forest's structure-the extent, location, and composition of the tree population. Urban foresters increasingly rely on remotely sensed and field inventory data to characterize urban forest structure and function. Geographic information systems (GIS) are used to analyze and display urban forest data for enhanced management decision-making. Due to their visual nature, GIS are also valuable public information and education tools. Virginia Tech forestry faculty and students have developed the first comprehensive web-based GIS for Virginia Tech's campus urban forest. Over 3,000 trees were inventoried on the campus during 2006 and 2007. A web-based GIS was created from the tree inventory using ESRI ArcIMS. The GIS contains composition data for each tree, including species name, size, condition, and structural defects. In addition, each record is hyperlinked to HTML fact sheets on the dendrology, silviculture, and arboriculture of each species. This GIS has enhanced undergraduate education in dendrology and urban forestry and has increased community awareness about urban forestry issues at Virginia Tech. In addition, the GIS has enabled university staff to better manage the campus urban forest. The purpose of this presentation is to describe the planning, development, and outcomes of the web-based GIS for Virginia Tech's campus urban forest.
Session: *Concurrent Sessions – Forest Management I – Tuesday, 3/25/08, 10:45 AM*
