American Water Resources Association
2010 SUMMER SPECIALTY CONFERENCE
GIS & Water Resources VI
March 29 – 31, 2010
Orlando, FL

Wednesday, March 31
10:30 AM – 12:00 Noon
SESSION 31: Forecasting Water Use

ARC Population and Employment Allocation Disaggregator -- A Simple GIS-Based Tool for Parcel-Scale Population Projection - Stephen Bourne, PBSJ, Smyrna, GA (co-authors: Mike Alexander, Wei Wang)

Continued development of urban areas requires careful planning to ensure adequate resources are provided for growing industry and population while sustaining a healthy environment. This paper will discuss the on-going development of a GIS-based software tool, developed by the Atlanta Regional Commission (ARC), for projecting future development of the Atlanta Metropolitan Region. With this tool, the ARC can model growth of projected populations at fine scales, and thereby estimate future demands for transportation infrastructure, water, and other utilities. The Atlanta metropolitan area is a 22-county region in the northwest corner of Georgia, with a burgeoning population of approximately 5 million. By land area, Atlanta is the fastest growing city in the world with some of the highest commute times in the United States. Continued development strains Atlanta's resources more and more. The ARC is dedicated to unifying the region's collective resources to prepare for a prosperous future. It does so through professional planning initiatives, the provision of objective information and the involvement of the community in collaborative partnerships.

Using Econometrics to Forecast Temporal Sensitivity of Critical Nutrient Loading Thresholds - Valerie Seidel, The Balmoral Group, Maitland, FL (co-authors: Paul Yacobellis, Chris de Bodisco)

Economic development begets environmental concerns as urban areas encroach on rural lands. In Florida, Comprehensive Land Use plans attempt to designate allowable future land use and zoning; however these plans don't always match individual landowners' objectives. By modeling the decisions of individual landowners over time, development can be predicted on a parcel level. This methodology may assist when policy decisions require a parcel-specific approach. Evolving econometric models incorporating GIS processing can predict the likelihood of development at the parcel level through analysis of spatially explicit attributes and other indicators. This paper analyzes 22 square miles of the environmentally sensitive Wekiva River Basin (WRB) near Orlando. A bisecting roadway is expected to increase the conversion of rural to developed land in this area. Using a probit regression model, we estimate the probability that available rural parcels will convert to developed use over a 5-year period. This is a two-step process; first, historical data is analyzed or reconstructed using GIS processing to identify and empirically test which indicators are best estimators of a development event. Then, the estimators are applied to forecast future land use decisions. Using ArcInfo, attributes are generated for each developable parcel in the study area for location-specific ecological, demographic, and economic factors. Conversion of neighboring parcels was also modeled to reflect interaction effects. The resulting dataset includes 18 variables for 1500 parcels, of which 484 converted to development during the time period studied. Using these variables as development indicators, the model predicted with 91% accuracy which parcels would remain in rural use, and which would develop by the end of the period. The estimators were then overlaid with current data to forecast parcel-specific future land use decisions over a five year horizon. Applications of this forecast include identification of temporal sensitivity to increased nutrient loading, including the time frame when a receiving water body is likely to reach impairment, or when a particular parcel should be restored or acquired to accomplish targeted load reductions. This approach may provide policymakers with a sound science-based tool to refine time-sensitive Basin Management Action Plans.

Linking Agricultural Land Use to Future Water Demands - Mehrshad Nourani, Southwest Florida Water Management District, Brooksville, FL

Introduction The Southwest Florida Water Management District (District) is one of five districts charged with protecting and managing the State of Florida's water resources, including ensure adequate water supplies to meet the needs of current and future users. The District has been delegated the authority by the state to issue

Water Use Permits (WUPs) within its boundaries. One of the responsibilities of the District includes the development of Regional Water Supply Plans where demands are expected to exceed available water supplies. The goal of the GIS Irrigated Agricultural Land Model is to analyze agricultural land activities and create an inventory of irrigated agricultural acreage by crop category. Within the District there are 108 discrete crop categories of which 12 are associated with acreage to be significant enough to be reported independently. Historically, statewide models without adequate local or regional sensitivity were employed as the best information available for estimating future acreage. After 10 years of auditing the accuracy of those projection models, it was clear a new approach linking historical and planned land use to recorded water use data was required. To accomplish that, this model was created. The model uses water use permitting data, land use/parcel information and aerial photography to prepare a land and water use inventory. The model assumes available agricultural land and water quantities are finite and land converted from agricultural to residential/commercial/industrial will not revert to agricultural in the future. Actual agricultural irrigated acreages are determined by comparing county parcel data to allocated water use quantities using permitting information. Irrigation quantities are determined by reported and estimated water use quantities by WUPs. The inventory includes four components: 1) Actual Irrigated Agricultural Land Acreage by Crop Category, 2) Non-irrigated (available or remaining) Agricultural Acreage, 3) Actual Reported Water Use by Crop Category, 4) Total Permitted (available or remaining) Water Quantities. Historical data is used to establish a use pattern for irrigation quantities and agricultural land. The use pattern is then used in a statistical regression analysis to determine the future pattern of increase or decrease for acreage and water use by crop category.

Modeling the Impacts of Land Use on Water Purification and Nutrient Retention Using Invest Tool - Driss Ennaanay, Stanford University, Stanford, CA (co-authors: Marc Conte, Stacie Wolny)

Abstract: Water quality in general and non-point-source pollution in particular, is gaining significant attention as regulators begin to incorporate the benefits of ecosystem services into policy decisions. This paper presents and describes a GIS-based modeling tool to help model the impact of land use and land cover (LULC) on the loading and value of nutrient retention by vegetation in a landscape. Unlike other models, this tool is designed to be simple to use, requires minimum data, and specifically links the provisioning and regulating processes in the landscape to ecosystem service demand point. Furthermore, this tool is an open source written in python language and built in Arc GIS framework, considered distributed hydrologic model, and developed based on widely known and simplified hydrologic laws. This tool uses the export-coefficient approach. These nutrient export values are adjusted for the pixel□□s position in the landscape based on factors such as slope and total runoff coming into this pixel of interest. These export values are then routed downslope of which portions will be retained by downslope pixels based on their retention coefficients. This tool uses a simplified approach to understand water quality linkages and processes, describes simple but generalized hydrologic processes, and characterizes the landscape vis-a-vis water purification and nutrient retention. This tool helps prioritize landscape planning with respect to water quality and nutrient loadings for support of watershed management. This tool contains two separate components. The first module deals with the biophysical processes that determine nutrient retention in a landscape. The second module values this retention in a spatially-explicit way to allow for prioritization in the context of LULC change. Both components generate distributed outputs for each pixel on the landscape. The application of this tool in different watersheds in Iowa, New Mexico, Hawaii, Willamette, and China shows that this tool could provide a quick simple way to characterize the landscape and significantly estimate the annual loading exported by each pixel on the landscape and total nutrient loading at the outlet of the watershed.