American Water Resources Association
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GIS & Water Resources VI
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Wednesday, March 31
1:30 PM – 3:00 PM
SESSION 36: Land Use I

The Leaf-Out Analysis as a GIS Tool in Urban Watershed Forestry - Lisa Fraley-McNeal, Center for Watershed Protection, Ellicott City, MD

Urban watershed forestry is a new practice that draws from multiple disciplines in an effort to increase tree canopy in communities. This practice is the use of forests and the practice of forestry to protect, restore, and sustain water quality, water flows, and the health and function of watersheds. The first step in urban watershed forestry planning entails an inventory of existing and future watershed land cover to systematically account for forest losses and gains. The inventory method is referred to as the "Leaf-Out" Analysis because it is similar to a build-out analysis, which predicts future impervious cover with development based on zoning categories. The Leaf-Out Analysis focuses on future forest cover rather than on impervious cover. Geographic Information Systems (GIS) is an important tool for the Leaf-Out Analysis and is used to identify and evaluate the location, distribution, average size, future use, and ownership of forest fragments and reforestation sites. This information can then be used to determine which types of projects (protection, restoration, or reforestation) and what types of lands (public, private, residential turf, parks) will yield the greatest returns in terms of increasing forest cover in a watershed. Specific topics covered will include the development of forest cover coefficients to estimate the amount of future forest cover on buildable land, the leaf-out analysis, and utilization of the results to determine the best practices for increasing forest cover in a watershed. A case study will be presented for the Linganore watershed in Frederick County, MD, where a forest cover coefficients were developed and a leaf-out analysis was conducted to estimate future forest cover within the watershed.

Estimating Tree Root Encroachment on Levees Using GIS - Tomomi Ito, Department of Civil Engineering, University of New Mexico, Albuquerque, NM (co-authors: John Stormont, Julie Coonrod, James Cleverly)

The middle Rio Grande (MRG) riparian corridor (Bosque) plays an important role in maintaining ecological diversity and richness in Bernalillo County, New Mexico. Current ecosystem management efforts include planting more trees to enhance biological and recreational values. However, riparian tree roots can degrade flood-control levees, resulting in their failure to perform as designed. In particular, tree roots invade and clog levee drain systems designed to alleviate pore pressures and increase levee stability. Engineered root barriers may allow trees to exist near levees without roots compromising the levee performance. It is necessary to evaluate the effect of root invasion so that root barriers are installed adequately. To assess the potential for root intrusion into levees in the MRG, the horizontal root system from the riparian vegetation was estimated. First, ArcGIS was applied to measure the location and crown size of the riparian trees adjacent to levees from high-resolution aerial photography. This GIS-based measurement was verified by field observations and vegetation mapping. In addition, easily available normalized difference vegetation index (NDVI) grids were compared with aerial photography and vegetation map to evaluate the potential for NDVI to be applied for similar analyses. The type and size of vegetation was then used in models to predict the lateral extent of the root system to determine if the root system would impinge on the adjacent levee. These results were used to assess the percentage of levees in Bernalillo County that are possibly affected by root systems.

Predicting Hydrologic/Hydraulic Condition of Streams for Stream Visual Assessment Protocol (SVAP) and Process for Assessing Proper Functioning Condition: Riparian Area Management Using Aerial Imagery/GIS/IFSAR and HRO Auto-Correlated Dems - Nathaniel Todea, Utah USDA NRCS, Salt Lake City, UT (co-author: Shane Green)

Geographic Information Technology as well as aerial imagery and video are being used to assess a 500-mile portion of the Sevier River in Utah. The Stream Visual Assessment Protocol (SVAP) and Process for assessing proper functioning condition: Riparian area management (PFC) are being used to assess the overall condition of

the river. An attempt to identify Rosgen's Stream Classification and valley types using High Resolution Orthographic Auto Correlated DEMs and IFSAR DEMS will be undertaken. Field verification and stream gage analysis will help determine the reliably of predictions of the GIS and remote sensing analysis. Predicting stream classification can aid in determining the hydrologic and hydraulic elements within the SVAP and PFC.

Land Use Dynamics Assessment and Its Impact on the Hydrology of Beles Basin, ETHIOPIA - Anwar Surur, The Royal Institute of Technology (KTH), Stockholm, Sweeden (co-author: Shimelis Setegn)

Land use have shown a significant changes during the past three decades in Ethiopia specially in the highlands of the country. That resulted in changes in stream flows and other hydrological processes. The existing land and water resources system of the area is adversely affected due the rapid growth of population, deforestation, surface erosion and sediment transport. the main objective of this study is to evaluate the impact of land use changes in the hydrology of Beles Basin, Ethiopia. The physically based hydrologic model, SWAT, was developed for the Beles basin, Ethiopia by combining geospatial and climatic data. ArcGIS has been used to process geospatial data which includes the Digital Elevation Model (DEM) which has a resolution of 90 m, land use and soil maps. A simple Interpolation technique has been used to fill in the missing precipitation data. The GIS interface version of SWAT (ArcSWAT) has the capability to utilize ArcGIS to facilitate input data preparation and output data generation. ArcSWAT interface was used to inert the necessary input data and establish the hydrological model in the basin. Three land use classes were used for the assessment of the land use dynamics and its impact on the hydrology of the study area. The model was evaluated through sensitivity analysis, model calibration, and model validation for realistic prediction of the different hydrological components in the basin. Out of twenty six flow parameters sixteen parameters were found to be sensitive. But the most sensitive ten parameters were selected and used for model calibration. The model calibration was carried using observed flow data from 01 January 2001 to 31 December 2002. The model validation also has been done using observed data from 01 January 2003 to 31 December 2005. The coefficient of determination (R2) and the Nash and Sutcliffe model efficiency coefficient (NSE) are important means to investigate and determine the accuracy of SWAT simulation results. The coefficient of determinations (R2) was 0.82 and the Nash-Sutcliffe simulation efficiency (NSE) was 0.81 which indicted that the model was able to predict stream flow with reasonable accuracy.