ENVIRONMENTAL SUSTAINABILITY OF INTERCROPPING SWITCHGRASS IN A LOBLOLLY PINE FOREST

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A multi-institutional watershed study has been conducted since 2010 to quantify the environmental sustainability of planting switchgrass (*Panicum virgatum* L.) between wide rows of loblolly pine (*Pinus taeda* L.). The hypothesized advantage of this intercropping system is the production of biofuel feedstock to provide additional revenue in forested lands and to utilize land areas that could not otherwise be used for food production. Three paired watershed scale (8 to 27 ha) studies are being performed at three locations: Carteret County, NC, Greene County, AL and Calhoun County, MS. An additional study is being performed at the plot scale (0.8 ha plots) in Lenoir County, NC. Treatments on these studies are: 1) Young trees (1 – 6 yr) with standard forestry practice, 2) Young trees with switchgrass planted between rows, 3) switchgrass planted with no trees, and 4) mid-rotation (15 to 18 yr) trees with standard forestry practice. Each watershed is instrumented to automatically measure and record flow at the outlet, water table depths and soil moisture in the fields, and weather data. Flow proportional composite samples are collected at the watershed outlets and shallow groundwater samples are collected in the fields. Water quality samples are analyzed for nitrate (NO_3^--N), ammonium (NO_4^+-N), total Kjeldahl nitrogen (TKN), total suspended solids (TSS), total phosphorous (TP), and dissolved organic carbon (DOC). Reference evapotranspiration (REF-ET) and actual ET for each vegetation type is being estimated using remote-sensing satellite images and meteorological data. Models have been developed to predict ET and ET related parameters (temperature, stomatal conductance) using LandSat data. Field and watershed scale models have been modified to better simulate the hydrology, and nutrient and sediment loss from the different land-uses on the watersheds. DRAINMOD based models have been used for simulating the flat poorly-drained watersheds in NC and APEX and SWAT models have been used for simulating the upland watersheds (MS and AL). Other sustainability parameters (wildlife, stream biota, plant biodiversity, soil carbon, biomass crop productivity and operational safety) are also being measured and analyzed in the watershed and plot studies. The information and models resulting from this multi-disciplinary study will be used to develop best management practices to sustainably produce biofuel feedstock in a forestry setting.

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