

Modeling hydrologic impacts of intensive woody biomass feedstock production in the Southeastern US.

Bitew, M M*, University of Georgia, Athens, GA, USA
Jackson, C R, University of Georgia, Athens, GA, USA
Vache, K B, Oregon State University, Corvallis, OR, USA
Griffiths, N, Oak Ridge National Laboratory, Oak Ridge, TN, USA
McDonnell, J J, University of Saskatchewan, Saskatoon, SK, Canada
Starr, G, University of Alabama, Tuscaloosa, AL USA
Rau B, US Forest Service, Aiken, SC, USA
Younger, S, University of Georgia, Athens, GA, USA
Kevin, F, University of Georgia, Athens, GA, USA

We applied several models to investigate hydrologic impacts of intensively managed short-rotation loblolly pine production for biofuel feedstocks. Climatic, hydrometric, isotopic, and water quality observations from three experimental headwater watersheds of Fourmile creek at the Savannah River Site, SC were used to inform the models. We applied an integrated watershed modeling system, MIKE SHE, and multi-objective assessment functions on observations describing the flow regimes at the study site. A reference conceptual model that accurately describes flow processes in the watershed was used to investigate the sustainability of possible short rotation pine management scenarios. We have developed five different scenarios based on existing forest BMPs and industry wide experiences ranging from 35 years (low intensity) to 10 years (high intensity) rotations. Simulation results, based long-term climate records, reveal that complete conversion of the land to short-rotation woody crops would have negligible effect on water budget components; <2% decrease in streamflow, <1.5% increase in actual evapotranspiration, an average fall of 0.5m in groundwater table and no flow change across the subsurface boundaries due to biofuel production. Simulation results of mixed 50% agriculture and pasture and 50% short-rotation woody crop have shown the largest deviation in water budget compared to the reference condition. Extreme events analysis showed the largest effect to be due to the low intensity mixed land use scenario between pasture, agriculture and pine production while the smallest effect would be due to low intensity biomass production with 0.5% increase of 100 years return period event.

Key words: Water budget, biofuel, watershed, integrated model, MIKE SHE, multi-objective, short-rotation woody crop, pine.

Biography - Menberu Meles Bitew

Menberu Meles Bitew earned his Bachelor of engineering degree in Agricultural Engineering from Alemaya University in Ethiopia. He received his Master of Science degree in Environmental engineering from the Technical University of Denmark and a Ph.D from the University of Connecticut in Environmental engineering in 2012. Menberu has extensive experience in water resource engineering design prior to his Ph.D studies. He worked as a post-doctoral fellow at the University of Connecticut. Currently, he is working as a post-doctoral research scientist at Warnell School of forestry and natural resources at the University of Georgia. Dr. Bitew's research interests are modeling of hydrologic processes, accuracy in water balance components estimation, advancing application of remotely sensed climatic and landscape variables in hydrologic analysis. His current research focuses on understanding the hydrologic and water quality responses of cellulosic biofuel production in the southeast through observations and modeling of processes.