IMPACT OF FOREST LAND USE CHANGES ON GROUNDWATER RESOURCES IN A BASIN OF LOWER MISSISSIPPI RIVER ALLUVIAL VALLEY OVER THE PAST 100 YEARS

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EXTENDED ABSTRACT

Groundwater overdraft, resulting from anthropogenic activities, is an issue of critical concern. Many regions of the world are now facing challenges related to the decline and/or shortage of groundwater resources. This issue is also occurring in the Lower Mississippi River Alluvial Valley (LMRAV), which is a key region for crop and forest production in the midsouth United States. To enhance crop production, the land area for crop irrigation in the LMRAV has increased 92 percent since 1998 and resulted in a significant depletion of groundwater resources. It is reported that the average loss of groundwater in the Mississippi Delta was approximately 493,000,000 cubic meters per year from 1987 to 2014.

Although forest lands have been recognized for conserving the water resource, improving water quality and mitigating flooding, the impacts of silvicultural treatments on groundwater resources in the LMRAV are poorly understood. Using the historical data of forest reduction, recorded precipitation, and groundwater recharge along with the U.S. Geological Survey's Mississippi Embayment Regional Aquifer Study groundwater model, we assessed the impacts of forest land use changes over the past 114 years (1900 to 2014) on groundwater resources in the Yazoo River basin (YRB), which is within the LMRAV and is the largest river basin in Mississippi. The specific objectives of this study were to: (1) simulate the temporal and spatial distributions of groundwater level due to the past deforestation, and (2) ascertain the long-term contribution of forest lands to groundwater resource.

Simulation results show that the groundwater level at a point in the Big Sunflower River watershed of the YRB declined 13.5 m from 1900 to 2014 and occurred because of groundwater pumping for crop irrigation. Conversion of the crop land into forest land in the Upper Yazoo River watershed (UYRW) increased the average groundwater head by 1.01 m after 20 years from 1987 to 2007. Afforestation could conserve 157,887 cubic meters per year of groundwater in the UYRW because no groundwater pumping occurs after afforestation. Knowledge gained from this historical study provides useful information to the local and regional foresters and water resource managers in planning groundwater supply strategies.

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