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Simulated Longleaf Pine (Pinus palustris Mill.) Restoration Increased Streamflow – a Case Study in the Lower Flint River Basin

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Abstract

Water scarcity in the southeastern United States has increased in recent decades due to population growth, land use intensification, and climate variability. Precipitation is relatively abundant, but declines in streamflow suggest a need to better manage water yield. Restoration of low-density, frequent-fire longleaf pine (Pinus palustris Mill.) woodlands, which once dominated the southeastern Coastal Plain, represents a possible strategy to increase water yield and mitigate water scarcity. The Flint River Basin has seen recent conflicts over water appropriations and lies within the historic range of longleaf pine. We used the Soil and Water Assessment Tool (SWAT) to evaluate the potential effect of longleaf pine restoration on streamflow in the Ichawaynochaway Creek, a major tributary of the Flint River. Parameters governing plant water use, e.g. leaf area and leaf physiology, were adjusted to create a longleaf pine land cover. We simulated the conversion of ˜95,000 ha of existing forest to longleaf pine, an increase from 3% to 35% of landcover in the basin. Modeled evapotranspiration was lower for longleaf pine compared to other forest types in the region, and conversion to longleaf pine increased annual water yield by 17.9 ± 1.6 mm, or 5.2%. Proportional changes in monthly streamflow were up to 74% higher during low flow periods, when in-stream habitat is most vulnerable. Restoration of longleaf pine could be a promising way to mitigate water scarcity in the southeastern U.S., and adding flow during extreme droughts may prove vitally important for conserving imperiled aquatic organisms.

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