

# The Carbon Budget of Land Conversion: Sugarcane Expansion and Implications for a Sustainable Bioenergy Landscape in Southeastern United States

## Background/Objective

Sugarcane is poised to become a key bioenergy crop in the Southeastern U.S., where its expansion may replace extensive pasturelands. This work examines the impact of cane expansion onto predominant pastureland in subtropical FL on the carbon (C) budget over a 3-year rotation.

## Approach

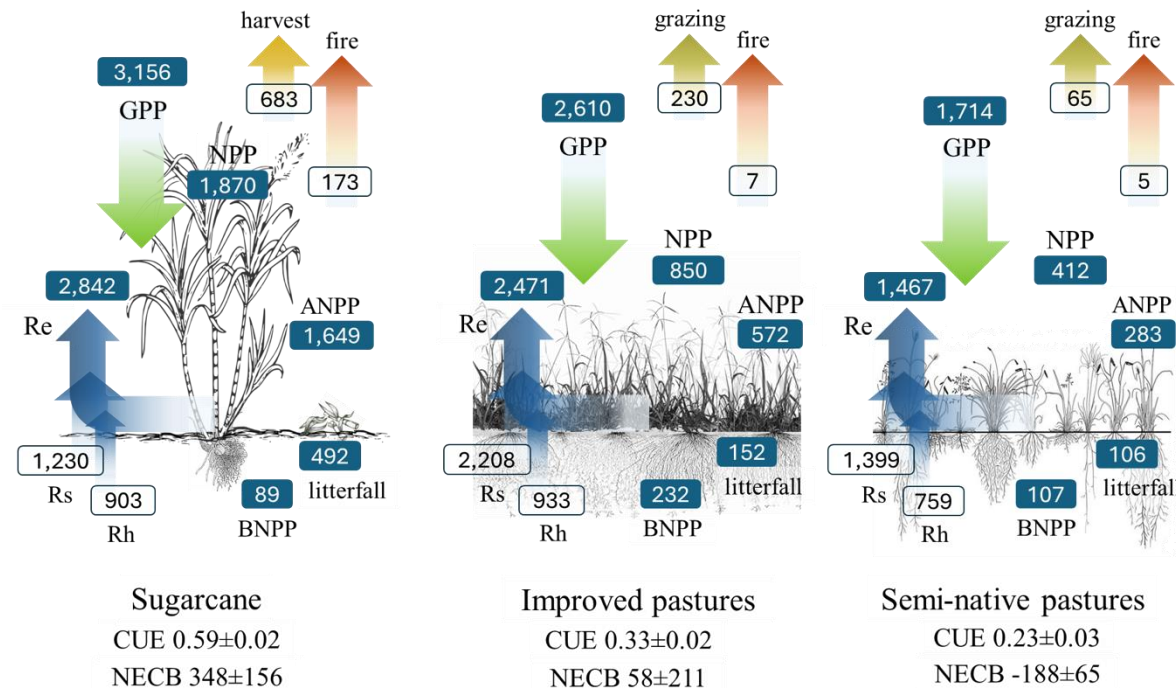
Improved pasture (IMP) converted to sugarcane at the beginning of the study was compared to IMP and semi-native pasture (SN) using biometric, ground-based, and eddy covariance methods to track the C budget over a three-year rotation.

## Results

Our findings show that such land-use transitions may incur significant C losses – beyond harvest or fire removals – led by rapid mineralization of legacy biomass and limited stabilization upon conversion. Yet, sugarcane’s high metabolic efficiency (CUE=0.59), high productivity (2.2-4.5x IMP and SN), and effective allocation to harvestable biomass (ANPP/NPP=0.9) position it as a strong candidate for biofuel production in subtropical regions. A shift from root- to litter-dominated inputs, however, may have implications for long-term soil carbon stabilization.

## Significance/Impacts

The environmental cost of converting pasture to sugarcane underscores the importance of implementing management practices to harness the soil C storage potential of sugarcane in order to improve the sustainability of a cane-based bioeconomy in the Southeastern U.S.



## Partial carbon budget for sugarcane and improved (IMP) and semi-native (SN) pastures over a three-year rotation following conversion.

GPP, gross primary productivity; Re, ecosystem respiration; NEE, net ecosystem exchange; NECB, net ecosystem carbon balance; Rs, soil respiration; Rh, heterotrophic respiration; CUE, carbon use efficiency; NPP, net primary productivity; ANPP, aboveground NPP; BNPP, belowground NPP. All values are in units of gC m<sup>-2</sup> y<sup>-1</sup>.