Project Title: PoSIES: *Populus* in the Southeast for Integrated Ecosystem Services
Applicant: Mississippi State University, Dr. Heidi Renninger (Principal Investigator)

The Project Team:
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SUMMARY

The Southeast has great production potential and lowest costs for growing hybrid poplar and other coppice regenerating woody crops for biomass energy. However, production costs of hybrid poplar grown on 2-3 year coppice rotations for biomass feedstock are still prohibitively high for wide-spread adoption, although calculations have often ignored co-produced ecosystem services relative to alternative land uses. Ecosystem services of hybrid poplar on short rotations have the potential to diversify income streams for landowners and producers and reduce impacts of market volatility risks while providing additional benefits to society. However, for these markets to be available to landowners, quantification and valorization of these ecosystem services need to be feasible and transaction costs must be low. Therefore, ***our main goal*** for this project is to evaluate productivity and ecosystem services and refine economic analyses of short rotation hybrid poplar production in the Southeast by leveraging our existing poplar trials and establishing new trials. ***Specifically, we propose to 1)*** quantify ecosystem services including nitrogen and phosphorus mitigation in riparian areas and belowground carbon storage in sites not directly connected to waterways, ***2)*** improve ecosystem services and productivity by increasing poplar plantation functional diversity, taxonomic diversity, and inoculating plantations with symbiotic (endophyte) bacteria, ***3)*** develop remote sensing strategies (hyperspectral reflectance fused with LiDAR) to enable faster quantification of ecosystem services and productivity over differing land types, ***4)*** identify other ecosystem impacts from short rotation poplar including greenhouse gas emissions and effects on biodiversity and wildlife habitat and ***5)*** integrate findings in an updated Techno-Economic Analysis (TEA) for short rotation hybrid poplar plantations in the Southeast.

We expect to achieve the following ***outcomes: 1)*** identify poplar cultural practices that increase yields and ecosystem services, ***2)*** quantify ecosystem services of nitrate and phosphorus mitigation, belowground soil carbon and wildlife benefits as well as greenhouse gas emissions in a variety of poplar field sites, ***3)*** identify novel technologies (hyperspectral reflectance/LiDAR) and create models to rapidly quantify ecosystem services across large land areas, ***4)*** determine the cost reductions of incorporating ecosystem services in poplar plantation biomass production. Integrating ecosystem services into short rotation poplar production will benefit a variety of stakeholder groups. For researchers and biomass industry, these data will introduce greater confidence in future projections and further enable comparison with other energy crop systems where similar metrics are presented. For agricultural producers, short rotation woody crops provide the opportunity to effectively utilize marginal land, diversify outputs and take advantage of income from the energy sector and retain it in the local economy. In addition, rural landowners may benefit from ecosystem service credits based on carbon sequestration and/or water quality improvement. In total, incorporating ecosystem services from hybrid poplar compared to alternate land uses may be an essential component of meeting targets of $3/GGE (gallon of gasoline equivalent) and less for biofuels.