Summary/Abstract for Public Release

Blue-green algal blooms and red tides are major environmental challenges in the U.S Southeast coastal plains (USSCP), particularly in Florida, which are a threat to public health and affecting aquatic life, wetlands, and agriculture. Nitrogen (N) and Phosphorus (P) runoff from agricultural fields is considered as one of the major causes of blue-green algal blooms in rivers and lakes and red tides in the coastal waters. We propose to evaluate energycane (EC) for ecosystem services (ES) including reduced N and P losses and greenhouse gas (GHG) emissions, and improved soil carbon (C) storage and biodiversity in marginal agricultural lands of the USSCP. The overall goal of this project is to develop a bioenergy feedstock production system using an advanced energycane cultivar (UFCP 84-1047) in marginal and fallow croplands of the USSCP. Specific objectives are to: 1) evaluate yield and quality of currently-available UFCP 84-1047 and advanced energycane cultivar for bioenergy at field-scale in marginal and fallow croplands to predict biomass yield potential and determine suitable agronomic practices, 2) quantify ES of UFCP 84-1047 compared to sugarcane and sweet corn cropping systems on marginal and fallow croplands, 3) test sensors for estimating environmental parameters and energycane's agronomic attributes, and ground-truth information management platforms, 4) develop a machine-learning (ML)-based model that can predict EC's agronomic attributes (yield and feedstock chemical composition) given a collection of environmental and crop management parameters, 5) use field-scale data to generate baseline and enhanced (with projected market values of ES) techno-economic analyses to quantify opportunities to meet BETO's cost goal of <$3/gge with >4 ton per acre yield and a refinery delivery cost of < $84/ton, 6) develop a life cycle analysis (LCA), and 7) develop a market transformation plan. This project will enable creation of field-scale demonstration on how to sustainably embed bioenergy crops in marginally productive croplands of the USSCP, another region in the U.S. that could potentially supply large amount of biomass for the bioeconomy. Field-scale production and demonstration will allow us to generate data of quality and quantity not achieved before for the proposed unique production system using one of the most productive bioenergy crops suitable for sub-tropical growing conditions. The expected multiple project outputs directly support the growing U.S. bioeconomy. These include remote sensing (RS) and modeling tools, high resolution information on production, feedstock compositional characteristics, economic potential, LCA, a market transformation plan which specifies the path to the integration of biofuel and bioproducts production into the local and regional economic systems, and sustainability of energycane in the USSCP. We anticipate to be able to achieve BETO's biofuel price point goal of <$3/gge. Development of RS technology for cost-effective and rapid data collection as well as ML model with agronomic predictive capabilities directly supports efforts towards utilizing precision agriculture in bioenergy cropping systems. Our collaboration with USDA-ARS and the Florida Department of Agriculture & Consumer Services will allow us to come up with sustainable management practices for the proposed production system. Our collaboration with Lanzatech, Inc. will allow us to have access to conversion technology insights. The involvement of the Commercial Aviation Alternative Fuels Initiative, along with the Florida Energy Systems Consortium and University of South Florida allows us to leverage multiple years of experience in developing commercial pathways for alternative fuel systems. Additional impacts of this projects are in the forms of field visits, training workshops, data dissemination through the Knowledge Discovery Framework, peer-reviewed publications, and presentations at various national and international conferences.