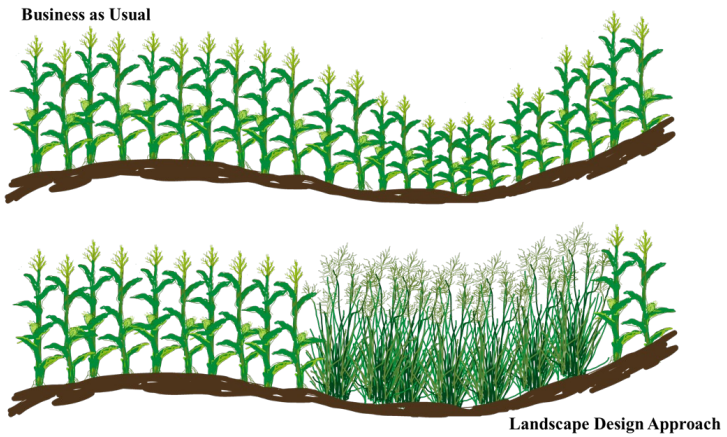
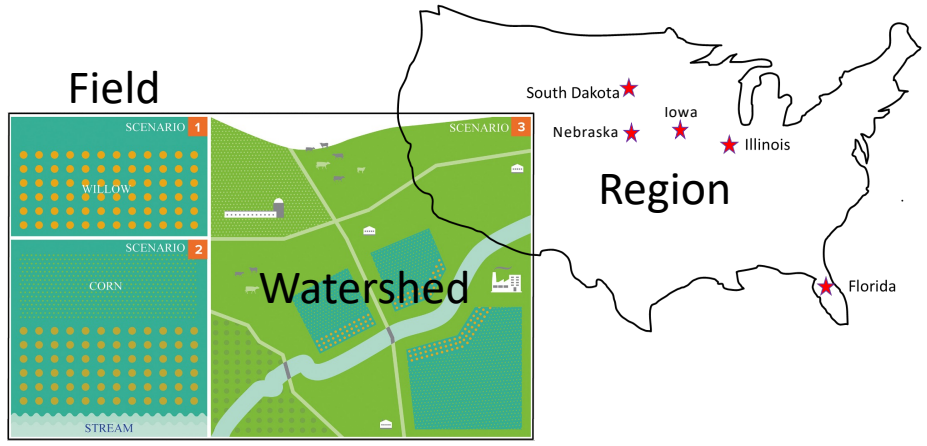
U.S. DEPARTMENT OF ENERGY | Office of ENERGY EFFICIENCY & RENEWABLE ENERGY
BIOENERGY TECHNOLOGIES OFFICE
Argonne NATIONAL LABORATORY

Production of Dedicated Energy Crops:

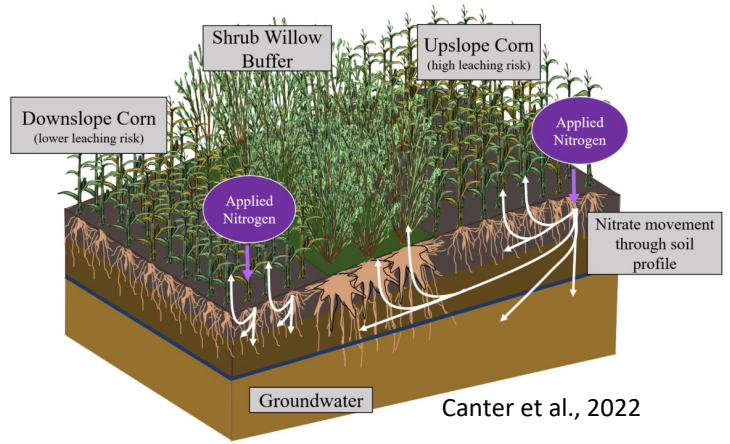
From Conceptualization to Application

C. Zumpf, M.C. Negri, J. Quinn, J. Cacho, B. Kasberg, N. Grasse

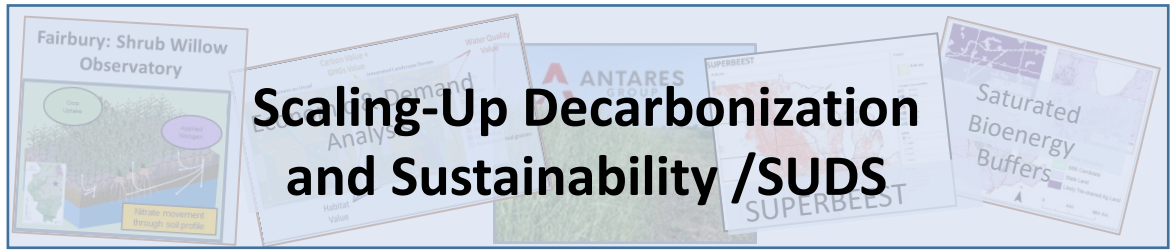




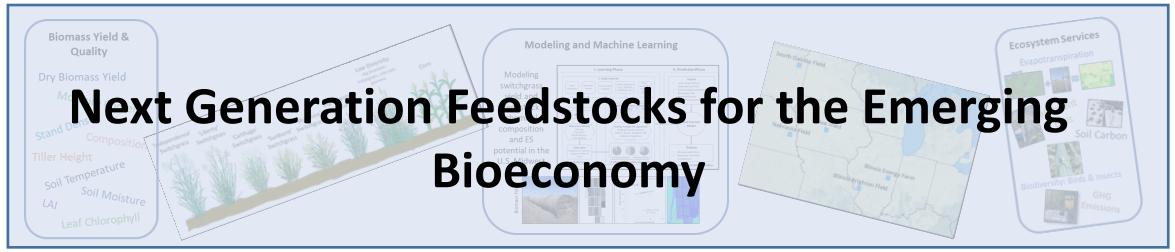
Ssegane et al., 2016



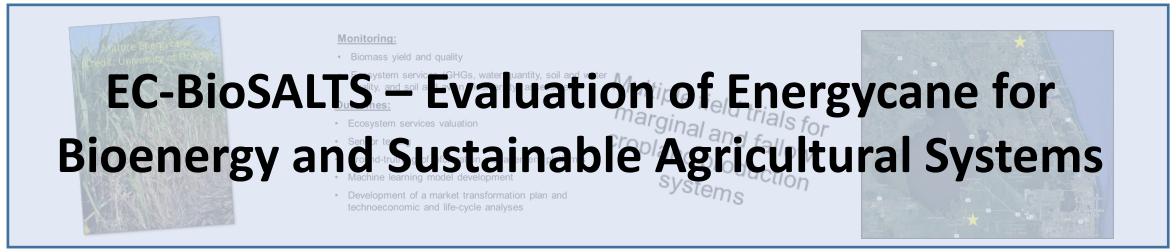
Canter et al., 2022



Scaling-Up Decarbonization and Sustainability /SUDS



Next Generation Feedstocks for the Emerging Bioeconomy



EC-BioSALTS – Evaluation of Energycane for Bioenergy and Sustainable Agricultural Systems

ExCHANGE – Expanding the Conservation of Habitat in the Northern Great Plains Ecosystem

Landowner Technical Assistance

Current Project Focuses

Our research focuses:

- Growing perennial bioenergy crops in agricultural landscape (U.S. Midwest and Southeast)
  - ✓ Biomass produced
  - ✓ Ecosystem services (ES) provided
  - ✓ Economic factors
- Landscape Design for Sustainability, Resiliency & Land-Use Efficiency
  - ✓ Targeting marginal lands
    - ✓ Low row-crop productivity
    - ✓ Susceptible to soil or nutrient loss, etc.
  - ✓ Fallow lands – citrus greening lands (Florida)
  - ✓ Corners of irrigation pivots (Nebraska)
- Moving from Design to Application
  - ✓ Providing data (ES, yield, ES value, LCA, TEA)
  - ✓ Tools for technical assistance to farmers, landowners, industry partners etc.
  - ✓ Demand Analysis & Market transformation plan –SAF focused

Challenges & Solutions

Variability in Productivity & Ecosystem Services

Impacts:

- ✓ Supply chain – providing enough biomass
- ✓ Sustainability & Adding ES value – providing the expected ES

Solutions:

- ✓ Field data collection
  - ✓ Different crops, different landscapes, different needs
- ✓ Use of machine learning to determine driving factors for yield, quality, and ES provision
- ✓ Development of SUPERBEEST tool to add in landscape design and decision making
- ✓ Use of remote-sensing
- ✓ Soil carbon scanner development

Market

Impacts:

- ✓ Adoption of bioenergy crop production
- ✓ Scale-up

Solutions:

- ✓ Development of bioenergy coalition
- ✓ Small markets / local use of biomass (e.g. biochar, anaerobic digesters, forage)
- ✓ Market transformation plan:
  - ✓ working directly with industry partners (Lanzatech) who have immediate needs for ethanol to jet fuel
  - ✓ Developing pathways to grow energycane production for fuel and solving nutrient loss problems

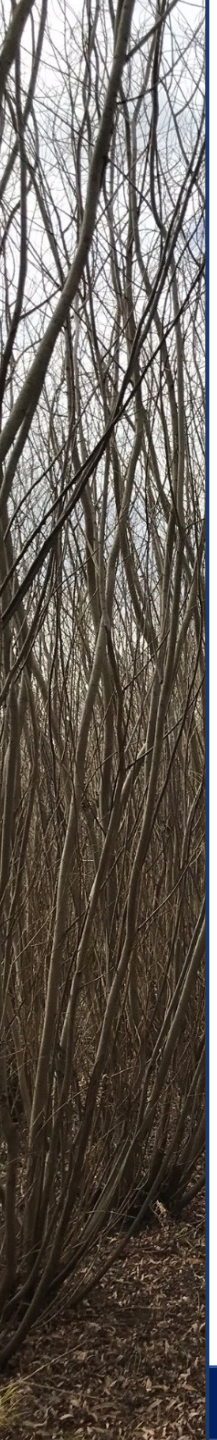
Climate Change

Impacts:

- ✓ Reaching 2030 & 2050 production and sustainability goals
- ✓ Crop management practices & crop selection

Solutions:

- ✓ Improved prediction models specific to bioenergy cropping systems in a changing climate to assess biomass supply and SAF supply-chain sustainability (proposed)
- ✓ How land marginality may change under future climate scenarios (proposed)



Future Project Outputs / Project Directions

- **Identifying Suitable Areas for Biorefineries - Based on Land Availability**
  - Purpose: Assist achieving the MYPP23 goals to build 4 biorefineries and fulfill near-term industrial interest
  - Approaches:
    - Identify fallow citrus acres (citrus greening) and agricultural buffer areas suitable for energycane production to build a feedstock supply for ethanol production for jetfuel
    - Employ SUPERBEEST to identify clusters of marginal land (economic and environmental) in regions of the U.S. Midwest that could benefit from a bioenergy market

- **Integrated Management Design: Row crops + Dedicated Bioenergy Crops**
  - Full field approach
    - ✓ The right crop/practice, in the right place, for the right purpose
    - ✓ Increasing the sustainability and resiliency of the entire agricultural production system
    - ✓ Focusing on SAF targeted bioenergy feedstocks (crop residues, purpose-grown energy crops, overwinter secondary crops)
    - ✓ Use project-based field data and modeling results (under current and future climate scenarios) to design, test, and implement bioenergy cropping systems