Sustainable Stormwater Management in Agriculture

Bibek Acharya and Vivek Sharma

Agricultural and Biological Engineering Department, University of Florida, USA

UF|IFAS UNIVERSITY of FLORIDA — ABE

FSA — Florida Stormwater Association

The Challenge

- Agriculture today confronts the challenge of stormwater runoff, leading to topsoil erosion and exacerbating surface and groundwater pollution.

- Additionally, the issue of nutrient leaching in agricultural practices contributes significantly to both surface and groundwater contamination.

Figure: Comprehensive Overview of Water Pollution Sources.
Source: leoncountyfl.gov

Research Endeavors

- Applying a Multi-Disciplinary Approach to Soil Health: Combining Fieldwork, Process-Based Modeling, and Machine Learning for In-Depth Analysis of Water and Nutrient Dynamics.
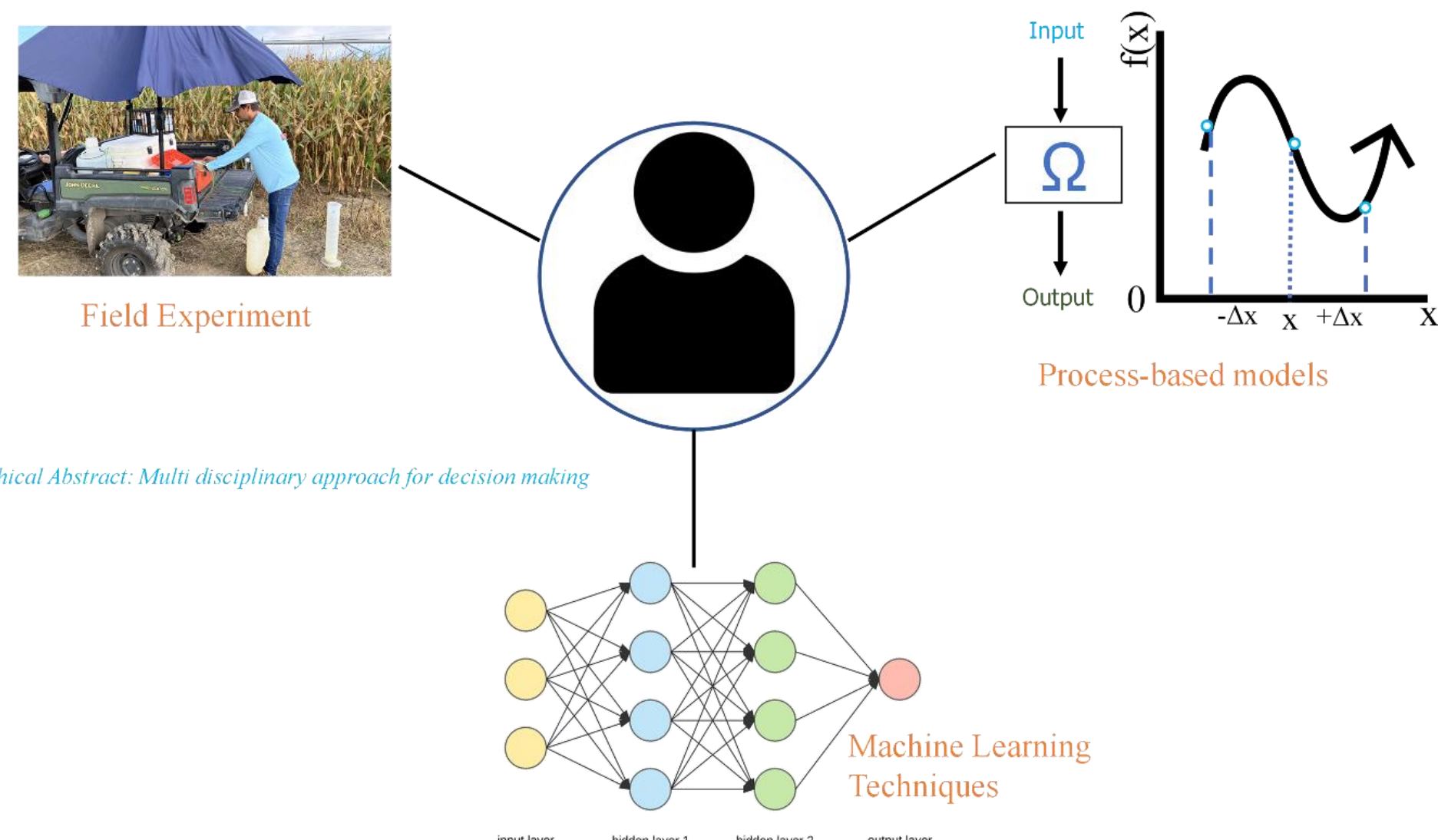
- Harnessing the power of remote sensing technology to monitor and analyze water consumption patterns at various scales.

Figure: Quantifying evapotranspiration (ET) via Satellite remote sensing.

- Informing water resource planning to optimize crop irrigation, with the goal of meeting agricultural needs while reducing runoff.

Towards Sustainable Practices

- A conventional corn-peanut rotation is commonly practiced by growers in this region.

Year 1 — Perennial Grass
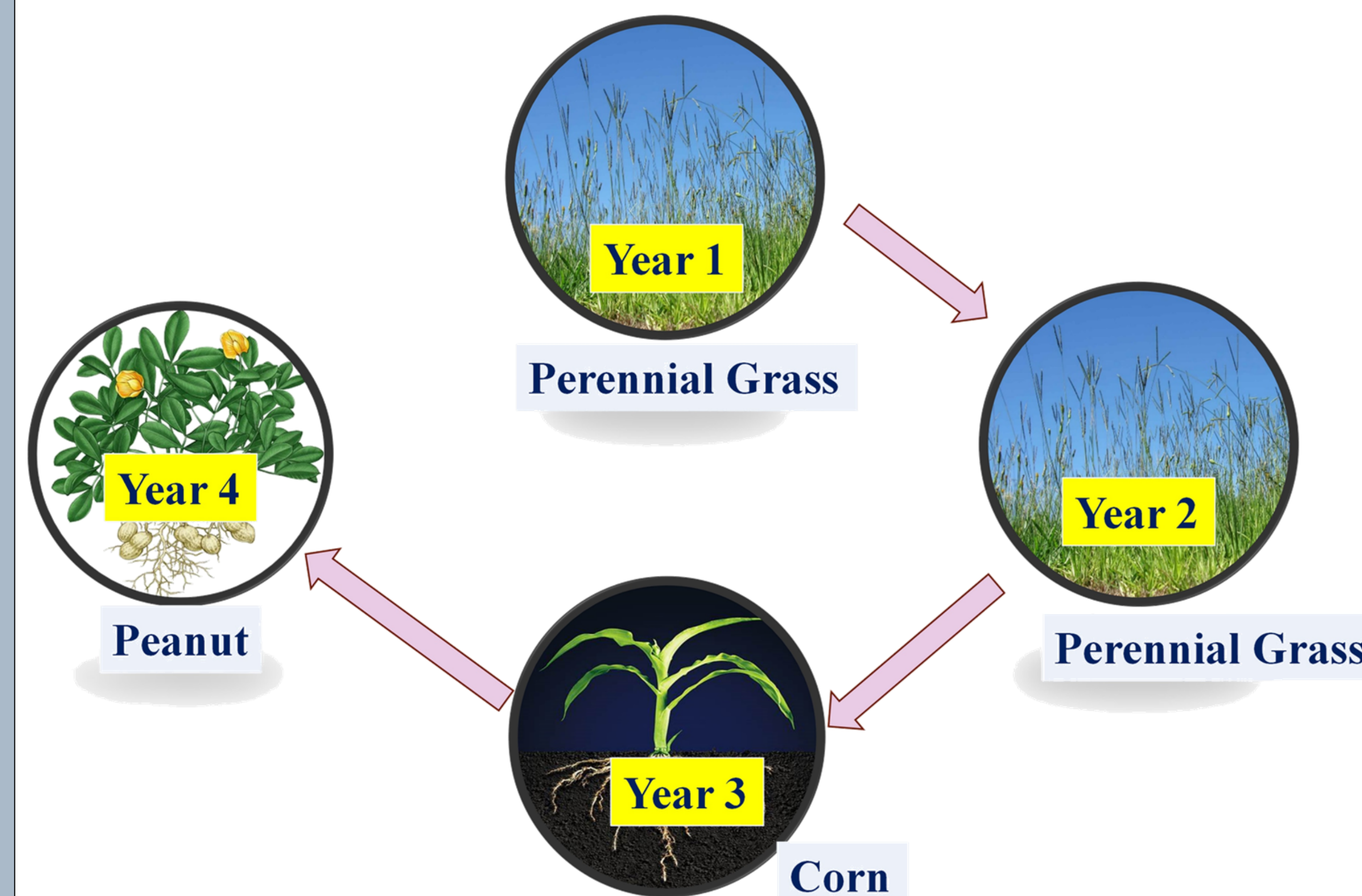Year 2 — Perennial Grass
Year 3 — Corn
Year 4 — Peanut

Figure: Crop rotation with 2 years of perennial grass with cattle grazing, followed by a year of corn and then a year of peanut.

- Integration of perennial grasses can add larger and deeper root masses and root channels thereby promoting soil structure, and increasing soil water and nutrient holding capacity, soil infiltration and soil aeration.

Ongoing Research Efforts

Field-Research

- Aerial view of the experimental field highlighting distinct cultivation practices.

- Right half: Conventional rotation with annual cycles of corn-peanut and corn-carrot-peanut.

Section 500 BBCAP | Section 100 PC
Section 200 CP
Section 400 BBCP | Section 300 CAP

Figure: Experimental Plot Structure in Suwannee Valley, North Florida

- Left side: Sod-based rotation starting with two years of perennial grass, followed by corn, peanut, or carrot crops.

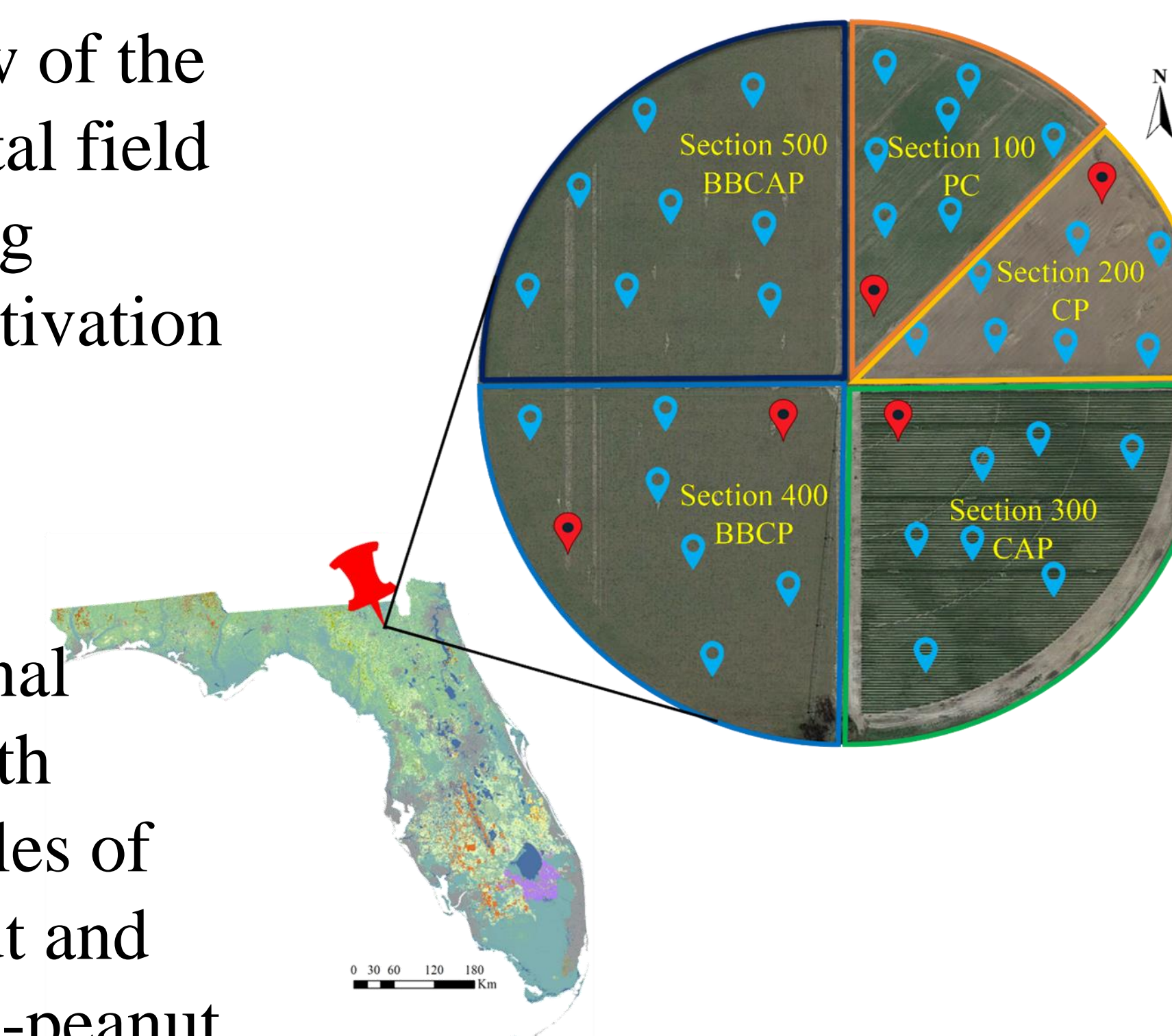| Treatments	Crops
Conventional Rotation (control)	1. corn-peanut (**CP**) and peanut-corn (**PC**) 2. corn-carrot-peanut (**CAP**)
Sod-based rotation	1. bahiagrass-bahiagrass-peanut-corn (**BBCP**) 2. bahiagrass-bahiagrass-corn-carrot-peanut (**BBCAP**)

Simulation Tools and Machine Learning

- Simulation tools such as SWAT, HYDRUS, and DSSAT combined with machine learning techniques are game-changers in stormwater management.

- Simulation allow us to model and assess best management practices with greater accuracy and efficiency, ultimately leading to better decision-making.
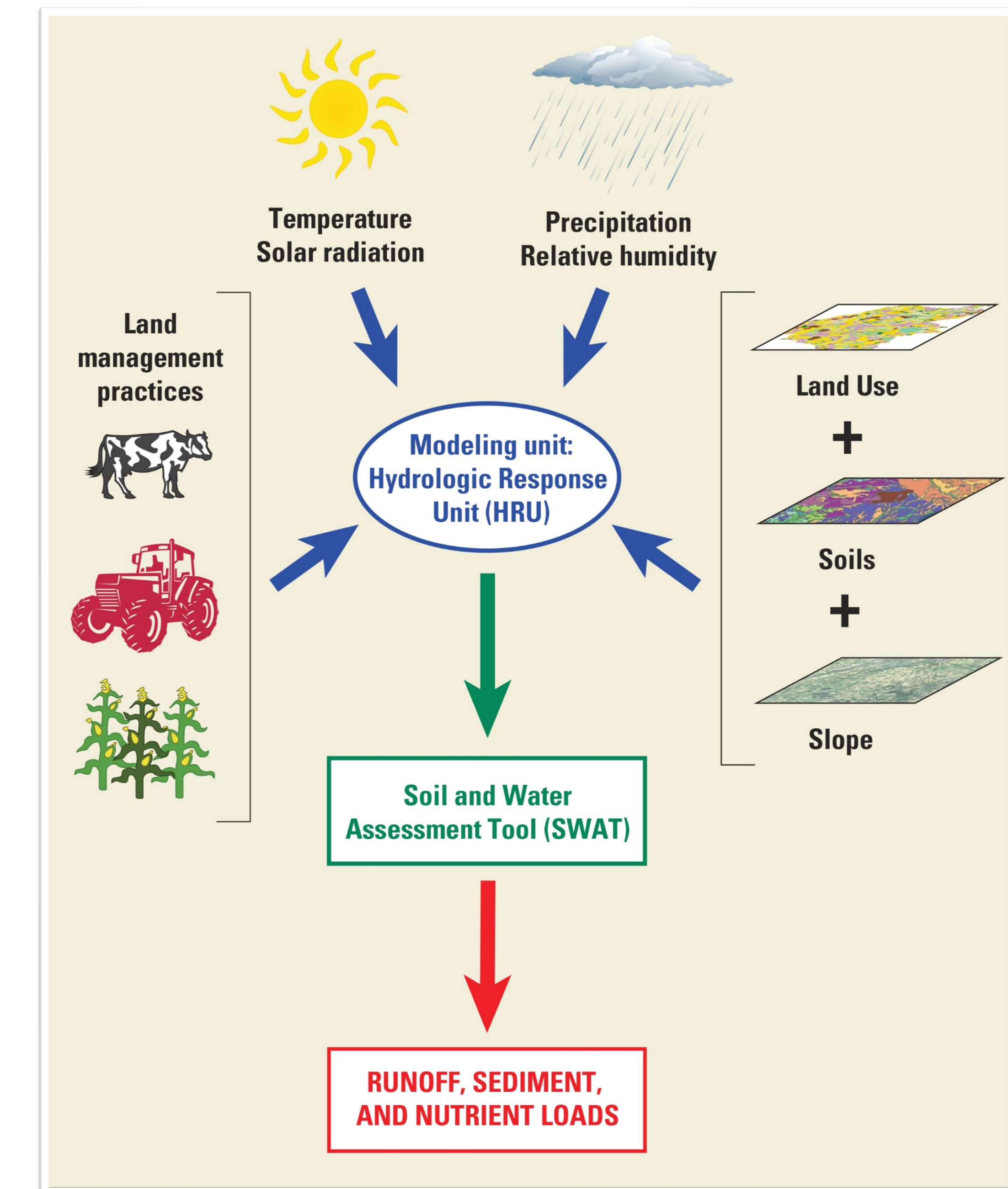

Figure: Illustration showing the input and output products of the Soil Water Assessment Tool (SWAT) used for edge-of-field modeling. Source: usgs.gov

Study Goals

- Examining the advantages of crop rotation versus continuous cropping methods.

- Investigating the impact of integrating Bahia grass into crop rotation systems.

- Aiming to identify improvements in soil structure, enhanced water infiltration, and decreased nitrogen leaching through these practices.

Acknowledgement