CIRCULAR AGRICULTURE

A COIL Training

Course Schedule:
Teaching modality: Asynchronous online lecture via Zoom.
Thursdays, 9am Eastern Time U.S
Zoom link: https://tennessee.zoom.us/j/86286357178 Password: COIL

Instructors:
Jie (Joe) Zhuang, PhD, Professor
Biosystems Engineering & Soil Science Office Building
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UT Invited Speaker:
Forbes Walker, PhD, Professor
Environmental Soil Extension Specialist
Biosystems Engineering & Soil Science
University of Tennessee

COIL Partner Institutions
Durban Technological University, South Africa. Dr. Bonga Lewis Ngcobo
Austral University in Rosario, Argentina. Drs. Pablo MacClay
Technological University of Uruguay. Drs. Ricardo Bedin, Cindy Ortiz, Gabriel Guigou.
National Institute for Agricultural Technology, Argentina. Drs. Sebastián Cambareri, Marcelo Beltrán.
Scotland's Rural University (SRUC), Dr. Nicolas Holden.

Participating students from Argentina, Brazil, Ethiopia, Nigeria, Scotland, South Africa, United States, Uruguay and Panama.

Course Description:
In the upcoming decades, agriculture systems are going to be plagued with opposing and intersecting demands: climatic threats, population growth and migration, increasing food and energy pressures, decreasing water and land availabilities, as well as degrading natural habitats and ecosystem services. As the global demand for food and fiber continues to rise, the need for sustainable agriculture practices has never been more urgent. Circular agriculture, which embraces the principles of a circular bioeconomy, offers a holistic approach to addressing the challenges of feeding a growing global population while building a resilient and sustainable food system for future generations. Practices include promoting responsible sourcing, reducing waste, reusing resources, recycling materials, generating renewable energy, and maximizing byproduct values. Innovations, such as food-energy-water nexus, digital agriculture, waste-valorizing biotechnology, agrivoltaic farming, and regenerative soil management can help farmers optimize resource use, improve productivity, reduce costs, and minimize environmental impact.

Course Goals:

This graduate course will introduce the concepts and principles of circular agriculture and their application to the innovation of agricultural systems for achieving United Nations' net zero emission goal by 2050. The learning will promote student's abilities to think critically and systematically following a transdisciplinary approach. The format includes lectures and essay writing. The lectures will overview circular agricultural practices, demonstrate case studies, and teach literature-based discovery methods. Students will apply the methods to search, analyze, and synthesize scientific literature and datasets for writing essays. The essays will identify challenges, knowledge gaps, and new approaches to climate-proofing, diversified food production systems. The course will help students promote their problem-solving ability in food security and justice. Students can opt-out from essay requirements and complete a blog to fulfill class requirements.

Course Plan:

Week—Date	**Topic or Learning Activity**
March 5	Complete pre- course evaluation survey
1—March 6	**Agricultural challenges and circular agriculture principles** (University of Tennessee, USA). Dr. Jie (Joe) Zhuang Key content: food and nutrition insecurities; concepts and principles of circular agriculture Recording **here** Homework Review examples for Science Communication Stories and Videos. NSF Science Stories | UT Extension News Biochar Cover Crops Infiltration Track Essay 1 (Part A) Track Blog: 2-3 paragraphs identify/select scientific issues, define scope of work with faculty mentor.
2 — March 13	**The Science Behind Regenerative Grazing: Soil Health and Carbon Sequestration** (University of Tennessee, USA). Dr. Forbes Walker Content: regenerative grazing and its impact on soil health and carbon sequestration. Learn how improved grazing management can increase carbon storage and reduce greenhouse gas emissions in agriculture. Pre-recording Homework: Track Essay 1 (Part B) Track Blog: 2-3 paragraphs assign team members roles/responsibilities/tasks.
3 — March 20	**Surviving High Fertilizer Prices (**University of Tennessee, USA) Dr. Forbes Walker **Pre-recording** Key Content: fertilizer **Strategies for Effective Science Communication (University of Tennessee, USA). Dr. Blake Colclasure Pre-recording** Key content: science communication Homework: Track Essay 1 (Part C) Track Blog: prepare a 100-word abstract
4 — March 27	**Regenerative Soils** (Durban University of Technology, South Africa) Dr. Bonga Lewis Ngcobo **Soilless cultivation as a form of circular agriculture** Key content: Soilless cultivation, including hydroponics, aeroponics, and aquaponics, is a key component of circular agriculture because it optimizes resource use, minimizes waste, and enhances sustainability in food production. By eliminating the

	need for soil, these systems allow for more efficient water and nutrient management, making them ideal for sustainable and climate-resilient farming. **The use of biostimulants to promote circular agriculture** Key content: By integrating biostimulants into farming systems, circular agriculture can achieve higher productivity, improved soil health, and sustainable nutrient cycling, leading to a low-input, high-efficiency agricultural model. Homework: Workshop Registration due April 14. **Please register here**
5 — April 3	**Innovation, value chains and business strategies for circular agriculture** (Universidad Austral, Argentina). Dr. Pablo Mac Clay Key content: Future trends in food value chains. Industrial organization aspects of new technologies oriented to sustainability in agri-food systems. Open innovation process for circular agriculture and sustainable agri-food systems. Technology adoption challenges at the farmer level. Recording Homework: Prepare your workshop presentations
6 — April 10	**Agricultural Technologies for Circular Agriculture in Uruguay** • Gabriel Guigou: Integration of Solar Energy in Uruguay's Agro-Industry: Opportunities, Trend and Case Studies. • Cindy Ortiz: Decarbonization of the Energy Matrix: Power Electronics as a Key Enabling Technology for Future Power Distribution Systems. • Ricardo Bedin: Detecting Forest and Agricultural Fires through Robotics and AI: A Case Study in Uruguay Recording: here Homework: • Prepare your workshop presentation.
7 — April 17	INTA-SRUC Collaboration for crop management and regenerative agriculture transitions in the Argentine Pampas. Drs. Sebastián Cambareri, Marcelo Beltrán (INTA, Argentina), Teresa Schutter, Innovation Hub Lead, Scottish Rural School, Edinburg (SRUC) Key Content: Nutrient cycling and soil carbon dynamics, baseline measurements for carbon stock and emissions. Homework: Prepare your workshop presentations
8 — May 7	International Student Workshop
9 — May 8	International Student Workshop
	Homework due May 10 Complete post- course evaluation survey

Student Responsibilities

Complete pre- course evaluation survey by March 5, 2025:
Complete post- course evaluation survey by May 10, 2025
Class attendance and participation
Homework must be submitted to smulvill@utk and faculty mentor at home institution.
Complete Track 1: Essay or Track 2: Blog with the support of your faculty mentor.
Register for International Student Workshop as presenter/or non-presenter
Certificate of participation is issued by NSF CFEWS

Track I. Essay

Essay Requirement:

The instructors will provide students with opportunities for applying their learning to develop thinking and writing abilities. Each student is required to write one essay to address a topical issue given by the instructors. Each essay should have a length of 1000 words (plus a list of cited references). The writing should be scheduled with 100-200 words each week. Instructors will review the work and provide comments for revisions. Topics include, but are not limited to, agricultural byproduct reuse, soil carbon sequestration for regenerative agriculture, biofertilizer manufacture, biogas generation, and water collection and recycle. The writing is encouraged to incorporate or summarize the lectures given by multiple faculty members. Selected students may be invited to contribute to co-author a chapter and/or journal publication with COIL participating faculty.

Example of Essay:

1. Title: Circular Agriculture
2. Body: (A) Concept and significance of circular agriculture; (B) Examples of circular agriculture practices such as biowaste/byproduct conversions to biofertilizers and biogas; (C) Policies and incentives for circular agriculture; (D) Concluding remark on the future of circular agriculture
3. References cited

Track 2: Blog

CFEWS Scientific Journalism Blog. Let's Talk Circular Agriculture!

Students will be evaluated on their ability to convey scientific findings and complex concepts to non-technical audiences. All blog submissions must be received by 5:00pm EST on April 20, 2025.

Instructions and submission here

2025 CFEWS International Student Workshop

Title: Climate Smart Food-Energy-Water Nexus

Topics accepted: circular agriculture (i.e. solar/energy, biofertilizers, bioenergy, soil carbon, socioeconomics). We welcome perspective, concept, outreach, policy, research and collaborative stakeholder involvement type submissions. Oral presentations (12 minutes presentation, Q&A 3 minutes). 10 PowerPoint slides. **Please register here**

Registration and abstracts must be received by 5:00pm EST on Monday, April 14, 2025.

Workshop will be held on May 7-8, 2025.

Check and get inspired by 2024 CFEWS Student International Workshops