

Life Cycle Assessment in Water-Energy-Food Systems

ABE 4630 Section: in-person

Class Periods: MWF Period 3, 9:35 – 10:25 am

Location: Frazier Rogers Hall Rm. 211

Academic Term: Spring 2026

Instructors:

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Office Hours: Friday 10:30-11:30 am or by appointment.

Course Description

Introduction and application of life cycle assessment (LCA) to evaluate the environmental impacts of various products, processes, or services related to the water-energy-food nexus. Additional topics include planetary boundaries, systems thinking, circular economy, mass and energy balances, life-cycle costing, social LCA and sensitivity and uncertainty analysis. This is an interdisciplinary course open to students from any major. (3 credits)

Course Pre-Requisites / Co-Requisites

MAC1147 Precalculus Algebra and Trigonometry & Junior Standing or higher

Course Objectives

After completing this course students will be able to:

- Recognize global sustainability challenges within the water-energy-food nexus.
- Explain what life cycle assessment is and how it is applied.
- Investigate the environmental impacts of a product, process or service within water-energy-food systems using life cycle assessment, including sensitivity and uncertainty analysis.
- Analyze, evaluate and communicate life-cycle assessment results via oral presentation and written report.

Materials and Supply Fees - None

Required Textbooks and Software

There is no required textbook for this course. Access to all readings and course materials will be provided to students on Canvas. Students will be able to access the LCA software to be used in this course via the ABE virtual workstation.

Attendance Policy, Class Expectations, and Make-Up Policy

- Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies. Click here to read the university attendance policies:
<https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/>
<https://catalog.ufl.edu/graduate/regulations>
- All assignments/class deliverables are due by 11:59 pm on the day specified for full credit. 10% deduction/day thereafter. Maximum deduction is 50%.

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Assignments (9)	225	45%
Quizzes (3)	75	15%
Midterm Presentation	50	10%
Final Presentation	50	10%
Final Report	100	20%
	500	100%

Grading Policy

Percent	Grade	Grade Points
93.4 - 100	A	4.00
90.0 - 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Course Schedule

<u>Week</u>	<u>Topic</u>	<u>Due</u>
1	Class Overview, Planetary Boundaries, Sustainability	--
2	Overview and Applications of LCA	Assignment 1
3	Goal, Scope & System Boundary	Assignment 2
4	Life-cycle Inventory	Quiz 1 & Assignment 3
5	Data Quality and Life-cycle Impact Assessment	Assignment 4
6	Working in SimaPro	Assignment 5
7	Sensitivity and Uncertainty Analysis	Assignment 6
8	Project Work Week	Quiz 2 & Assignment 7
9	Mid-term Project Presentations	Midterm Presentation
10	Life Cycle Costing, and Social LCA	--
11	Presenting and Communicating Results	Assignment 8
12	Project Work Week	Quiz 3 & Assignment 9
13	Project Work Week	--
14	Final Project Presentations	Final Presentation
15	Finalize Project Reports	Project Report

Description of Course Elements:

Lectures: The course is divided into weekly modules. Each week's topic and supporting information will be introduced using a lecture format, and supported with in-class activities, small and large-group discussions, readings, videos, and an assignment. Lecture slides and other supporting material will be provided on the week's Canvas page.

Assignments: There will be an assignment each week related to the weekly topic. In some cases, we will start the assignment in class on Fridays, and all assignments will be due the following Thursday by 11:59 pm. Most assignments will directly relate to a component of the LCA class project. Others will serve to emphasize sustainability related concepts. Prior to the Friday class meetings, students may be required to complete a reading

or watch a video to prepare for the in-class activity/assignment. A rubric will accompany each assignment outlining the expectations and point allocation for grading.

Assign. #	Description
1	Complete the EN-ROADS simulator activity and submit a written report outlining proposed greenhouse gas emissions reduction plan.
2	Read two articles on a topic of choice related to sustainability grand challenges and answer a questionnaire.
3	Complete a Miro Board-based brainstorming activity, identify three published LCAs on your project topic.
4	Review three published LCAs on your project topic and answer a questionnaire
5	Define the goal and scope, and system boundary (using a system boundary diagram) for your LCA.
6	Complete the practice LCA exercise using Simapro.
7	Complete the practice sensitivity and uncertainty analysis exercise using Excel Macros.
8	Construct a life cycle inventory for your LCA project using at least five published sources.
9	Write a 300-word essay describing the economic and social impacts of your LCA topic.

Quizzes: Three quizzes will be given in class throughout the semester to assess students' understanding and application of the lecture material. The quizzes will be delivered and graded via Canvas.

Quiz #	Description
1	Sustainability topics and defining the goal and scope of an LCA
2	Interpreting LCA results and uncertainty in LCAs
3	The three pillars of LCAs and broader impacts

Class Project and Deliverables: Over the course of the semester, students will carry-out an LCA on a topic/system of their choice. Several of the weekly assignments will serve as building blocks toward completion of the LCA project. Students will work as individuals or in teams depending on the number of students in the class. If working in teams, each student will complete a mid-term and final peer evaluation to provide feedback on individual performance within the team. As the project comes together, students will be required to complete three project deliverables: A rubric will accompany each deliverable outlining the expectations and point allocation for grading.

- **Midterm Oral Presentation** – Students will prepare a scientific poster that describes the goal, scope, and system boundary of the LCA, and present the poster in class for critical feedback.
- **Final Oral Presentation** – Students will prepare a 10 min PowerPoint presentation that provides an overview of all four components of the LCA (goal and scope definition, life cycle inventory, life cycle impact assessment, and interpretation of results) and present in class for critical feedback.
- **Final Written Report** – Student will prepare a report including abstract, introduction, methods, results, discussion and conclusion, describing the complete LCA in detail and formatted as a scientific manuscript.

Project Work Weeks: Time will be given in class to work on the LCA projects and ask questions. Guest presentations and supplementary lectures may also be given during these weeks.

Relation to Program Outcomes (ABET):

This course is not used for ABET assessment.

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	Medium
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	Low
3. An ability to communicate effectively with a range of audiences	High

4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	Medium
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	Low
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	Medium
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	High

**Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.*

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

In-Class Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

University Honesty Policy

UF students are bound by The Honor Pledge which states “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code.

On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Conduct Code specifies a number of behaviors that are in violation of this code and the possible sanctions. [See the UF Conduct Code website for more information.](#) If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Undergraduate/Graduate Program Coordinator
- Jennifer Nappo, Director of Human Resources, 352-392-0904, jpennacc@ufl.edu
- Pamela Dickrell, Associate Dean of Student Affairs, 352-392-2177, pld@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

Campus Resources:

Health and Wellness

U Matter, We Care: If you or someone you know is in distress, please contact umatter@ufl.edu, 352-392-1575, or visit [U Matter, We Care website](#) to refer or report a concern and a team member will reach out to the student in distress.

Counseling and Wellness Center: [Visit the Counseling and Wellness Center website](#) or call 352-392-1575 for information on crisis services as well as non-crisis services.

Student Health Care Center: Call 352-392-1161 for 24/7 information to help you find the care you need, or [visit the Student Health Care Center website.](#)

University Police Department: [Visit UF Police Department website](#) or call 352-392-1111 (or 9-1-1 for emergencies).

UF Health Shands Emergency Room / Trauma Center: For immediate medical care call 352-733-0111 or go to the emergency room at 1515 SW Archer Road, Gainesville, FL 32608; [Visit the UF Health Emergency Room and Trauma Center website.](#)

GatorWell Health Promotion Services: For prevention services focused on optimal wellbeing, including Wellness Coaching for Academic Success, visit the [GatorWell website](#) or call 352-273- 4450.

Academic Resources

E-learning technical support: Contact the [UF Computing Help Desk](#) at 352-392-4357 or via e-mail at helpdesk@ufl.edu.

[Career Connections Center](#): Reitz Union Suite 1300, 352-392- 1601. Career assistance and counseling services.

[Library Support](#): Various ways to receive assistance with respect to using the libraries or finding resources. Call 866-281-6309 or email ask@ufl.libanswers.com for more information.

[Teaching Center](#): 1317 Turlington Hall, 352-392-2010 or to make an appointment 352- 392-6420. General study skills and tutoring.

[Writing Studio](#): Daytime (9:30am-3:30pm): 2215 Turlington Hall, 352-846-1138 | Evening (5:00pm-7:00pm): 1545 W University Avenue (Library West, Rm. 339). Help brainstorming, formatting, and writing papers.

Academic Complaints: Office of the Ombuds; [Visit the Complaint Portal webpage for more information](#).

Enrollment Management Complaints (Registrar, Financial Aid, Admissions): [View the Student Complaint Procedure webpage for more information](#).