

BENG 5623 – Life Cycle Assessment

Term: Spring 2021

Instructors: Dr. Marty Matlock

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Office: ENGR 233

Office hours: Open office policy. Contact Dr. Matlock to schedule office hours as needed.

Course Overview: This course is a project-based introduction to the theory and application of the life cycle assessment methodology. Students will conduct parallel life cycle assessments using the commercial software SimaPro™ and the open-source software OpenLCA. The goal of this course is to develop a fundamental understanding of LCA: What it is, what it is used for, and how to do it. This course will guide students through each step in conducting an LCA through hands on modeling. Participants in this course will learn how to properly define the goal and scope, build a life cycle inventory from government databases, use process models to produce inventory data, conduct life cycle impact assessments, and interpret results.

Learning Outcomes:

- Proficiency with LCA nomenclature
- Competency using SimaPro and OpenLCA
- Proficiency in fulfilling metadata requirements according NAL guidelines
- Ability to use government databases/process models to create life cycle inventories
- Proficiency using LCA databases
- Calculate emissions according to IPCC Tier 1 methods

Knowledge Application:

- Conduct a cradle-to-farm-gate life cycle assessment of a complex agricultural supply chain
- Written report due each week detailing methods, results, and conclusions
- Final report detailing the process and the results

Materials: We will use the textbook Life Cycle Assessment: Quantitative Approaches for Decisions That Matter by H. Scott Matthews, Chris T. Hendrickson and Deanna H. Matthews. There is a PDF available for download on Blackboard or else it is available for free at www.lcatextbook.com.

Academic integrity: My commitment to you is to provide a learning environment that promotes academic honesty, and I expect each student to maintain a high level of academic integrity. The university is a community of scholars engaged in learning, teaching, and research. It is crucial to adhere to the highest of ethical standards. Any academic dishonesty will be dealt with as outlined in the university's "Academic Integrity Policy". Each University of Arkansas student is required to be familiar with and abide by this policy which may be found at <http://provost.uark.edu/245.php>. Students with questions about how these policies apply to a particular course or assignment should immediately contact their instructor and ASK!

Accommodations for Students with Disabilities: If you need an accommodation due to a disability, please notify me during the as soon as possible upon diagnosis. Students must be registered with the Center for Educational Access (575-3646; 104 Arkansas Union; ada@uark.edu) and you will need to send me an official Accommodation Letter from the Center for Educational Access for accommodations in your classes.

Grading: Students will be graded on the weekly assignments and the final report. Point values for assignments in this class are as follows:

Weekly assignments (400 X 7)	2800	points
Quizzes (50 X 16)	800	
<u>Final report</u>	<u>1400</u>	
Total	5000	points

Letter grades are determined according to the total points earned and are distributed as follows:

<u>% Points</u>	<u>Grade</u>
90.0-100	A
80.0-89.9	B
70.0-79.9	C
60.0-69.9	D
< 60.0	F

Course schedule:

1. Week 1
 - 1.1. Lecture 1.1: Introduction to LCA Part 1
 - 1.2. Lecture 1.2: Introduction to LCA Part 2
 - 1.3. Lecture 1.3: Project overview – Defining the goal and scope
 - 1.4. Assignment 1: Goal and scope document
2. Week 2
 - 2.1. Lecture 2.1: Life cycle inventory
 - 2.2. Lecture 2.2: LCA software Part 1 - SimaPro
 - 2.3. Lecture 2.3: LCA software Part 2 - OpenLCA
 - 2.4. Assignment 2: Constructing unit processes using government databases
3. Week 3
 - 3.1. Lecture 3.1: Metadata
 - 3.2. Lecture 3.2: Life cycle impact assessment
 - 3.3. Lecture 3.3: Calculating field emissions using IPCC Tier 1 methods
 - 3.4. Assignment 3: Adding field emissions and metadata to crop models
4. Week 4
 - 4.1. Lecture 4.1: Allocation Part 1
 - 4.2. Lecture 4.2: Allocation Part 2
 - 4.3. Lecture 4.3: Using parameters in LCA software
 - 4.4. Assignment 3: Constructing multi-output unit processes
5. Week 5
 - 5.1. Lecture 5.1: Introduction to the PPEC
 - 5.2. Lecture 5.2: Using the PPEC to produce LCI data
 - 5.3. Lecture 5.3: Refining the goal and scope
 - 5.4. Assignment 5: Create grow and sow barns
6. Week 6
 - 6.1. Lecture 6.1: Feed rations
 - 6.2. Lecture 6.2: Product systems
 - 6.3. Lecture 6.3: Interpreting results
 - 6.4. Assignment 6: Bring it all together
7. Week 7

7.1. Lecture 7.1: Analysis groups and calculation setups

7.2. Lecture 7.1: Contribution and sensitivity analyses

7.3. Lecture 7.3: Scenarios and parameter sets

7.4. Assignment 7: Scenario analysis

8. Week 8

8.1. Final report