

# Spring 2020: SUSM 675 Introduction to LCA

Faculty of Environment, University of Waterloo

Instructor: Prof. Goretty Dias [gdias@uwaterloo.ca](mailto:gdias@uwaterloo.ca); EV3-4251; 519-888-4567 X 38571

## Course description

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This course builds students' technical competencies in life cycle assessment (LCA) and in critical analysis of products' environmental impacts through an understanding of life cycle management. Course content covers the ISO life-cycle assessment framework, how to conduct technical LCA (including applying quantitative approaches using LCA software and databases, as available and appropriate), challenges of application of LCA to a range of product systems, limitations of LCA, and product life cycle management concepts. Students will use the knowledge gained to conduct their own technical LCA on a product.

## Course Objectives and Learning Outcomes

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The desired outcomes from this course are to:

1. Describe and apply the four phases of ISO LCA framework for conducting LCA studies
2. Explain the limitations/challenges associated with each phase of the framework
3. Critically review LCA studies using ISO LCA framework/guidelines
4. Learn and apply the technical skills required to conduct an ISO standard LCA
5. Articulate the appropriate use and limitations of LCA as a tool for sustainability assessment

## Course Text & Readings

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### **Required (posted on Learn):**

E-text (free): Matthews S, Hendricks and Matthews D. 2015. LCA: Quantitative approaches for decisions that matter. <https://www.lcatextbook.com/>

### **Case study**

Montalbo T, Gregory J, Kirchain R. 2011. Life Cycle Assessment of Hand Drying Systems. Materials systems Laboratory Massachusetts Institute of Technology, 51 pp.

### **Supporting Readings**

Finnveden G, Hauschild MZ, Ekvall T, Guinée J, Heijungs R, Hellweg S, Koehler A, Pennington S, Suh S. 2009. Recent developments in Life cycle assessment. *J. Env. Manage.* 91 (1) pp. 1-21.

Ny H, MacDonald JP, Broman G, Yamamoto R, and Robert KH. 2006. Sustainability Constraints as System Boundaries: An Approach to Making Life-Cycle Management Strategic. *J. Ind. Ecol.* 10(1-2), 61-77.

Reap, J., Roman, F., Duncan, S., and Bras, B. 2008a. A survey of unresolved problems in life cycle assessment- Part 1: goal and scope and inventory analysis. *Int J Life Cycle Assess.* 13:290–300.

Reap, J., Roman, F., Duncan, S., and Bras, B. 2008b. A survey of unresolved problems in life cycle assessment- Part 2: impact assessment and interpretation. *Int J Life Cycle Assess.* 13:374-388.

Rebitzer, G., T. Ekvall, R. Frischknecht, D. Hunkeler, G. Norris, T. Rydberg, W. -P. Schmidt, S. Suh, B. P. Weidema and D. W. Pennington. 2004. Life cycle assessment: Part 1: Framework, goal and scope definition, inventory analysis, and applications, *Environ. Int.* 30 (5), 701-720.

Sim, S., H. King, and E. Price. 2016. The Role of Science in Shaping sustainable Business: Unilever Case Study. Ch. 15 Taking Stock of Industrial Ecology. R. Clift, A. Druckman (Eds.). DOI 10.1007/978-3-319-20571-7\_15. [https://link.springer.com/chapter/10.1007%2F978-3-319-20571-7\\_15](https://link.springer.com/chapter/10.1007%2F978-3-319-20571-7_15)

UNEP and SETAC. LCM How business uses it to decrease footprint, create opportunities and make value chains more sustainable. <http://www.unep.fr/shared/publications/pdf/DTIx1208xPA-LifeCycleApproach-Howbusinessusesit.pdf>

Weidema, B.P. and Wesnaes MS. 1996. Data quality management for life cycle inventories-an example of using data quality indicators. *J. Cleaner Prod.* 4 (3-1), pp. 167-174.

### **Reading for Critical Review**

Ellingsen H and Aanonsen SA. 2006. Environmental impacts of Wild Caught Cod and Farmed Salmon- A comparison with chicken. *Int. J. LCA.* 11: 60-65.

### **Optional Reading for Critical Review**

Pelletier N, P Tyedmers, U Sonesson, A Scholz, F Ziegler, A Flysjo, S Kruse, B Cancino and H Silverman. 2009. Not All Salmon Are Created Equal: Life Cycle Assessment (LCA) of Global Salmon Farming Systems. *Environ. Sci. Technol.* 2009 43, 8730–8736.

**Other resources/readings are provided on Learn.**

## **Summary of Course Assessment Items**

**Please note: Unless otherwise indicated, all assignments should be submitted online using LEARN.**

A detailed description of the requirements for each assignment is available on LEARN. G indicates group assignment and I indicates individual assignment.

<b>Assessment</b>	<b>Description</b>	<b>Due Date</b>	<b>Weight (%)</b>
Critical review assignment	Review LCA study using ISO Framework as a guideline	Friday May 22, 5 pm	25
LCA project Part 1: Goal and Scope document	Detailed report describing how you will conduct your LCA, and what data you will use.	Friday May 15, 5 pm	20
LCA project Part 2: Final project report	LCA study report	Friday May 29, 5 pm	35
	Detailed and transparent Excel calculations for inputs/outputs, openLCA model structure, and model results.	Friday May 29, 5 pm	20

## **Course Policies**

### **Communications with Instructor:**

All communication with students must be through either the student's University of Waterloo email account or via Learn. If a student emails me or the TA from a personal account they will be requested to resend the email using their personal University of Waterloo email account.

I want to help you succeed in this course. To help me help you, please keep the following in mind:

I will try to reply to legitimate inquiries from students within 2 business days (M to F). Please ensure that you include the **course number** in the subject line, as well as a meaningful descriptor of the topic of your inquiry (I will delete emails without a Subject Line). I will not answer any questions that have already been answered through the course outline or other course materials, so make sure you consult your course resources before submitting inquiries. General questions on process, assignments, evaluations, etc. should be posted on LEARN and "General Discussion". Please see me during office hours for help with any course material or email me to make an appointment if you can't make it to office hours. I will meet you based on my availability. I have another course to teach, graduate students to mentor, and a research program to run, so I'm not widely available. I will work with you to try to find a reasonable time that works for a meeting outside office hours.

### **Policy on Late Submissions**

**I do not allow late submissions unless you have compassionate grounds for lateness.** Should you not be able to meet a deadline due to compassionate reasons (e.g. illness or death in the family), you must try to contact me and let me know BEFORE the deadline, or as soon as possible thereafter. It is unacceptable to wait to contact me more than a couple of days after a deadline. In the event you require an extension due to compassionate reasons, you may **be asked for documentation**. Technology failures are NOT acceptable reasons for lateness.

Submissions are due by the times and dates indicated. Submissions received after this time will be penalized 5 per cent per day, or any part thereof, including weekends (i.e. 5% of an assignment that is worth 10% of your course grade would be penalized 0.5% of your final grade per day). Only in exceptional cases will this penalty be waived!

### **Lecture Attendance and In-class Assignments**

**You are responsible** for attending all lectures or getting notes and information from your peers if you miss a lecture. I will not provide individuals with course notes, information that was provided in class, etc. I will post all lectures within 24 hours after the class. If you miss an in-class assignment, you will get 0 unless there are extenuating circumstances. It is **your responsibility** to contact me as soon as possible in this situation.

### **Learn (D2L)**

I will be using Learn (D2L) online for this course. The course website will be the PRIMARY mode of communication for this course. Please ensure that you check this website regularly for announcements and other material that may be added from time to time. You will also be posting in-class assignments to Learn, where appropriate. It is your responsibility to ensure that your Learn (D2L) email address is kept up to date in case I need to send you a message individually. Unless otherwise noted on the Assignment outline, all assignments must be **submitted electronically to Learn (D2L)** by the indicated deadline. Any handouts as well as lecture notes that are important will also be added to the website throughout the semester. **Detailed descriptions of the requirements for each assignment are also placed on Learn (D2L).**

### **Policy on Use of Electronics and Electronic Media in Class**

#### **Laptop use in-class**

Laptops are permitted in class for **course-related purposes only**. **You will need a laptop (or calculator) in most classes for in-class assignments.** While I encourage the use of laptops in this course, I request that you have a sense of **courtesy and respect** and do not misuse the computer in class. Anybody found accessing the internet for other purposes (e.g. checking email, chatting, Facebook, noncourse sites, playing on-line games, etc.), or using laptops off-line for non-course purposes (e.g. games, movies, music), **will be asked to leave the class**. I also refer you to university policy:

University Policy 33 ("Ethical Behaviour") states that "no member of the University community (faculty, staff, student) may unduly interfere with the study, work or working environment of other members of the University or any aspect of another's University activity." The policy adds that "A 'poisoned environment' (or one that is intimidating, hostile or offensive) can be created based on any of the prohibited grounds under the Ontario Human Rights Code, and can be described as comment or conduct that is contrary to the aims of maintaining a supportive, respectful and tolerant environment." Using a laptop to view potentially offensive or inappropriate images during class could certainly contravene this policy, and an instructor would therefore have the responsibility to direct a student to refrain from this activity during class. Similarly, if a student is using a laptop in class to view material that is not offensive per se but merely distracting to others -- for example, a video of a high-speed car-chase -- it might reasonably be deemed to "interfere with the study, work or working environment of other members" of the class.

I may ask that you close your laptops for short times during certain activities, such as during a small group discussion.

#### **Cell phones and other mobile devices**

Please make sure that all cell phones, iPhones, smart phones, similar devices are turned off while in-class. If you are found using these during lectures, you will be asked to leave the classroom if you want to continue using them.

### **General Academic Information**

#### **Academic Integrity**

Academic integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. [Check the Office of Academic Integrity for more information.]

**Grievance:** A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4. When in doubt, please be certain to contact the department's administrative assistant who will provide further assistance.

**Discipline:** A student is expected to know what constitutes academic integrity to avoid committing an academic offence, and to take responsibility for his/her actions. [Check the Office of Academic Integrity for more information.] A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course instructor, academic advisor, or the undergraduate associate dean. For information on categories of offences and types of penalties, students should refer to Policy 71, Student Discipline. For typical penalties, check Guidelines for the Assessment of Penalties.

**Appeals:** A decision made or penalty imposed under Policy 70, Student Petitions and Grievances (other than a petition) or Policy 71, Student Discipline may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72, Student Appeals.

**Note for students with disabilities:** AccessAbility Services, located in Needles Hall, Room 1401, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with AccessAbility Services at the beginning of each academic term.

**Turnitin.com:** Text matching software (Turnitin®) may be used to screen assignments in this course. Turnitin® is used to verify that all materials and sources in assignments are documented. Students' submissions are stored on a U.S. server, therefore students must be given an alternative (e.g., scaffolded assignment or annotated bibliography), if they are concerned about their privacy and/or security. Students will be given due notice, in the first week of the term and/or at the time assignment details are provided, about arrangements and alternatives for the use of Turnitin in this course.

It is the responsibility of the student to notify the instructor if they, in the first week of term or at the time assignment details are provided, wish to submit alternate assignment.

### **Intellectual Property:**

For further information on IP related to teaching, please see [https://uwaterloo.ca/legal-and-immigration-services/sites/ca.legal-and-immigration-services/files/uploads/files/volume\\_1\\_issue\\_3\\_winter\\_2018.pdf](https://uwaterloo.ca/legal-and-immigration-services/sites/ca.legal-and-immigration-services/files/uploads/files/volume_1_issue_3_winter_2018.pdf) and the Guidelines for Faculty, Staff and Students Entering Relationships with External Organizations Offering Access to Course Materials, <https://uwaterloo.ca/secretariat/faculty-staff-and-students-entering-relationships-external>. The following text is recommended:

Students should be aware that this course contains the intellectual property of their instructor, TA, and/or the University of Waterloo. Intellectual property includes items such as:

- Lecture content, spoken and written (and any audio/video recording thereof);
- Lecture handouts, presentations, and other materials prepared for the course (e.g., PowerPoint slides);
- Questions or solution sets from various types of assessments (e.g., assignments, quizzes, tests, final exams); and
- Work protected by copyright (e.g., any work authored by the instructor or TA or used by the instructor or TA with permission of the copyright owner).

Course materials and the intellectual property contained therein, are used to enhance a student's educational experience. However, sharing this intellectual property without the intellectual property owner's permission is a violation of intellectual property rights. For this reason, it is necessary to ask the instructor, TA and/or the University of Waterloo for permission before uploading and sharing the intellectual property of others online (e.g., to an online repository).

Permission from an instructor, TA or the University is also necessary before sharing the intellectual property of others from completed courses with students taking the same/similar courses in subsequent terms/years. In many cases, instructors might be happy to allow distribution of certain materials. However, doing so without expressed permission is considered a violation of intellectual property rights.

Please alert the instructor if you become aware of intellectual property belonging to others (past or present) circulating, either through the student body or online. The intellectual property rights owner deserves to know (and may have already given their consent).

### **Recording lectures:**

- Use of recording devices during lectures is only allowed with explicit permission of the instructor of the course.
- If allowed, video recordings may only include images of the instructor and not fellow classmates.
- Posting of videos or links to the video to any website, including but not limited to social media sites such as: facebook, twitter, etc., is strictly prohibited.

### **Mental Health:**

The University of Waterloo, the Faculty of Environment and our Departments/Schools consider students' well-being to be extremely important. We recognize that throughout the term students may face health challenges - physical and / or emotional. Please note that help is available. Mental health is a serious issue for everyone and can affect your ability to do your best work. Counselling Services <http://www.uwaterloo.ca/counselling-services> is an inclusive, non-judgmental, and confidential space for anyone to seek support. They offer confidential counselling for a variety of areas including anxiety, stress management, depression, grief, substance use, sexuality, relationship issues, and much more.

**Religious Observances:**

Students need to inform the instructor at the beginning of term if special accommodation needs to be made for religious observances that are not otherwise accounted for in the scheduling of classes and assignments.

**Unclaimed assignments**

Unclaimed assignments will be retained until one month after term grades become official in Quest. After that time, they will be destroyed in compliance with UW's confidential shredding procedures.

**Research Ethics:**

The University of Waterloo requires all research conducted by its students, staff, and faculty which involves humans as participants to undergo prior ethics review and clearance through the Director, Office of Human Research and Animal Care (Office). The ethics review and clearance processes are intended to ensure that projects comply with the Office's Guidelines for Research with Human Participants (Guidelines) as well as those of provincial and federal agencies, and that the safety, rights and welfare of participants are adequately protected. The Guidelines inform researchers about ethical issues and procedures which are of concern when conducting research with humans (e.g. confidentiality, risks and benefits, informed consent process, etc.). If the development of your research proposal consists of research that involves humans as participants, the please contact the course instructor for guidance and see: <https://uwaterloo.ca/research/office-research-ethics>