THE UNIVERSITY OF BRITISH COLUMBIA

FNH 414 Sustainability and the Food Industry Syllabus

Prerequisites	None
Term/year	2024W1 (September - December 2024)
Class day/time	Mondays 1:00 – 4:00
Class location	
Instructor	Alberto Mendoza
Email	agalina@mail.ubc.ca
Office hours	by appointment
Syllabus version	April 2023 (currently under revision, minor changes)

Course Objectives

Food primary production, processing, handling, and distribution are components of a complex, interdependent system. Therefore, the evaluation of a food site's environmental impact requires a systemic approach based on an understanding of regenerative sustainability and the nexus where food, water, energy, climate, and human activities meet.

In this course, students will learn what contributes to the overall environmental impact of the food systems and explore potential solutions, considering carbon and water footprints, pollution, waste, energy consumption, and potential for regenerative strategies. Students will also learn how to evaluate environmental performance indicators and develop and apply a continuous improvement environmental management system based on ISO 14001 2015, the international standard for environmental management systems.

This course prepares students to contribute to local sustainability initiatives and help food industries work towards their sustainability goals.

Academic Calendar entry: Regenerative sustainability and the sustainability nexus; health and environmental impacts of the food industry; environmental performance indicators and management systems; approaches for enhancing sustainability in the food industry.

Learning Outcomes

By the end of the course, students will be able to:

- Describe the sustainability nexus and regenerative sustainability
- Apply carbon footprint, ecological footprint, and water footprint concepts to the food systems as sustainability indicators
- Identify common wastes and pollutants produced by different food industry sectors and their impacts on human health and the environment

- Identify common strategies used in the food industry to reduce, recycle and minimize environmental impact
- Situate Canada's status and progress within global climate change and sustainability goals

Course Format

This course will be student-driven and require self-directed strategies for one's learning. Prior to class, students are expected to reflect upon the weekly readings, answer questions posed for each class, and prepare for class discussions. Students are encouraged to seek out other relevant literature and share their findings with the class. The instructor will serve as the course coordinator and begin classes with presentations to facilitate student participation. At the end of each class, students will co-produce a summary of the concepts discussed during the session.

Learning Resources

UBC Library has a series of undergraduate user guides to support your learning. For the upcoming terms, their Online Learning video tutorial and UBC's Keep Learning website are helpful resources.

Course Assessment

Course assessments include a personal journal, a presentation accompanied by a midterm paper, and an individual final paper. Each student will maintain a journal throughout the course, submitting brief summaries of class readings prior to class based on answering questions posed by the professor. The midterm presentation and paper will be focused on a food system sustainability issue of the student's choice. The final paper will have the same theme as the midterm. The final paper will be solution-focused, allowing students to propose sustainability strategies for the food industry or entirely new ideas for sustainable food systems.

Student learning will be evaluated as follows: TBD in class

Personal journal	40%		
Midterm paper	20%		
Presentation-midterm	10%		
Final paper	30%	Total	100%

Personal journal: Students will keep an individual journal where they will respond to questions posed by the instructor based on the course readings, group presentations, and case studies. The deadline for submission is 12 midnight on the day prior to class. Students will only have to read 2 articles, from each week's list (TBD in class)

Midterm paper: Students will choose a sustainability issue and expand on its details, root cause, and impact, supported by scientific evidence. ETD week 7-8.

Presentation-midterm: Students will present their issue to the class as described in their midterm paper, students can use video, audio, and any other creative way to present their findings and ideas. The presentation requires to cover the following sections, Introduction (10%), Industry environmental impacts (30%), sustainability issues (30%), conclusions, clear presentation, and well supported (references) (30%). Week 7-8

Final paper: The final paper shall be solution-focused, it is the solution to the sustainability issues presented in the midterm. The paper will focus on strategies for enhancing sustainability. The final paper will include an abstract (5%), introduction (10%), literature review (15%), discussion (35%), and conclusion (30%), and references (5%). The final paper should not exceed 15 pages (not including references). Final exam period.

Course Schedule

Week 1-2

Introduction: Current state of climate change and sustainability in Canada and globally, IPCC report and Canada's Sustainable Future: Progress Report. Natural systems and sustainability, is our understanding of sustainability compatible with natural systems?

Week 3-4

Sustainability definitions and approaches. Guest speaker, William Rees, Professor Emeritus at UBC School of Community and Regional Planning, Applied Science, ecological footprint and earth's biocapacity.

Week 5-6

Methods for evaluating the environmental impacts of complex systems, carbon footprint, ecological footprint and water footprint. Guest speaker, Hanspeter Schreier, Professor Emeritus Faculty of Land and Food Systems, water footprint, virtual water.

Week 6

Typification and characterization of common wastes and pollutants produced by different food industry sectors and their impacts on human health and the environment.

Week 7-8

Student's Presentations on the environmental impacts of particular food industries/food systems, sustainability issues. Midterm paper deadline.

Week 9

Overview of the ISO 14001 Environmental Management System (EMS) Certification. Guest speaker Rick Everest, Sustainability Director, Food Packaging, CKF Packaging, Vancouver, BC.

Week 10

Developing and Implementing an Environmental Management System (EMS)

Week 11

This week is dedicated to review environmental pollutants that originate from non-food industries but that constitute a constant risk for food contamination.

Week 12-13

Discussion - Creating a regenerative sustainable food industry/food system. Pathways to effect positive change, education, policy making, designing new food processes, new agri-food methods and technology.

Course Readings (final list and reading load will be updated by end of summer to reflect new findings, research)

Week 1

IPCC (2018). Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)] (24 pages)

Week 2

Rees, W. E. (1995). Achieving sustainability: reform or transformation? *Journal of Planning Literature*, *9*(4), 343-361.

Rees, W. E. (2015). Economics vs the Economy. Retrieved from: https://www.postcarbon.org/economics-vs-the-economy/#social-constructs-and-social-reality (18 pages)

Rees, W. (2010). What's blocking sustainability? Human nature, cognition, and denial. *Sustainability: Science, Practice and Policy*, *6*(2), 13-25.

Mace, G. M. (2012). The limits to sustainability science: ecological constraints or endless innovation? *PLoS Biol*, *10*(6), e1001343. (2 pages)

Matthews, J. H., & Boltz, F. (2012). The shifting boundaries of sustainability science: are we doomed yet?. *PLoS Biol*, *10*(6), e1001344. (4 pages)

Week 3

Robinson, J., & Cole, R. J. (2015). Theoretical underpinnings of regenerative sustainability. Building Research & Information, 43(2), 1-11.

O'Riordan, J., Sandford, R. W., & Harford, D. (2015). The Climate Nexus: Water, Food, Energy and Biodiversity. Rocky Mountain Books Ltd. pp 1-7 and 117-145.

William Rees "Ecological Footprint" Link: Legg, R., Moore, J., Kissinger, M., Rees, W. E. Ecological Footprint, Concept of." In: Levin S.A. (ed.) Encyclopedia of Biodiversity, second edition, Vol. 2: 701-713. Waltham, MA: Academic Press.

Week 4

Moore, J., Kissinger, M., & Rees, W. E. (2013). Urban metabolism and ecological footprint assessment of Metro Vancouver. Journal of environmental management, 124, 51-61.

Kissinger, M., Sussman, C., Moore, J., & Rees, W. E. (2013). Accounting for the ecological footprint of materials in consumer goods at the urban scale. Sustainability, 5(5), 1960-1973.

Kissinger, M., Sussmann, C., Moore, J., & Rees, W. E. (2013). Accounting for greenhouse gas emissions of materials at the urban scale-relating existing process life cycle assessment studies to urban material and waste composition. (9 pages)

Week 5

Analyze the content of the following website prior to class: HansPeter, S. (2014). Water footprint and virtual water. Retrieved from: https://waterfootprint.org/en/

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Week 6

Visit the National Pollutant Release Inventory and obtain data from a specific food site that you know (ex. Maple Leaf, Saputo, etc.): Government of Canada (2018). National pollutant release inventory. Retrieved from https://www.canada.ca/en/services/environment/pollution-waste-management/national-pollutant-release-inventory.html

Week 7-10 No readings

Week 11 Visit two of these websites, evaluate the impact of two contaminant examples from each link you've selected.

Government of Canada (2019). Environmental contaminants. Retrieved from: https://www.canada.ca/en/health-canada/services/food-nutrition/food-safety/chemical-contaminants/environmental-contaminants.html

Government of Canada (2019). Food-Processing-Induced Chemicals. Retrieved from: https://www.canada.ca/en/health-canada/services/food-nutrition/food-safety/chemical-contaminants/food-processing-induced-chemicals.html

Government of Canada (2016). Health Canada's maximum levels for chemical contaminants in food. Retrieved from: https://www.canada.ca/en/health-canada/services/food-nutrition/food-safety/chemical-contaminants/maximum-levels-chemical-contaminants-foods.html

Government of Canada (2020). List of contaminants and other adulterating substances in foods. Retrieved from: https://www.canada.ca/en/health-canada/services/food-nutrition/food-safety/chemical-contaminants/contaminants-adulterating-substances-foods.html

Week 12

Dale, A., Robinson, J., King, L., Burch, S., Newell, R., Shaw, A., & Jost, F. (2020). Meeting the climate change challenge: local government climate action in British Columbia, Canada. Climate Policy, 20(7), 866-880.

Świąder, M., Lin, D., Szewrański, S., Kazak, J. K., Iha, K., van Hoof, J., ... & Altiok, S. (2020). The application of ecological footprint and biocapacity for environmental carrying capacity assessment: A new approach for European cities. Environmental Science & Policy, 105, 56-74.

Week 13

Explore the global footprint of countries in the world, their ecological deficit/reserve, and the differences between ecological footprint and biocapacity at the following website: Global

Footprint Network (2019). Ecological Footprint Explorer. Retrieved from: http://data.footprintnetwork.org/#/

Academic Integrity

The academic enterprise is founded on honesty, civility, and integrity. All UBC students are expected to behave as honest and responsible members of an academic community. At the most basic level, this means submitting only original work done by you and acknowledging all sources of information or ideas, and attributing them to others as required. This also means you should not cheat, copy, or mislead others about what is your work.

It is the student's obligation to learn, understand and follow the standards for academic honesty. Students must be aware that standards at the University of British Columbia may be different from those in secondary schools or at other institutions.

Violations of academic integrity lead to the breakdown of the academic enterprise, and therefore serious actions are taken. Plagiarism or cheating may result in a mark of zero on an assignment, exam, or course. More serious consequences may apply if the matter is referred to the President's Advisory Committee on Student Discipline. Academic misconduct may result in a one-year suspension from the University and a notation of academic discipline on the student's record.

The UBC library has a useful Academic Integrity website that explains what plagiarism is and how to avoid it. If a student is in any doubt as to the standard of academic honesty in a particular course or assignment, then the student must consult with the instructor as soon as possible. A more detailed description of academic integrity, including the University's policies and procedures, may be found in the Academic Calendar. All coursework is required to be submitted to Turnitin.com for review.

University Policies

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions.

Details of the policies and how to access support are available on the UBC Senate website.

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Institute of Food Technologists (IFT)

UBC's Food Science Program is one of few in Canada that are approved by the Institute of Food Technologists (IFT), an internationally recognized leader in undergraduate education standards for degrees in Food Science. Programs with this approval badge are recognized as delivering a comprehensive Food Science education that covers 55 essential learning outcomes (ELOs) established by the IFT organization. Further information about the IFT ELOs is available as a detailed report here. The highlighted ELOs below are covered in this course.

Institute of Food Technologists Essential Learning Objectives (IFT ELOs)

Food chemistry (FC)

FC.1. Discuss the major chemical reactions that limit the shelf life of foods.

FC.2. Explain the chemistry underlying the properties and reactions of various food components.

FC.3. Apply food chemistry principles used to control reactions in foods.

FC.4. Demonstrate laboratory techniques common to basic and applied food chemistry.

FC.5. Demonstrate practical proficiency in a food analysis laboratory.

FC.6. Explain the principles behind analytical techniques associated with food.

FC.7. Evaluate the appropriate analytical technique when presented with a practical problem.

FC.8. Design an appropriate analytical approach to solve a practical problem.

Food microbiology (FM)

FM.1. Identify relevant beneficial, pathogenic, and spoilage microorganisms in foods and the conditions under which they grow.

FM.2. Describe the conditions under which relevant pathogens are destroyed or controlled in foods.

FM.3. Apply laboratory techniques to identify microorganisms in foods.

FM.4. Explain the principles involved in food preservation via fermentation processes.

FM.5. Discuss the role and significance of adaptation and environmental factors (e.g., water activity, pH, temperature) on growth response and inactivation of microorganisms in various environments.

FM.6. Choose relevant laboratory techniques to identify microorganisms in foods.

Food safety (FS)

FS.1. Identify potential hazards and food safety issues in specific foods.

FS.2. Describe routes of physical, chemical, and biological contamination of foods.

FS.3. Discuss methods for controlling physical, chemical and biological hazards.

FS.4. Evaluate the conditions, including sanitation practices, under which relevant pathogenic microorganisms are commonly controlled in foods.

FS.5. Select appropriate environmental sampling techniques.

FS.6. Design a food safety plan for the manufacture of a specific food.

Food engineering and processing (FE)

FE.1. Define principles of food engineering (mass and heat transfer, fluid flow, thermodynamics).

FE.2. Formulate mass and energy balances for a given food manufacturing process.

FE.3. Explain the source and variability of raw food materials and their impact on food processing operations.

FE.4. Design processing methods that make safe, high-quality foods.

FE.5. Use unit operations to produce a given food product in a laboratory or pilot plant.

FE.6. Explain the effects of preservation and processing methods on product quality.

FE.7. List properties and uses of various packaging materials and methods.

FE.8. Describe principles and practices of cleaning and sanitation in food processing facilities.

FE.9. Define principles and methods of water and waste management.

Sensory science (SS)

SS.1. Discuss the physiological and psychological basis for sensory evaluation.

SS.2. Apply experimental designs and statistical methods to sensory studies.

SS.3. Select sensory methodologies to solve specific problems in food.

Quality assurance (QA)

QA.1. Define food quality and food safety terms.

QA.2. Apply principles of quality assurance and control.

QA.3. Develop standards and specifications for a given food product.

QA.4. Evaluate food quality assessment systems (e.g. statistical process control).

Food laws and regulations (FL)

FL.1. Recall government regulatory frameworks required for the manufacture and sale of food products.

FL.2. Describe the processes involved in formulating food policy.

FL.3. Locate sources of food laws and regulations.

FL.4. Examine issues related to food laws and regulations.

Data and statistical analysis (DS)

DS.1. Use statistical principles in food science applications.

DS.2. Employ appropriate data collection and analysis technologies.

DS.3. Construct visual representation of data.

Critical thinking and problem solving (CT)

CT.1. Locate evidence-based scientific information resources.

CT.2. Apply critical thinking skills to solve problems.

CT.3. Apply principles of food science in practical, real-world situations and problems.

CT.4. Select appropriate analytical techniques when presented with a practical problem.

CT.5. Evaluate scientific information.

Food science communication (CM)

CM.1. Write relevant technical documents.

CM.2. Create oral presentations.

CM.3. Assemble food science information for a variety of audiences.

Professionalism and leadership (PL)

PL.1. Demonstrate the ability to work independently and in teams.

PL.2. Discriminate tasks to achieve a given outcome

PL.3. Describe social and cultural competence relative to diversity and inclusion.

PL.4. Discuss examples of ethical issues in food science.