Global Nitrogen Innovation Center for Clean Energy & the Environment

EMERGING NITROGEN TECHNOLOGY AND SUSTAINABILITY CHALLENGES FROM FARM TO FORK

Spring 2025

Draft Syllabus Subject to Some Change Prior to Jan 2025

Instructor(s):
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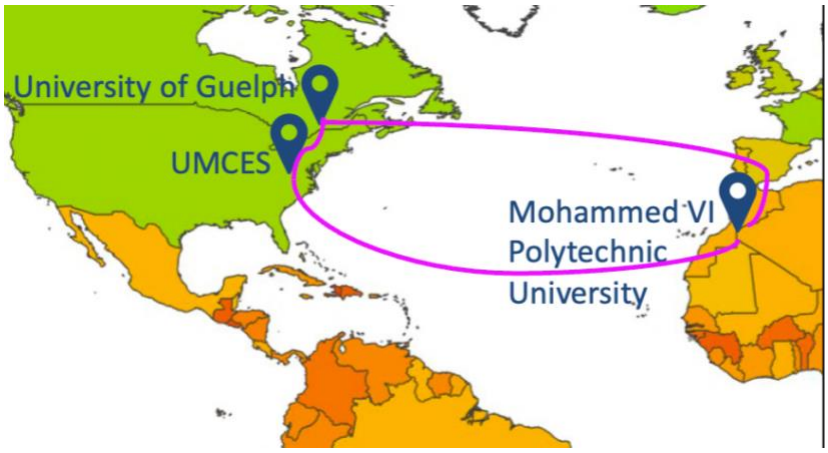
Dr. Lora Harris (harris@umces.edu), UMCES
Dr. Xin Zhang (xin.zhang@umces.edu), UMCES
Dr. Claudia Wagner-Riddle (cwagnerr@uoguelph.ca), Univ. of Guelph
Dr. Bruno Gerard (bruno.gerard@um6p.ma), UM6P

Curriculum fulfillment:
elective

Prerequisites:
N/A

Course meeting details:
Day of week: Tuesdays
Times: 11:00 am - 1:50 pm EST
Originating Site: UMCES Appalachian Lab
Zoom link: Provide upon registration

Course Objectives / Overview



This unique course offered by the Global Nitrogen Innovation Center for Clean Energy & the Environment (NICCEE) brings together interdisciplinary graduate students from three countries: the U.S. (UMCES), Canada (University of Guelph and other participating universities), and Morocco (UM6P). This course will allow students to investigate action-oriented solutions to address the challenge of sustainable nitrogen management.

This course is focused on student-led learning and will provide students with an opportunity to collaborate with local stakeholders and international peers. It will provide students with transdisciplinary professional development regarding science communication, facilitation skills, co-production, and understanding emotional intelligence. Through the course, students will engage with local stakeholders to understand emerging nitrogen technology and sustainability challenges from farm to fork. Students will also participate in group discussions and synthesize varying world

perspectives. This course is intended to be relevant, timely, and useful in the contexts where students may take their careers.

More specifically, this course will:

- Increase understanding of emerging nitrogen technology and green ammonia
- Foster interdisciplinary collaboration and provide hands-on experience to understand real-world challenges of nitrogen management
- Cultivate critical thinking and analytical skills through discussions and comparative analysis of nitrogen practices and policies
- Develop science communication and collaboration skills, preparing students to communicate effectively across disciplines

Class Discussions

This course has a significant discussion component, allowing students to explore and compare nitrogen management practices and policies across NICCEE Center participating countries (US, UK, Canada, Morocco) and worldwide. Topics include policy frameworks, technological innovations, and cultural considerations, including:

- What factors (*e.g.*, political, economic, environmental) influence the development and implementation of nitrogen policies, and how?
- How do cultural attitudes and practices regarding agriculture and food production influence nitrogen management?
- How do government initiatives and private sector involvement influence the adoption of new nitrogen technologies?
- How can policymakers balance agricultural productivity with environmental sustainability? How do such needs vary across the world?
- What role does international cooperation play in addressing global nitrogen challenges?
- How do we bridge communication gaps between scientists, policymakers, industry and agriculture?

Expected Learning Outcomes

At the end of this course, students will

- Describe NUE, green ammonia, and key issues related to fertilizer and energy production
- Gain practical experience in identifying, communicating with, and collaborating with local stakeholders regarding nitrogen management
- Develop a transnational, transdisciplinary lens to investigate emerging nitrogen technology and synthesize diverse perspectives
- Apply effective communication and collaboration practices to collaborate with classmates across time
- Build a reflective practice where students regularly assess what they are learning, struggling with, thinking about, and wanting to know more about.

Expected Course Products

Stakeholder engagement: Outside of class, students will engage with local stakeholders, such as farmers, industry representatives or policymakers, to understand their perspectives and challenges related to sustainable nitrogen management.

Mind maps: Students will develop and share a mind map that synthesizes nitrogen management concepts, challenges and solutions from their local stakeholder outreach.

Final deliverable: Students will apply course learning to develop a communication product on emerging nitrogen technologies and related sustainability challenges. This can take the form of a report, manuscript, visual resource (e.g., infographic, video, data visualization, summary table, zine), or other creative format (with instructor approval). At the end of the semester, students will share their final products with their classmates and local stakeholders.

Nitrogen Summer Institute – an extension of course

Students enrolled in the Issue Study Group are eligible to apply to attend the Nitrogen Summer Institute, held annually in Maryland. There, students will come together in person to connect with one another and gain hands-on experience communicating and working with stakeholders and the NICCEE community. Students will be empowered by NICCEE leadership to lead and facilitate the *Catalyst Lab* to promote creative and engaged work across the NICCEE.

Course Assessment / Grading

Assessment	**100%**
Class Participation	20%
Assignments	20%
Mind map development & presentation	25%
Final report/deliverable & presentation	30%
Reflective essay	5%

Tentative Weekly Course Schedule

Each week of class will include a reflective practice.
The first half of the course includes a greater emphasis on content while the second half of the course is process focused for development of mind maps, comparative work within and across nations, and fine-tuning of final projects.

Week	Date	Topic	Instructor(s) & guest speaker(s)
1	Jan. 27	Introduction and course overview. Survey and mind maps	Harris, Davis, Wagner, Gerard, Zhang
2	Feb. 3	**Module 1**. An Introduction to Nitrogen: Management, Agriculture, and Global Challenges	Dr. Xin Zhang
3	Feb. 10	**Module 2.** The Issue: Emerging Challenges and Opportunities for Enhancing NUE in Agri-Food and Energy Systems.	Dr. Bruno Gerard
4	Feb. 17	***Emotional Intelligence workshop***	
5	Feb. 24	**Module 3.** Policy: National Action Plan for Sustainable N Use	Dr. Claudia Wagner-Riddle TBD Guest Speaker
6	Mar. 3	***Process Module:*** *Interview protocols and strategic science communication*	Davis/Harris
7	Mar. 10	Field Module: first farm visit	
8	Mar. 17	Spring Break	
9	Mar. 24	**Module 4.** Technology: Green Ammonia at the Intersection of Energy and Food Security	Dr. Bruno Gerard Dr. Lora Harris Guest Speaker
10	Mar. 31	Mind Map Pair and Share	
11	Apr. 7	Iterative Revision of Mind Maps with stakeholders	
12	Apr. 14	Comparative Analyses	
13	Apr. 21	Comparative Analyses	
14	Apr. 28	Final Product Work	
15	May 5	Final Product Work	
16	May 12	Exam week: no final exam **Deadline for submitting final deliverables**	

Course Communication

Email and Google Drive

Readings will be shared via google drive.

Campus Policies

The University of Maryland Center for Environmental Science has drafted and approved various academic and research-related policies by which all students and faculty must abide. Please visit the following website for more information on the University of Maryland Center for Environmental Science Code of Academic Integrity and Policy III-1.00: Policy on Faculty, Student and Institutional Rights and Responsibilities for Academic Integrity.

Course-Specific Policies and Expectations

This course is interactive and focused on discussion and peer-exchanges. Students are expected to fully participate in course activities including completing all assignments and coming to class prepared to engage in group discussion. They are also expected to treat all participants with respect and to follow an agreed upon code of conduct.