

**NUTC261 - Sustainability on the Farm**  
**Fall 2022**

**Class Meetings:** Online, asynchronous

**Instructor(s):** Lead instructor: Kevin Cody, PhD

Dr. Cody will guide you through the course by facilitating discussions, offering feedback, grading assignments, and introducing each week's topic. When you have questions as you work through the course you can reach out to Dr. Cody at [kevin.cody@tufts.edu](mailto:kevin.cody@tufts.edu)

Lecturers: Timothy Griffin, PhD

Dr. Griffin will present the pre-recorded lectures.  
[timothy.griffin@tufts.edu](mailto:timothy.griffin@tufts.edu)

**Office Hours:** Email Dr. Cody anytime (will respond within 48 hours) or schedule an appointment via Zoom

**Semester Hour Units:** 3 Semester Hour Units

**Prerequisites:** Graduate standing or consent of instructor

**Course Description:** Agriculture is the single largest user of land and water, and thus, has broad environmental impacts. Gains in productivity over the last five decades have met increasing demands without increasing agricultural land area in the U.S., but the environmental, economic and social costs have been considerable.

The costs and benefits of the *status quo* and of alternatives can be analyzed at different scales (e.g., farm level, watershed level). We will profile current conventional and alternative approaches to food production in the U.S. and assess their impacts. Students will examine environmental and conservation concerns, as well as economic and social outcomes, and evaluate policy responses within the context of meeting future food demands.

**Course Goals:** Upon completion of this course, students will be able to do the following:

- Provide a nuanced assessment of sustainability outcomes across domains.
- Explain the primary impacts on air, water, and soil currently attributed to U.S. agriculture
- Illustrate the relationship between the major structural trends in the U.S. agricultural sector over the past century, the resulting effects on sustainability, and the policy response
- Compare the sustainability of conventional and alternative agricultural practices and food systems
- Develop proposals for increasing sustainability of agricultural production in all three domains (i.e., social, ecological, economic)

**Texts or Materials:** There are several *required* readings for the class intended to compliment what is covered in online lectures. All readings will be posted on the Canvas course site (<https://canvas.tufts.edu>) with one exception. There is one required book for the course by Tom Philpott, *Perilous Bounty: The Looming Collapse of American Farming and How We Can Prevent It*, published in 2020 by Bloomsbury Publishing. This book is available at the Tisch Library in print and online. (<https://tischlibrary.tufts.edu/>)

*Supplemental* readings will be posted for each class if you would like to have access to more information about the topics than we will cover. Lectures and readings for each week will be posted at 12:01am, **Monday morning** of that week.

**Academic Conduct:** Each student is responsible for upholding the highest standards of academic integrity, as specified in the [Friedman School's Policies and Procedures Handbook](#) and Tufts University policies (<https://students.tufts.edu/student-affairs/student-code-conduct/academic-integrity-resources>). It is the responsibility of each student to understand and comply with these standards, as violations will be sanctioned by penalties ranging from failure on an assignment and the course to dismissal from the school.

Plagiarism will not be tolerated under any circumstance. Avoiding plagiarism is outlined in section IV of the above booklet. We reserve the right to use the anti-plagiarism program, [Turnitin.com](#), to evaluate student work. Please speak with one of the instructors if you have any questions about these policies.

**Accommodation of Disabilities:** Tufts University is committed to providing equal access and support to all students through the provision of reasonable accommodations so that each student may access their curricula and achieve their personal and academic potential. If you have a disability that requires reasonable accommodations, please contact the Friedman School Assistant Dean of Student Affairs at 617-636-6719 to make arrangements for determination of appropriate accommodations. Please be aware that accommodations cannot be enacted retroactively, making timeliness a critical aspect for their provision.

**Diversity Statement:** We believe that the diversity of student experiences and perspectives is essential to the deepening of knowledge in this course. We consider it part of our responsibility as instructors to address the learning needs of all of the students in this course. We will present materials that are respectful of diversity: race, color, ethnicity, gender, age, disability, religious beliefs, political preference, sexual orientation, gender identity, socioeconomic status, citizenship, language, or national origin among other personal characteristics.

## Assessment and Grading

### **Discussion Posts x 5 (30%)**

Substantive discussion is a critical element contributing to understanding and integration of the concepts and topics covered in this course. To foster discussion during the course, instructors will provide a prompt based on the lectures and reading material.

You will write **5 discussion posts** throughout the semester. For each post, you will write a **250–300-word response**. Your posts can include links to relevant websites, articles, and images. You can also “connect” your post to others and include comments and/or “likes” to help build engagement among course participants. Your level of engagement with others will count towards your participation grade.

Posts on topics listed below are due on Sunday by 11:55 pm on the following dates:

1. Sustainability and Agroecology—9/18
2. Structural Trends and Resilience—10/2
3. Soil and Water—10/16
4. Pests and Livestock—10/30
5. Energy and Conservation—11/13

### **Participation (10%)**

To encourage participation and engagement in this asynchronous online course, interacting with and responding to your peers’ discussion posts will be essential. You can do this by “connecting” your posts in Padlet, and/or referring to their posts in your own response. Additional “check-ins” will happen throughout the semester, allowing you to provide feedback and weigh in on the course in general.

### **Grant Proposal (40% total)**

A major component of this course will entail you drafting a partial project grant proposal that addresses agricultural sustainability for a real or hypothetical organization. The purpose of your proposal must be to enhance one or more dimensions of sustainability (i.e., ecological, social, economic) and it must be designed for small-scale implementation (e.g., farm level, local municipal level, local watershed level, etc.). Example projects would be designing a sustainable food procurement program for your business – as in Case Study #2 – or developing a program to bring produce to a low-income neighborhood. You must be explicit about which dimension(s) of sustainability your project addresses and how it addresses it. Be creative, but remember the foundation for your project must be evidence-based. You should orient your proposal toward your intended funding agency, which may be internal or external to your organization. Examples of funding opportunities and funded applications will be provided.

Additional information will be provided on each of the parts listed below, including examples from funded research projects submitted by New Entry Sustainable Farming Project, a program of the Friedman School that trains new and beginning farmers.

Your proposal will be submitted in a multi-step process and will include the following parts:

- Prospectus (10%)
  - o Summary and introduction:



Your final essay will be due on Canvas by 11:55 p.m. on Thursday, 12/15.

**Assignment Percentages and Grading Range:**

Five discussion posts (6% each):	30%
Grant—Prospectus	10%
Grant—Literature Review	10%
Grant—Project Design	10%
Grant—Final Proposal	10%
Final Essay	20%
Participation	10%

A passing grade in the course is B- or better. Course grades will be based on the below (subject to revision during the course):

A	> 94%
A-	90 - <94%
B+	87 - <90%
B	84 - <87%
B-	80 - <84%

**Late Assignments and Exams:** Assignments received after the deadline will receive a 5 percentage point deduction, and a 2.5 percentage point deduction will be applied for every additional 24 hours until the assignment is successfully submitted. Students who are unable to complete an assignment on time for any reason should notify me by email **prior** to the deadline, with a brief explanation for why the extension is being requested. It is at my discretion to grant extensions on assignments. All assignments are due on **Sundays at 11:55 pm (Eastern Time), unless otherwise indicated** on the Canvas site.

**Course Topics and Assignments Schedule at a Glance:**

*Provide in this section a summarized list (quick view) of your course’s class dates, course topics, lecturers, and assignments for each class (as appropriate). Include at the end of this section the disclaimer: This schedule is subject to modification at the instructor’s discretion.*

Wk #	Dates	Topic/Lectures	Assignments & Due Dates
1	9/6-9/11	Course Introduction: Sustainability and Systems Thinking	Introductions via Canvas Due 9/11
2	9/12-9/18	Agricultural Policy in Context	Discussion Post # 1 Due 9/18
3	9/19-9/25	Resilience and Shocks: The COVID-19 Example	Grant Prospectus Due 9/25

4	9/26-10/2	Structural Trends in U.S. Agriculture	Discussion Post # 2 Due 10/2
5	10/3-10/9	Water Use and Quality	Literature Review Due 10/9
6	10/10-10/16	Managing Soils and Nutrients	Discussion Post # 3 Due 10/16
7	10/17-10/23	Pest Management and Genetics	Project Design Due 10/23
8	10/24-10/30	Livestock and Sustainability	Discussion Post # 4 Due 10/30
9	10/31-11/6	Energy Use and Climate Change	
10	11/7-11/13	Farm Bill and Conservation Programs	Discussion Post # 5 (Peer review) Due 11/13
11	11/14-11/20	Local and Regional Food Systems and Urban Agriculture	Final Grant Proposal Due 11/20
12	11/21-11/27	Sustainability Certifications & Labels	
13	11/28-12/4	Agroecology and Food Sovereignty	
14	12/5-12/11	The Future of Food and Agriculture	Final Essay Due 12/11

---

### **Course Topics, Learning Objectives and Assignments**

This schedule is subject to modification at the instructor's discretion

#### **Week 1: Course Introduction: Sustainability and Systems Thinking**

##### **Lectures:**

- Introduction to Sustainability and Agroecology
- Systems Thinking in Agriculture

##### **Learning Objectives:**

Upon completion of this class, students will be able to:

- Define sustainability and describe its three pillars
- Apply systems concepts to agroecosystems
- Compare and contrast the structure and function of natural versus agroecosystems
- Explain reasons for human intervention in agroecosystems using the concepts of nutrient cycling and energy flow

##### **Required Readings:**

- Wezel, A., Casagrande, M., Celette, F., Vian, J. F., Ferrer, A., & Peigné, J. (2014). Agroecological practices for sustainable agriculture. A review. *Agronomy for sustainable development*, 34(1), 1-20.
- Francis, C., Lieblein, G., Gliessman, S., Breland, T. A., Creamer, N., Harwood, R., ... & Poincelot, R. (2003). Agroecology: The ecology of food systems. *Journal of sustainable agriculture*, 22(3), 99-118.
- Sundkvist, Å., Milestad, R., & Jansson, A. (2005). On the importance of tightening feedback loops for sustainable development of food systems. *Food policy*, 30(2), 224-239.
- Union of Concerned Scientists (2017). What is sustainable agriculture? Reports & Multimedia/Explainer.

#### **Assignments:**

- Introductions via Canvas

### **Week 2: Ag Policy in Context**

#### **Lectures:**

- Regenerating Agriculture and the Food System

#### **Learning Objectives:**

Upon completion of this class, students will be able to:

- Describe turning points in American agricultural history and policy that have shaped today's agricultural landscape
- Critique key agricultural policies over the last 150 years using an integrative framework focused on goals, motivation, mechanisms, dimensions of sustainability and outcomes

#### **Required Readings:**

- Tweeten, L., & Zulauf, C. (2008). Farm price and income policy: lessons from history. *Agribusiness: An International Journal*, 24(2), 145-160.
- Hinrichs, C. C. (2014). Transitions to sustainability: a change in thinking about food systems change?. *Agriculture and human values*, 31(1), 143-155.
- USDA Economic Research Service (2000). U.S. Farm Policy: The first 200 years. *Agricultural Outlook*.

#### **Assignments:**

- Discussion Post # 1

### **Week 3: COVID-19 Response and Shocks**

#### **Lectures:**

- Frameshift: How do farms shift their models during COVID
- Agricultural Workers and COVID: Most essential and vulnerable food system workers

#### **Learning Objectives:**

Upon completion of this class, students will be able to:

- Explain how and why crises like the global pandemic can have widespread ramifications on the food system
- Propose solutions for increasing resilience and mitigating risks that result of crises and shocks in the food system

**Required Readings:**

- Pyle, A., Eichinger, M., Garst, B., Mobley, C., Griffin, S., Hossfeld, L., ... & Saunders, H. (2021). Disease and disaster: Navigating food insecurity in a community affected by crises during COVID-19. *Journal of Agriculture, Food Systems, and Community Development*, 10(3), 1-18.
- Ransom, E. et al. (2020). Why farmers are dumping milk down the drain and letting produce rot in fields. *The Conversation*

**Assignments:**

- Grant Prospectus

**Week 4: Structural Trends in U.S. Agriculture**

**Lectures:**

- Structural Trends and their Drivers in the Agricultural Sectors: Part 1—Drivers of structural change
- Structural Trends and their Drivers in the Agricultural Sectors: Part 2—Structural change since 1900
- Structural Trends and their Drivers in the Agricultural Sectors: Part 3—Changing relationships between humans and the food system

**Learning Objectives:**

Upon completion of this class, students will be able to:

- Identify the major drivers of structural trends in US agriculture through its history
- Describe how the major drivers of structural trends have contributed to the development of modern agriculture in the US
- Contrast the benefits and detriments of structural trends

**Required Readings:**

- Weis, T. (2013). Breadbasket contradictions: The unstable bounty of industrial agriculture in the United States and Canada. In *Food security, Nutrition and Sustainability* (pp. 49-62). Routledge.
- USDA Economic Research Service (2005). The 20th Century Transformation of U.S. Agriculture and Farm Policy.
- USDA Economic Research Service (2015). Agricultural Productivity Growth in the United States: Measurement, Trends, and Drivers. Report Summary.

**Assignments:**

- Discussion Post # 2

**Week 5: Water Use and Quality****Lectures:**

- Water Use and Quality: Part 1—Water use
- Water Use and Quality: Part 2—Water quality

**Learning Objectives:**

Upon completion of this class, students will be able to:

- Explain the major biological processes that guide water use and quality at the farm level
- Describe the major policies that affect water use and quality at the farm level
- Demonstrate how on-farm management decisions affect water use and quality on a landscape and watershed scale
- Develop hypotheses on how producers can maintain or increase output while ensuring sustainable water use and quality

**Required Readings:**

- Philpott, Tom. (2020). *Perilous Bounty: The looming collapse of American farming and how we can prevent it*. Bloomsbury Publishing
  - Introduction
  - Ch. 1: High and Dry
  - Ch. 2: The Flood Next Time
  - Ch. 3: Pumping Air
- USDA Economic Research Service. (2019). Agricultural Resources and Environmental Indicators, Group 3: “Natural Resources and Conservation,” pgs. 84-96.
- VIDEO: Water & Power: A California Heist (2017)

**Assignments:**

- Literature Review

**Week 6: Managing Soil and Nutrients****Lectures:**

- Managing Soils and Nutrients: Part 1—Soil basics and erosion
- Managing Soils and Nutrients: Part 2—Nutrient needs, sources, and losses
- Managing Soils and Nutrients: Part 3—Farm management and practices

**Learning Objectives:**

Upon completion of this class, students will be able to:

- Outline soil erosion as an ecological issue in the U.S. and its connection to management practices
- Illustrate tradeoffs farmers face when considering one nutrient source or management practice over another

- Generate potential solutions to soil and nutrient management challenges at the farm-level to increase sustainability

**Required Readings:**

- Gliessman, Steve. (2015). Chapter 8: "Soil," pgs. 99-114, in *Agroecology: The ecology of sustainable food systems (3<sup>rd</sup> edition)*. Routledge.
- Philpott, Tom. (2020). *Perilous Bounty: The looming collapse of American farming and how we can prevent it*. Bloomsbury Publishing
  - Ch. 4: Empire of Dirt
- Erisman, J. W., Sutton, M. A., Galloway, J., Klimont, Z., & Winiwarter, W. (2008). How a century of ammonia synthesis changed the world. *Nature Geoscience*, 1(10), 636-639.
- Davis AS, Hill JD, Chase CA, Johanns AM, Liebman M (2012). Increasing Cropping System Diversity Balances Productivity, Profitability and Environmental Health. *PLoS ONE* 7(10): e47149. doi:10.1371/journal.pone.0047149

**Assignments:**

- Discussion Post # 3

**Week 7: Pest Management and Genetics**

**Lectures:**

- Pest Management and Pesticides
- Genetic Improvement in Agriculture

**Learning Objectives:**

Upon completion of this class, students will be able to:

- Define pesticides and describe why they are used (or not) in cropping systems
- Describe some concerns about the effects of pesticides on public health and the environment
- Analyze research on the benefits and costs of GMO technology and identify critical knowledge gaps

**Required Readings:**

- Philpott, Tom. (2020). *Perilous Bounty: The looming collapse of American farming and how we can prevent it*. Bloomsbury Publishing
  - Ch. 5: Failing Upward
- Benbrook, C. M. (2012). Impacts of genetically engineered crops on pesticide use in the US--the first sixteen years. *Environmental Sciences Europe*, 24(1), 1-13.
- Magdoff, F., & Van Es, H. (2000). Soil Health, Plant Health, and Pests in *Building Soils for Better Crops: Sustainable Soil Management*, pgs. 77-87. Sustainable Agriculture Research and Education.

**Assignments:**

- Project Design

**Week 8: Livestock and Sustainability**

**Lectures:**

- Global Grazing Livestock: Production and impacts
- Livestock Production in the US

### **Learning Objectives:**

Upon completion of this class, students will be able to:

- Identify resources use and impacts of grazing livestock globally.
- Knowledge of primary livestock categories in the U.S. including consumer issues and sustainability concerns.

### **Required Readings:**

- Peters, C. J., Picardy, J. A., Darrouzet-Nardi, A., & Griffin, T. S. (2014). Feed conversions, ration compositions, and land use efficiencies of major livestock products in US agricultural systems. *Agricultural Systems*, 130, 35-43.
- Trusts, P. C., & Hopkins, J. (2008). Putting meat on the table: Industrial farm animal production in America. *A Report of the Pew commission on industrial Farm Animal Production*.
- Philpott, Tom. (2020). *Perilous Bounty: The looming collapse of American farming and how we can prevent it*. Bloomsbury Publishing
  - Ch. 6: Gully Washers
- USDA Economic Research Service. "Animal Products."
  - Animal Policy & Regulatory Issues; Cattle & Beef; Dairy; Hogs & Pork; Poultry & Eggs <https://www.ers.usda.gov/topics/animal-products/>

### **Assignments:**

- Discussion Post # 4

## **Week 9: Energy Use and Climate Change**

### **Lectures:**

- Climate Change, Energy Use, and Biofuels: Part 1—Climate change
- Climate Change, Energy Use, and Biofuels: Part 1—Energy use and biofuels

### **Learning Objectives:**

Upon completion of this class, students will be able to:

- Describe how agriculture contributes to, and is affected by, climate change
- Describe the major policies and policy tools that address air quality, energy use, and climate change, and how these policies (can) affect farm management
- Summarize the opportunities to mitigate, and adapt to, climate change at the farm level, and the difficulties associated with doing so
- Explain the current and potential impacts that biofuels may have on sustainability
- Propose changes to energy policy and infrastructure that could reduce the carbon footprint of the U.S. food system.

### **Required Readings**

- Canning, Patrick, Ainsley Charles, Sonya Huang, Karen R. Polenske, and Arnold Waters. (2010). Energy Use in the U.S. Food System, ERR-94, U.S. Dept. of Agri., Econ. Res. Serv., pgs. 1-27.

- Pelletier, N., Audsley, E., Brodt, S., Garnett, T., Henriksson, P., Kendall, A., ... & Troell, M. (2011). Energy intensity of agriculture and food systems. *Annual review of environment and resources*, 36.
- Weber, C. L., & Matthews, H. S. (2008). Food-miles and the relative climate impacts of food choices in the United States. *Environ. Sci. Technol.* 2008, 42, 10, 3508–3513.
- Philpott, Tom. (2020). *Perilous Bounty: The looming collapse of American farming and how we can prevent it*. Bloomsbury Publishing
  - o Ch. 7: The Big Lift
  - o Ch. 8 The Future of the Farm

### **Week 10: Farm Bill and Conservation Programs**

#### **Lectures:**

- Introduction to the Farm Bill
- Conservation Programs: Part 1—Working lands programs
- Conservation Programs: Part 1—Land retirement programs

#### **Learning Objectives:**

Upon completion of this class, students will be able to:

- Describe the contents of and process of creating the Farm Bill and the structure of major conservations programs
- Describe changes in programs, priority and spending for the 2014 Farm Bill compared to the 2008 FB
- Explain how a producer's adoption of major conservation programs would affect farm management decisions
- Evaluate the programs of the Natural Resource Conservation Service (NRCS) for addressing the most critical environmental challenges in agriculture

#### **Required Readings:**

- USDA Economic Research Service: Agriculture Improvement Act of 2018: Highlights and Implications. <https://www.ers.usda.gov/agriculture-improvement-act-of-2018-highlights-and-implications/>
- Ayazi, H., & Elsheikh, E. (2015). The US Farm Bill: Corporate Power and Structural Racialization in the US Food System. Hass Institute for a Fair and Inclusive Society.

#### **Assignments:**

- Discussion Post # 5

### **Week 11: Local and Regional Food Systems and Urban Agriculture**

#### **Lectures:**

- Sustainable Regional Food Systems: A Northeast perspective
- Urban Agriculture: Benefits and challenges

#### **Learning Objectives:**

Upon completion of this class, students will be able to:

- Compare the challenges that producers and buyers face when operating within a local food system
- Critique popular claims made about local foods using available scientific evidence
- Describe the potential ecological, social and economic benefits for urban agriculture
- Recommend strategies for promoting urban agriculture and alternative food movements that would result in a more sustainable and equitable food system.

**Required Readings:**

- Brodt, S., Kramer, K. J., Kendall, A., & Feenstra, G. (2013). Comparing environmental impacts of regional and national-scale food supply chains: A case study of processed tomatoes. *Food Policy, 42*, 106-114.
- Fernandez, M., Goodall, K., Olson, M., & Méndez, V. E. (2013). Agroecology and alternative agri-food movements in the United States: Toward a sustainable agri-food system. *Agroecology and sustainable food systems, 37*(1), 115-126.
- Rogus, S., & Dimitri, C. (2015). Agriculture in urban and peri-urban areas in the United States: Highlights from the Census of Agriculture. *Renewable Agriculture and Food Systems, 30*(1), 64-78.

**Assignments:**

- Final Grant Proposal

**Week 12: Sustainability Certifications and Labels**

**Lectures:**

- Overview and Good Agricultural Practices
- Sustainability Claims: Fact and fiction

**Learning Objectives:**

Upon completion of this class, students will be able to:

- Evaluate market-based tools to increase sustainability in agricultural production
- Describe the major provisions of the Organic Standards
- Critique popular claims made about the sustainability and health of organic food
- Describe the Fair Trade standards, certification process, and rationale behind this initiative

**Required Readings:**

- Tuomisto, H. L., Hodge, I. D., Riordan, P., & Macdonald, D. W. (2012). Does organic farming reduce environmental impacts?—A meta-analysis of European research. *Journal of environmental management, 112*, 309-320.
- Constance, D. H., Choi, J. Y., & Lara, D. (2015). Engaging the organic conventionalization debate. In *Re-Thinking organic food and farming in a changing world* (pp. 161-185). Springer, Dordrecht.
- Jaffee, D. (2010). Fair trade standards, corporate participation, and social movement responses in the United States. *Journal of business ethics, 92*(2), 267-285.

**Week 13: Agroecology and Food Sovereignty**

**Lectures:**

- Agroecology and sustainable food movements
- Justice, equity, and sustainability on the farm

**Learning Objectives:**

Upon completion of this class, students will be able to:

- Describe the ways agroecology is used as a framework for food system transformation
- Compare various meanings and applications of agroecology at the farm scale with more conventional methods of production.
- Critique agroecology and food sovereignty in their potential, or lack there of, to scale up and out while addressing needs of growing populations

**Required Readings:**

- Holt-Giménez, E., & Altieri, M. A. (2013). Agroecology, food sovereignty, and the new green revolution. *Agroecology and sustainable Food systems*, 37(1), 90-102.
- FAO on 10 Elements of Agroecology

**Week 14: The Future of Food and Agriculture****Lectures:**

- Thinking Big: Sustainability and Food Security

**Learning Objectives:**

Upon completion of this class, students will be able to:

- Describe the merits and limitations of proposals to sustainably increase food production on a global scale
- Describe the trade-offs between achieving dietary recommendations and the resulting environmental impacts in the US
- Propose alternatives to current composition of U.S. agriculture that address critical social, environmental, and economic issues
- Evaluate alternative food movements and urban agriculture for the potential to contribute to large-scale transformation in the food system

**Required Readings:**

- Garnett, T., Appleby, M. C., Balmford, A., Bateman, I. J., Benton, T. G., Bloomer, P., ... & Godfray, H. C. J. (2013). Sustainable intensification in agriculture: premises and policies. *Science*, 341(6141), 33-34.
- Foley, J. A., Ramankutty, N., Brauman, K. A., Cassidy, E. S., Gerber, J. S., Johnston, M., ... & Zaks, D. P. (2011). Solutions for a cultivated planet. *Nature*, 478(7369), 337-342.
- Bernard, B., & Lux, A. (2017). How to feed the world sustainably: an overview of the discourse on agroecology and sustainable intensification. *Regional Environmental Change*, 17(5), 1279-1290.

**Assignments:**

- Final Essay