

**Tufts University, Friedman School of Nutrition Science and Policy**

**NUTC 0261 - Sustainability on the Farm  
Fall 2017**

**Class Meetings:** Online course

**Instructor:** Timothy Griffin  
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Room 125 Jaharis Building  
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**Teaching Assistant:** Tessa Salzman

**Office hours:** By appointment: Phone, Skype, email

**Graduate Credits:** 1 credit

**Prerequisites:** None

**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 will be analyzed at different scales (e.g., farm level, watershed level), along with a profile of current conventional and alternative approaches to food production in the U.S. Students will examine environmental and conservation concerns, as well as policy responses, within the context of meeting future food demands.

**Course Objectives:** *At the completion of this course, students will be able to:*

1. Explain the primary impacts on air, water, and soil currently attributed to U.S. agriculture
2. 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
3. Compare the sustainability of conventional and alternative agricultural practices and food systems
4. Develop proposals for increasing sustainability of agricultural production in all three dimensions (i.e., social, ecological, economic)

**Texts or Materials:**

There are a number of *required* readings for the class: these readings are intended to compliment what is covered in online lectures. All readings will be posted on the Canvas course site (<https://canvas.tufts.edu>). There are no required books to purchase for the class. *Supplemental* readings will be posted for each class if you would like to have access to more information about the topics that we will cover. Lectures and readings for each week will be posted by **Monday morning** of that week.

**Academic Conduct:**

Academic integrity, including avoiding plagiarism, is critically important. Each student is responsible for being familiar with the standards and policies outlined in the Friedman School's Policies and Procedures manual (<http://nutrition.tufts.edu/student/documents>).

It is the responsibility of the student to be aware of, and comply with, these policies and standards. In accordance with Tufts University's policy on academic misconduct, violations of standards of academic conduct will be sanctioned by penalties ranging from grade reduction or failure on an assignment; grade reduction or failure of a course; up to dismissal from the school, depending on the nature and context of any infraction. If you haven't already, please visit the Tufts website on academic integrity (<https://students.tufts.edu/student-affairs/student-life-policies/academic-integrity-policy>).

In particular, 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](https://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.

**Penalties for late or incomplete assignments:**

Please notify one of the instructors at least 48 hours in advance if you know you will be unable to meet a deadline, or as soon as possible in the event of an emergency. Assignments that are turned in late without advanced notice will be reduced by 5% (half a letter grade) the first day they are past due, and 5% each day thereafter. If you anticipate being unable to complete an assignment on time, please contact the instructors immediately.

**Assessment and Grading:**

This course consists of two worksheets (Census of Agriculture Activity and one case study), four (4) Discussion Forum posts, a program grant proposal, and a critique of your classmates' proposals. Please see the Canvas site for a detailed explanation of each of these assignments. Grades for each assignment (and for the course) will be awarded on the following scale: A- = 90% to 92.49%, A = 92.5% to 97.49%, A+ = 97.5% to 100%. Instructors will grade assignments and provide feedback within approximately one (1) week from the date of submission. Please see below for the grading weight for each assignment.

Assignment Weight

Census of Agriculture activity	10%
Case study	15%
Discussion forum posts	20%
Program grant proposal	35%
Critique of grant proposals	10%
Participation	10%
TOTAL	100%

**Assignments and Submission Instructions:**

All assignments should be submitted through Canvas. If you are having difficulty submitting an assignment through Canvas, you should submit your assignment as an email attachment to both of the instructors. 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 the instructors by email **prior** to the deadline, with a brief explanation for why the extension is being requested. It is at the discretion of the instructors to grant extensions on assignments. All assignments are due on ***Sundays at 11:55 pm, unless otherwise indicated*** on the Canvas site.

### **Due Dates for Assignments**

<b>Due date</b>	<b>Assignments due</b>
September 10	Student introductions (PowerPoint presentation)
September 17	Discussion Forum 1 (agroecology)
September 24	Census of Agriculture Activity
October 1	Grant Proposal: Introduction
October 8	Discussion Forum 2 (genetic engineering of crops)
October 15	Grant Proposal: Literature Review
October 22	Case Study
October 29	Discussion Forum 3 (agricultural intensification)
November 6	Discussion Forum 4 (organic and fair trade)
November 12	Grant Proposal: Project Design
December 1	Grant Proposal: all sections
December 10	Grant Proposal Critique

### **Final Project: Program Grant Proposal**

Each student will use the material covered throughout the course to develop a program grant proposal that addresses a specific component of agricultural sustainability. The ultimate goal of the proposal must be to enhance sustainability without reducing total agricultural output. Proposals may be designed for a real or hypothetical organization, and must include the following sections, each of which will be due at different points in the semester: introduction, literature review, and methods. More information will be provided on Canvas.

### **Discussion Forum:**

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 week’s lecture and reading material. Two students will be selected as “Discussion Leaders” to each write a **400 word** response to this prompt using peer reviewed or grey literature (i.e. periodicals, reports from government or non-government agencies). There will be four discussion prompts total during the course. Students should use keywords and concepts from that week’s lecture material to write their response. The remaining students in the class will then respond to what Discussion Leaders have posted in a thoughtful manner.

**Course Schedule:**

<b>Week of</b>	<b>Topic</b>
September 4	Course Introduction: Sustainability and Agricultural Systems
September 11	Agricultural Policy in Context
September 18	Structural Trends in the U.S. Agricultural Sector
September 25	Managing Soils and Nutrients
October 2	Pest Management and Genetics
October 9	Water Use and Quality
October 16	Livestock and Sustainability
October 23	Energy Use and Climate Change
October 30	Farm Bill and Conservation Programs
November 6	Organic and Fair Trade
November 13	Local and Regional Food Systems and Urban Agriculture
November 20	No Class – THANKSGIVING WEEK
November 27	Sustainability Certifications
December 4	The Future of Food and Agriculture

*This schedule is subject to modification at the discretion of the instructor.*

## Course Topics, Learning Objectives and Assignments:

### Week 1: Course Introduction (9/4)

#### Learning Objectives:

*By the end 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

#### Preparation for Class:

- Wilde. 2013 "Agriculture" in *Food Policy in the United States*.
- Sundvist. 2005. "On the importance of tightening feedback loops for sustainable development of food systems." *Food Policy*
- Gliessman. 2007. "The Agroecosystem Concept," Chapter 2 in *Agroecology: The Science of Sustainable Food Systems*

#### Assignments:

- **Student introductions:** Create one PowerPoint (or equivalent) slide with your picture, name and a brief description about what you do and why you are taking the course. Due by Sunday, September 10 at 11:55 pm.

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### Week 2: Agricultural Policy in Context (9/11)

#### Learning Objectives:

*By the end 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

#### Preparation for Class:

- USDA, ERS. U.S. Farm Policy: The First 200 Years. *USDA Agricultural Outlook, March 2000*.
- Tweeten and Zulauf. 2008. "Farm Price and Income Policy: Lessons from History"

**Assignments:**

- **Discussion Forum #1:** Agroecology
- **Grant Proposal:** Begin thinking about and writing the Introduction section for your Grant Proposal. Refer to the instructions under the assignments tab in Canvas. Due by Sunday, October 1 at 11:55pm.

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**Week 3: Structural Trends in U.S. Agriculture (9/18)****Learning Objectives:**

*By the end 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

**Preparation for Class:**

- O'Donoghue, E.J., Hoppe, R.A., Banker, D.E., Ebel, R., Fuglie, K., Korb, P., Livingston, M., Nickerson, C. and Sandretto, C. 2011. The changing organization of US farming. USDA Economic Research Service. Economic Information Bulletin. Number 88. US Government Printing Office, Washington, DC. Pages 1-17, 38-70.
- MacDonald, J.M., Korb, P. and Hoppe, R.A. 2013. Farm Size and the Organization of US Crop Farming. USDA Economic Research Service. Economic Research Report No. 152. US Government Printing Office, Washington, DC. Pages 4-38.
- ERS USDA. Agricultural Productivity.

**Assignments:**

- **Census of Agriculture Activity:** Refer to the description under the assignments tab on Canvas. Due by Sunday, September 24 at 11:55pm.

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**Week 4: Managing Soils and Nutrients (9/25)****Learning Objectives:**

*By the end 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

**Preparation for Class:**

- Gliessman. 2007 "Soils," Chapter 8 in *Agroecology: The Science of Sustainable Food Systems*.
- Erisman et al. 2008. "How a century of ammonia synthesis changed the world." *Nature*
- Davis et al. 2012 "Increasing Cropping System Diversity Balances Productivity, Profitability and Environmental Health" *PLoSone*

**Assignments:**

- **Grant Proposal:** Continue working on the Introduction section of your Grant Proposal. Due by Sunday, October 1 at 11:55pm.

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**Week 5: Pest Management and Genetics (10/2)**

**Learning Objectives:**

*By the end of this class, students will be able to:*

- Define pesticide 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 costs of GMO technology and identify critical knowledge gaps

**Preparation for Class:**

- Oerke. 2006. "Crop Losses to Pests." *Journal of Agricultural Science*
- Magdoff and Van Es. 2009. "Soil Health, Plant Health and Pests," Chapter 8 in *Building Soils for Better Crops*, Third Edition.
- Kathage and Qaim. 2012 "Economic Impacts and Impact Dynamics of Bt cotton in India" *PNAS*
- Benbrook. 2012. "Impacts of genetically engineered crops on pesticide use in the U.S. – the first sixteen years"

**Assignments:**

- **Case Study** : Read the instructions for Case Study on Canvas and respond to the questions. Due by Sunday, October 8 at 11:55pm.
- **Grant Proposal:** Begin working on the Literature Review section of your Grant Proposal. Refer to guidance under the assignments tab on Canvas. Due by Sunday, October 15 at 11:55pm.

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## Week 6: Water Use and Quality (10/19)

### Learning Objectives:

*By the end 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

### Preparation for Class:

- Wiebe, K. and Gollehon, N. 2006. Agricultural Resources and Environmental Indicators, 2006 edition. Read Chapter 2.
- US EPA. Clean Water Act.
- USDA. NRCS. Water.
- Wines, Michael. *West's Drought and Growth Intensify Conflict Over Water Rights*. The New York Times. March 16<sup>th</sup>, 2014.

### Assignments:

- **Discussion Forum #2:** Genetic engineering of plants.
- **Grant Proposal:** Continue working on the Literature Review section of your Grant Proposal. Refer to guidance under the assignments tab on Canvas. Due by Sunday, October 15 at 11:55pm.

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## Week 7: Livestock and Sustainability (10/16)

### Learning Objectives:

*By the end of this class, students will be able to:*

- Under Construction!

### Preparation for Class:

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### Assignments:

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## Week 8: Energy Use and Climate Change (10/23)

### Learning Objectives:

*By the end 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

### Preparation for Class:

- Canning, P., Ainsley, C., Huang, S. and Polenske, K.R. 2010. Energy use in the US food system. Economic Research Report Number 94. US Government Printing Office, Washington, DC.
- Weber, C.L. and Mathews, H.S. 2008. Food-miles and the relative climate impacts of food choices in the United States. *Environmental Science and Technology* 42: 3508-3513
- Pelletier et al. 2011. Energy Intensity of Agriculture and Food Systems. *Annual Review of Environment and Resources*.

### Assignments:

- **Discussion Forum #3:** Agricultural intensification.
- **Grant Proposal:** Begin working on the Methods section of your Grant Proposal. Refer to guidance under the assignments tab on Canvas. Due by Sunday, November 12 at 11:55pm.

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## Week 9: Farm Bill and Conservation Programs (10/30)

### Learning Objectives:

*By the end of this class, students will be able to:*

- Describe the contents of and process of creating the Farm Bill
- Describe changes in programs, priority and spending for the 2014 Farm Bill compared to the 2008 FB
- Describe the structure of the major conservation programs

- Explain how a producer's adoption of major conservation programs would affect farm management decisions

**Preparation for Class:**

- Chite, R. 2014. "The Farm Bill (P.L. 133-79): Summary and Side-by-Side" (up to page 19). *Congressional Research Service*
- ERS. 2014. "Agricultural Act of 2014: Highlights and Implications" <http://www.ers.usda.gov/agricultural-act-of-2014-highlights-and-implications.aspx>. Browse through Topic Area Highlights and Economic Implications section
- Claassen et al. 2004. Summary *In* Environmental Compliance in U.S. Agricultural Policy Past Performance and Future Potential. USDA, ERS. Agricultural Economic Report No. 832.

**Assignments:**

- **Grant Proposal:** Continue working on the Methods section of your Grant Proposal. Refer to guidance under the assignments tab on Canvas. Due by Sunday, November 12 at 11:55pm.

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**Week 10: Organic and Fair Trade (11/6)**

**Learning Objectives:**

By the end of this class, students will be able to:

- 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
- Assess the benefits and costs of scaling up Fair Trade

**Preparation for Class:**

- Smith-Spangler et al., 2012. Are Organic Foods Safer or Healthier Than Conventional Alternatives? A Systematic Review. *Annals of Internal Medicine* 157: 348-366.
- Tuomisto, H.L., Hodge, I.D., Riordan, P. and Macdonald, D.W. 2012. Does organic farming reduce environmental impacts? – A meta-analysis of European research. *Journal of Environmental Management* 112: 309-320.
- Jaffee. 2010. "Fair Trade Standards, Corporate Participation, and Social Movement Responses in the United States." *Journal of Business Ethics*

- Darnhofer, I., Lindenthal, T., Bartel-Kratochvil, R., & Zollitsch, W. (2010). Conventionalisation of organic farming practices: from structural criteria towards an assessment based on organic principles. A review. *Agronomy for sustainable development*, 30(1), 67-81.

**Assignments:**

- **Discussion Forum #4:** Organic and fair trade.
- Grant Proposal Methods section due by Sunday, November 12 at 11:55pm.

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**Week 11: Local and Regional Food; Urban Agriculture (11/13)**

**Learning Objectives:**

*By the end 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
- Describe some agronomic and social challenges for urban production systems

**Preparation for Class:**

- Martinez, S., Hand, M., Da Pra, M., Pollack, S., Ralston, K., Smith, T., Low, S. and Newman, C. 2010. Local food systems: Concepts, impacts, and issues. USDA Economic Research Service (ERS). Economic Research Report Number 97. US Government Printing Office, Washington, DC.
- Brodt, S., Kramer, K.J., Kendall, A. and 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.
- Zezza and Tasciotti. 2010. "Urban agriculture, poverty, and food security: empirical evidence from a sampling of developing countries." *Food Policy*

**Assignments:**

- None!!

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**Week 12: Sustainability Certifications (11/27)**

**Learning Objectives:**

- Evaluate market-based tools to increase sustainability in agricultural production

**Preparation for Class:**

- Humane Farm Animal Care Comprehensive Animal Welfare Standards Comparison By Program – Laying Hens. Produced by Humane Farm Animal Care (HFAC). 2014.
  
- Humane Farm Animal Care Comprehensive Animal Welfare Standards Comparison By Program – Beef, Chicken and Pork. Produced by Humane Farm Animal Care (HFAC). 2013.
- “United States Standards for Livestock and Meat Marketing Claims, Naturally Raised Claim for Livestock and the Meat and Meat Products Derived From Such Livestock,” *Federal Register* Vol. 74, No. 12.
- FDA. 1998. *Guidance for Industry: Guide to Minimize Microbial Food Safety Hazards for Fresh Fruit and Vegetables*.  
<http://www.fda.gov/downloads/Food/GuidanceComplianceRegulatoryInformation/GuidanceDocuments/ProduceandPlantProducts/UCM169112.pdf>

**Assignments:**

- **Grant Proposal:** Continue working on your grant proposals. Complete proposals are due by Friday, December 1 at 11:55pm.

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**Week 13: The Future of Food and Agriculture (12/4)****Learning Objectives:**

*By the end 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 consequences in the US

**Preparation for Class:**

- Godray et al. 2010. Food security: the challenge of feeding 9 billion people. *Science*, 327:812-818.
- Garnett et al. 2013. Sustainable intensification in agriculture: premises and policies. *Science*, 341:33-34.
- Foley et al. 2011. Solutions for a cultivated planet. *Nature*, 478:337-342.

**Assignments:**

- **Proposal critique:** Refer to guidance under the Assignments tab in Canvas. Due by Sunday, December 10 at 11:55 pm.

**This schedule is subject to modification at the discretion of the instructors.**