NUTR 342: Food Systems Modeling and Analysis  
Spring 2016

Class Time: Mondays and Wednesdays, 10:00-11:30am

Location: Jaharis J155  
(Some sessions will meet in Sackler, see schedule)

Course Director: Christian Peters (christian.peters@tufts.edu)
Office hours: Mondays, 11:30am-12:30pm

Teaching Assistants: Ashley McCarthy
Graduate credit: 1.0
Prerequisites: Introductory GIS Course or instructor’s consent

Recommended
NUTR 233 Agricultural Science and Policy I AND
NUTR 333 Agricultural Science and Policy II

Course Description:
Agriculture and food industries are a subject of growing interest in terms of their resource requirements, ecological impacts, and sustainability. This course will provide a foundation in some of the methods of modeling and analysis used to study food systems. We will address several types of approaches, generally building in complexity, starting with net balances of production and consumption and continuing through modeling carrying capacity, foodshed analyses, life cycle assessment, and system dynamics and integrated modeling. Students will learn what types of questions are best addressed through modeling approaches, the methods used to conduct food systems models, and the data required to complete the analyses. In addition, they will have opportunities to conduct simple analyses through in-class exercises. Finally, students will learn how models might be relevant to the development of policy related to local and regional food systems or dietary changes to reduce environmental impact.

Course Objectives:
Upon completion of this course, students will be able to describe the types of questions for which require food systems modeling and quantitative analysis to answer. They will be able to explain the methods used to conduct such models, including the data sources upon which the models are based. Students will be able to name the key lessons learned through food systems models to date and will be able to cite the principle limitations of these analyses. They will be able to succinctly describe the results of such analyses in lay language and explain the relevance of modeling or quantitative analysis to a policy issue.
Description of assignments, tests, and other required activities:
Four in-class modeling or analysis exercises will be conducted during the semester. Each will require a short report describing the methods and findings. These exercises will give students hands-on experience with each of the modeling and analysis techniques. Detailed instructions on the exercises and expectations for the report will be provided on the day we start each modeling exercise.

The fifth, and final, assignment is a paper that addresses how modeling can inform decisions related to food systems. Specific instructions will be provided later in the semester.

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<thead>
<tr>
<th>Summary of Assignments and Grading</th>
<th>Grading Weight</th>
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<tbody>
<tr>
<td>Net-balance exercise</td>
<td>20%</td>
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<tr>
<td>Foodprint model exercise</td>
<td>25%</td>
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<td>Foodshed mapping exercise</td>
<td>25%</td>
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<tr>
<td>Systems dynamics exercise</td>
<td>10%</td>
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<tr>
<td>Final Paper</td>
<td>20%</td>
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Penalties for late or incomplete assignments:
With the exception of emergencies, students must request an extension within 48-hours of the due date for an assignment. Unless a postponement is approved in advance by the instructors, half a letter grade for the assignment will be deducted for missed deadlines, with an additional half grade deducted for each full day of delay.

Course texts and materials:
Each week’s readings will be available through the course website on Trunk. Registered students will receive instructions by email regarding login procedures. If you have any problems accessing the site please contact Patrick Connell at 636-2415 or patrick.connell@tufts.edu, and inform one of the teaching assistants as well. Readings for each week should be completed in advance of class, as familiarity with that material will be the basis for class lectures and discussions.

Academic Conduct:
Academic integrity, including avoiding plagiarism, is critically important. Each student is responsible for being familiar with the standards and policies outlined in

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. (http://uss.tufts.edu/studentaffairs/judicialaffairs/AcademicIntegrity.pdf).

**Course structure:**

*Food Systems Modeling and Analysis* is organized into units that address different types of modeling or quantitative analysis. Each unit begins with reading and discussion of some prominent examples of an analytical approach, focusing on the value of the approach for addressing key questions about the food system. The unit continues with two or three interactive lectures that address central methodological or data related issues in the approach. The units conclude with an in-class exercise in which students have an opportunity to employ a model or analytical approach to integrate their understanding of how the work is conducted, what is learned from the analysis, and the limitations of the approach. The common thread running through the units is the use of quantitative modeling and analysis for scenarios and projections, as opposed to hypothesis testing with statistical methods. The course concludes with discussion and reflection on what food system models can offer to policy discussions and decision makers.

**Structure and Sequence of Topics in NUTR 342:**

1. Introduction
2. Net balance studies
3. Carrying capacity modeling
4. Foodshed analysis
5. Systems thinking and dynamics
6. Readings based exploration of additional approaches
7. Wrap-up
### Course & Assignment Schedule:

<table>
<thead>
<tr>
<th>SECTION</th>
<th>CLASS</th>
<th>TOPIC</th>
<th>ASSIGNMENTS / ROOM</th>
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<tbody>
<tr>
<td>INTRO.</td>
<td>1. Jan 25</td>
<td><strong>Food systems and modeling:</strong> What are the food systems questions that require models to answer?</td>
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<tr>
<td>NET BALANCE</td>
<td>2. Jan 27</td>
<td><strong>Concept of a net balance:</strong> Comparisons of production and consumption at local, state, regional, and national levels</td>
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<td></td>
<td>3. Feb 1</td>
<td><strong>Consumption: translating between intake and supply</strong> How do we know how much food people eat? Intake surveys and loss-adjusted food supply.</td>
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<td></td>
<td>4. Feb 3</td>
<td><strong>Production: translating between agricultural and food commodities</strong> Tabulating agricultural production. Converting from agricultural to food commodities</td>
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<td></td>
<td>5. Feb 8</td>
<td><strong>Exercise 1:</strong> A net-balance study of New England</td>
<td>Sackler 514</td>
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<tr>
<td>CARRYING CAPACITY AND LAND REQUIREMENTS</td>
<td>6. Feb 10</td>
<td><strong>Carrying capacity and land requirements:</strong> Models for understanding the potential to produce food or feed people under alternative scenarios</td>
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<td>7. Feb 17</td>
<td><strong>Scenario development and estimating consumption for hypothetical diets</strong> How do you frame an analysis of potential production capacity under alternative diets or agricultural systems?</td>
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<td>9. Feb 22</td>
<td><strong>Exercise 2:</strong> Working with the U.S. foodprint model</td>
<td>Sackler 514</td>
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<td>10. Feb 24</td>
<td><strong>Exercise 2:</strong> (continued)</td>
<td>Sackler 854</td>
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<tr>
<td>FOODSHED MODELS</td>
<td>11. Feb 29</td>
<td><strong>Concept of a foodshed:</strong> Origins and evolution of the idea of a foodshed, contemporary examples of foodshed analyses.</td>
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<td></td>
<td>12. Mar 2</td>
<td><strong>Spatial analysis of production and consumption</strong> Data sources and methods for estimating available land area, soil productivity, and food need in a spatial context</td>
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<td>13. Mar 7</td>
<td><strong>Mapping foodsheds</strong> Methods for estimating the area capable of meeting the food needs of a population</td>
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<td>Date</td>
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<td>14. Mar 9</td>
<td><strong>Exercise 3:</strong> Mapping a potential foodshed for Greater Boston or other Northeast city of your choice.</td>
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<td>15. Mar 14</td>
<td><strong>Exercise 3:</strong> Continued</td>
<td>Sackler 514</td>
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<tr>
<td>16. Mar 16</td>
<td><strong>Exercise 3:</strong> Continued</td>
<td>Sackler 851</td>
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<td>17. Mar 28</td>
<td><strong>Systems thinking:</strong> What is it? Key concepts: stocks, flows, feedback loops, equilibrium states, and other principles of systems dynamics.</td>
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<td>18. Mar 30</td>
<td><strong>Exercise 4:</strong> Working with a systems model of livestock production</td>
<td>Sackler 851</td>
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<td>19. Apr 4</td>
<td><strong>Concept of Life Cycle Assessment:</strong> Origins in industrial ecology and the application of LCA to understand biological systems</td>
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<td>20. Apr 6</td>
<td><strong>Input-Output and Process-based LCA:</strong> How do they work? What are the data sources? What do they teach us?</td>
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<td>21. Apr 11</td>
<td><strong>Supply chain models:</strong> Sector-based supply chain models and their contribution to the study of food systems.</td>
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<td>22. Apr 13</td>
<td><strong>Integrated assessment:</strong> How are they used to study food systems? What do such models teach us?</td>
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<td>23. Apr 20</td>
<td><strong>AgMIP and Crop Models:</strong> The relationship of crop models to integrated food systems models and the Agricultural Model Inter-comparison and Improvement Project.</td>
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<td>24. Apr 25</td>
<td><strong>Engaging stakeholders in modeling:</strong> What questions require modeling to answer? How do you communicate complex methods and findings to a lay audience?</td>
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<td>26. May 2</td>
<td><strong>Evidence and policy</strong> Looking forward, how can models contribute to the ongoing debate about diets, food security, and sustainability?</td>
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This schedule is subject to modifications at the discretion of the instructor.
COURSE INTRODUCTION

Class 1. Food systems and modeling

In this session we will discuss the types of food systems questions that require a modeling approach to answer. In addition, we will explore how food system modeling is developing as a field of study and how it differs from other approaches.

Learning Objectives for class 1:
Upon completion of this class, students will be able to describe and discuss:
- Why models are used in science
- How modeling differs from controlled experimentation and observation
- Types of questions about that models are well-suited to answer

Required Readings for class 1:


NET BALANCE STUDIES

Class 2. Concept of a net balance

The local food movement has popularized the question, “Where does my food come from?” Sadly, we lack the data to arrive at a satisfying answer to this question. As a result, net balance studies have been used as a proxy for understanding how much might be supplied within a given locale by comparing estimates of food consumption and food production. While simple in concept, data gaps can make these analyses tricky to complete. However, the effort is worthwhile for providing a baseline from which to evaluate a locale’s capacity to supply its own food.

Learning Objectives for class 2:
Upon completion of this class, students will be able to:
- Explain the contexts in which net-balance studies have been used in the literature on food systems.
- Interpret the results of a net-balance study of a food system
- List common errors in understanding net-balance studies and describe the limits of the net-balance approach
Required Readings for class 2:


Class 3. Consumption: translating between intake and supply

One step in a net balance study is estimating a locale’s food consumption. Two principal sources of consumption data exist in the U.S., food intake surveys and food supply balance sheets. Each approach has its strengths and weaknesses, and the discrepancies between the two sources raise the question, “How much do people actually eat?” This session will explore the methods of estimating consumption and in comparing consumption to production. We will address food losses, inedible portions, the concept of a primary food commodity, and regional differences in consumption.

Learning Objectives for class 3:
Upon completion of this class, students will be able to describe, discuss and critique:
- Challenges of converting food intake into the required food supply
- Challenges of converting food supply into estimated intake
- Strengths and weaknesses of intake and food supply data for estimating consumption

Required Readings for class 3:
No required readings. See TRUNK site for recommended reference material.

Class 4. Production: translating between agricultural and food commodities

Farms produce very little food. Rather, they generally produce agricultural commodities that get processed into food products. This session will explore how to estimate the amount of food that is produced in a locale, starting with data from the Census of Agriculture and USDA National Agricultural Statistics Service annual surveys. We will discuss data gaps, the challenges of estimating production for livestock, and the conversion factors used to convert agricultural commodities into quantities of primary food commodities.
Learning Objectives for class 4:
Upon completion of this class, students will be able to describe, discuss and critique:
- The differences in how Census and Survey data are collected
- The value of these data for estimating production
- How to convert estimates of agricultural production into equivalent amounts of edible food

Required Readings for class 4:
No required readings. See TRUNK site for recommended reference material.

Class 5. Exercise 1: A net-balance study of New England

Experience is a great teacher. In this session, we will conduct a net-balance study of New England for three commodities: fluid milk, apples, and potatoes. Students will break into teams to gather and assemble the data on per capita consumption, population, agricultural production, and processing conversions to complete the analysis. The instructor will provide guidance on how to get started and will help to answer questions as they arise.

Learning Objectives for class 5:
Upon completion of this class, students will be able to:
- Access data from the Loss-Adjusted Food Supply database, the Census of Agriculture, data from NASS annual surveys
- Assemble the requisite data for a net-balance study
- Complete a net-balance analysis of a food commodity and accurately calculate self-sufficiency ratios
- Explain the concept of a “net balance” study and clearly interpret the meaning of the results for a lay audience.

Required Readings for class 5:
No required readings. See TRUNK site for recommended reference material.

CARRYING CAPACITY MODELING

Class 6. Carrying capacity and land requirements

Agriculture is the single largest use of land in the world. In addition, the past 50 years of agricultural science have focused primarily on improving crop yields to contain agricultural expansion. Accordingly, debates about the future of food production always address the availability and future needs for land. As the human population continues to grow and diets worldwide shift toward greater consumption of livestock products, the pressure on land increases. This session will
explore attempts to model the land requirements of food production and potential capacity to produce food under different scenarios of diet and (in some cases) agricultural system.

**Learning Objectives for class 6:**
Upon completion of this class, students will be able to describe, discuss and critique:
- The definition and classification of agricultural land
- The definition of carrying capacity and its relevance to sustainability
- The relevance of dietary land requirements to food security and environmental impact

**Required Readings for class 6:**


**Class 7. Scenario development and estimating consumption for hypothetical diets**
Scenarios are used in modeling to represent a range of possible futures, each reflecting different assumptions about how the factors that influence a system will change over time. This session will explore how to set clear assumptions that lead to useful and interesting scenarios using diet scenarios as an example. While consumption data present our best estimate of what people actually eat, models of land requirements and carrying capacity often wish to examine how nutrition might be improved or food security ensured or environmental impact reduced by changing diets. Examples in the literature explore diets that diverge greatly from actual consumption patterns, such as a vegetarian diet in the U.S. In such cases, a modeler must make assumptions about the contents of a hypothetical diet. To this end, we will explore how to develop model diets that comply with Dietary Guidelines, that reflect preferences for certain types of foods, and to convert intake to an equivalent quantity of food commodities.

**Learning Objectives for class 7:**
Upon completion of this class, students will be able to describe, discuss and
critique:
- The differences between scenarios and forecasts
- How to develop engaging scenarios that are informative for planning
- Examples of scenarios used in food system studies
- How relevant are past consumption patterns to the creation of hypothetical scenarios?
- How do analysts transform abstract ideas about a hypothetical diet into a concrete list of individual food commodities?

Required Readings for class 7:

Class 8. Estimating available land area and agricultural yields

Once the composition of the hypothetical diets has been determined and converted into quantities of food commodities, a modeler must determine the productivity of available agricultural land to estimate dietary land requirements. Information on crop yields and processing conversions can be gathered from the same sources discussed in session 4. However, data on the feed requirements of livestock and the productivity of grazing lands are essential to estimating dietary land needs. Furthermore, data on the availability of agricultural and grazing land must be collected in order to estimate potential food supply or carrying capacity. This session will address how to collect such data and the challenges involved.

Learning Objectives for class 8:
Upon completion of this class, students will be able to describe, discuss and critique:
- The definitions and relationships between area, yield, and production
- Sources of crop yield data
- Sources of livestock feed requirement data

Required Readings for class 8:
No required readings. See TRUNK site for recommended reference material.

Classes 9 and 10. Exercise 2: Working with the U.S. Foodprint model

Students will be introduced to the foodprint model as a method for estimating the land requirements of dietary patterns and potential carrying capacity of an agricultural resource. The instructor will explain the structure of the model and how it is used. Students will then use the model to explore how dietary changes influence
land needs. They will develop and record their own scenarios to address two questions: 1) what type of diet could feed the most people, and 2) what type of diet could feed the current population on the smallest footprint?

**Learning Objectives for classes 9 and 10:**
Upon completion of this class, students will be able to:
- Trace the relationships between the component worksheets in the model for an individual commodity
- Access additional data sources not used in the previous unit, such as population data from the U.S. Census Bureau or nutrient composition data from the Nutrient Database for Standard reference
- Use the foodprint model in a systematic fashion to assess different scenarios of dietary intake.
- Add a food to the model, including all requisite data and formulae needed to integrate that food commodity into the model
- Explain how working directly with a model influences their perceptions of land use, diet, and carrying capacity

**Required Readings for classes 9 and 10:**
No additional readings.

**FOODSHEET ANALYSIS**

**Class 11. Concept of a foodshed**

Analogous to a watershed, the term foodshed refers to the area which supplies, or is capable of supplying, a population with its food. In this session, we will explore the origins of the term, its evolution in the context of the local and alternative food movements, and examples of foodshed analyses.

**Learning Objectives for class 11:**
Upon completion of this class, students will be able to describe, discuss and critique:
- The origin of the term foodshed
- Meaning of the concept and variations in definition
- How the concept is relevant to sustainability

**Required Readings for class 11:**

Class 12. Spatial representation of production and consumption

Part of foodshed analysis is spatially estimating where food is produced. At a minimum, this step in a foodshed analysis addresses the capacity of land to produce agricultural commodities. Depending on the complexity of the model, it may also address the movement of food through a transportation network and the transformation of agricultural products into processed food commodities. Similarly, people reside in discrete municipalities we call cities, towns, and villages. However, the boundaries of where people shop for food are quite amorphous. Given this reality, how do we aggregate people into discrete populations for which it is meaningful to map a “foodshed”? This session will discuss a few data sources used to spatially estimate agricultural production and food consumption.

Learning Objectives for class 12:
Upon completion of this class, students will be able to describe, discuss and critique:
- Differences and similarities between land cover and land use
- Sources of spatial data on land cover
- Methods for assessing productivity of soils and climate
- Concept of an urbanized area
- How to define the point of consumption in a foodshed analysis in both urban and rural contexts

Required Readings for class 12:
No required readings. See TRUNK site for recommended reference material.

Class 13. Mapping foodsheds

Once the modeler has characterized consumption and production, a method must be chosen to determine how the foodshed will be calculated. A variety of possible approaches will be discussed, some of which examine population centers individually and others which consider all population centers simultaneously. Both standard GIS operations and optimization approaches will be discussed.

Learning Objectives for class 13:
Upon completion of this class, students will be able to describe, discuss and critique:
- Variation in the approaches used to map foodsheds
- Interpretation of food analysis results
- Strengths and weaknesses of various approaches
Required Readings for class 13:


Classes 14, 15, and 16. Exercise 3: Mapping a potential local foodshed

Building on the analysis conducted in Exercise 2, students will create a map of food production potential for the twelve Northeastern States (Maine through West Virginia). They will estimate the total food need for Greater Boston, then calculate the minimum distance within which area could meet its food needs from a “local” diet. The instructor will provide access to necessary data to enable students to complete the analysis within a class session.

Learning Objectives for class 14, 15, and 16:
Upon completion of this class, students will be able to:
- Access the raw spatial data required for conducting a basic foodshed analysis, such as land cover data and urban area delineations
- Process the raw spatial data to create the layers of spatial information on production potential and food requirements used in the foodshed model
- Perform a basic foodshed analysis using tools available within ArcGIS and integration of data from previous exercises
- Troubleshoot solutions to address gaps in data availability

Explain the assumptions inherent in a foodshed analysis and correctly interpret a map of a potential, local foodshed

SYSTEMS DYNAMICS AND INTEGRATED MODELS

Class 17. Systems and systems thinking

This session will introduce fundamental concepts in systems theory such as stocks, flows, feedback loops, and equilibrium states. In addition, this session will address the issue of lag time in the context of systems and how it influences our ability to recognize and respond to problems. We will discuss how systems modeling can be
applied to understand real-world phenomena in the context of environmental issues, such as climate change and population growth.

**Learning Objectives for class 17:**
Upon completion of this class, students will be able to describe, discuss and critique:
- How the concepts of stocks, flows, feedback loops, and equilibrium states describe real world phenomena, like population growth.
- Why modeling change over time is important to food systems analysis

**Required Readings for class 17:**

**Class 18. Exercise 4: Systems modeling**

Dynamic systems modeling of food and agricultural systems remains in its infancy. We will use a simple, two-stock model of a livestock system to illustrate some of the key principles of systems dynamics: stocks, flows, feedback loops, and equilibrium states. The exercise will examine how the output of a beef system can be influenced over time by changes in birth rates, mortality rates, and culling rates.

**Learning Objectives for class 18:**
Upon completion of this class, students will be able to:
- Define and illustrate central concepts in systems thinking: inflection points, equilibrium states, and lag times in observing a change in a system
- Use a system model to identify the sensitivity of a system to changes in key parameters to identify leverage points
- Construct a simple systems-model using Excel

**Required Readings for class 18:**
No additional readings

**ADDITIONAL METHODS TO STUDY FOOD SYSTEMS**

**Class 19. Concept of life cycle assessment (LCA)**

Life cycle assessment (LCA) originated in the field of industrial ecology. However, it has recently been applied to understand the ecological impacts associated with biological systems, specifically food products. This session will explore the types of questions LCA helps to address with regard to food systems. We will discuss a few prominent examples of LCA applied to food systems questions.
Learning Objectives for class 19:
Upon completion of this class, students will be able to describe, discuss and critique:
- Concept of life cycle assessment: what does it measure?
- Differences and similarities between the two major modes of LCA, process-based and input-output based
- Relevance to food systems analysis

Required Readings for class 19:
To be decided. Readings will be posted on TRUNK at least one week prior to class session.

Class 20. Input-Output and Process-based life cycle assessment

Input-output data are widely used in economics to study the flow of economic activity between industries. These data have been employed in LCA to study the environmental impacts, such as energy use, associated with the food system. In this session, we will discuss the strengths and weaknesses behind this approach. We will focus on one of the most critical assumptions made in Input-Output based LCA, namely the relationship between economic activity and environmental impact (e.g. energy use per dollar of economic activity).

Within any industry, substantial variation may exist between firms in the amount of environmental impact generated per unit of production. On farms, for example, variation in crop yields or management practices greatly influences the greenhouse gas emissions associated with a unit of crop production. In order to understand which components of a process have the greatest impact on the environmental emissions or resource requirements, LCA practitioners use process-based approaches. This session will also address the methods, advantages, and disadvantages of process-based LCA.

Learning Objectives for class 20:
Upon completion of this class, students will be able to describe, discuss and critique:
- Input-output (I-O) analysis as a basis for understanding material flows
- How the link is made between dollar flows and environmental impact
- Strengths and limitations of I-O based LCA
- How data are collected for process-based LCA
- How can LCA results be used to guide decision-making regarding the environmental impact of food systems
- Strengths and limitations of process-based LCA

Required Readings for class 20:
To be decided. Readings will be posted on TRUNK at least one week prior to class session.

Class 21. Supply chain models

A supply chain is a network of entities that together enable the production, processing, and distribution of foods. Supply chain models are used to study the economics and, increasingly, the environmental impacts of individual food sectors. This class session will explore some food-related examples of supply chain analyses, and the contribution such models make to our understanding of food systems.

Classes 22 and 23. Integrated assessment and crop modeling

Integrated assessment integrates economic and biophysical models to study interactions between human and natural systems. This type of modeling has been used widely within the realm of climate change, but it is also relevant to sustainability of food systems. In this class session, we will discuss prominent examples of using integrated assessment to capture the complexity of the real world through the use of computational approaches.

Class 24. Engaging stakeholders in modeling

A common critique of models is that they are impenetrable to all but a handful of experts. This presents a formidable barrier to using models to inform practical decisions, since people are unlikely to trust or use information they cannot understand. A related concern is that the output of models is too abstract to be of use to practitioners. To this end, the use of participatory approaches may offer ways to ensure that modeling research proceeds in a manner that delivers relevant knowledge to the people who need it. This class session will address these concepts by exploring examples of transdisciplinary research and participatory integrated assessment.

WRAP-UP

Classes 25 and 26. Evidence, policy, and the place of models in understanding food systems

This session will begin by revisiting the question posed at the start of the semester, namely, what types of food system questions require answers from models? We will address the ever-present danger of creating models that are simply justifications of a modeler’s presuppositions about how the world works. In addition, we will discuss the famous dictum, “All models are wrong, some are useful.” Careful modeling can produce valuable insight into food system questions like, “How do dietary choices influence land requirements?” However, even good evidence can be
ignored. Accordingly, this session will also address the degree to which rational arguments can shape the values-driven process of policy making.

In the first session, we will examine the case of including sustainability in the report of the 2015 Dietary Guidelines Advisory Committee and the ensuing public comment that followed after the report’s release. In the second session, we will look forward, discussing the types of questions that are important to address in the context of sustainability and food security. What types of questions require modeling to answer? How well can we answer them with available approaches? How can modeling research be translated into relevant knowledge?

**Learning Objectives for classes 25 and 26:**
Upon completion of this class, students will be able to describe, discuss and critique:
- The two roles of models: tools for prediction and tools for comprehension
- When is modeling the right approach to choose for answering a food systems question?
- How to effectively communicate the methods, results, and implications of modeling studies
- How much evidence is needed to make an informed decision?
- Approaches taken to qualitatively describe the strength of a body of evidence
- Conditions under which evidence is irrelevant to the outcome of a decision