**Foodprint**

**Understanding Connections Between Food Choices and Our Environment**

**Prof. Jennifer Jay**

**Session 5: Land Use**

**Class Plan**

**Introductions** **(10 min)**

Introduce yourself.

**Section 1. Learning Objectives**

By the end of this chapter, you will be able to:

* Describe the status of the Land Use planetary boundary
* Understand some of the current literature (World Resource Institute, van Dooren et al.) on land use of various dietary scenarios
* Understand results of a study optimizing nutrition while minimizing environmental impact.
* Calculate the estimate land required for various 2000 cal/day diets.

**Slides:**

Slides 3 and 4. **Planetary Boundary for Land Use**

Show planetary boundary diagrams from 2009 and 2015 to emphasize that Land Use Change is the one boundary that was within the boundary in 2009 and exceeded the boundary at the follow up.

Slides 5 and 6. There are different estimates for the amount of land used by agriculture and specifically livestock.

Ask: Why does livestock take up so much space? See what answers come up—following slides cover some reasons.

Slides 7-12.

First there are so many animals being raised for food. (Slide 7)

Slides 9-10—livestock’s role in habitat change

Slides 11-12 Stats from Nil Zacharias’s Eat for the Planet

Slides 13-14

A report from World Resources Institute estimated the land requirement for the current US diet, as well as for various scenarios of dietary shifts. The leftmost circular graph shows the calorie distribution of the current US diet, divided into the categories plant, dairy, beef, and other animal products. Moving across the diagram to the right, and onto the second panel, the circular graphs show various scenarios that were modeled for environmental impact. The first two scenarios were focused on reducing overconsumption, and the next six scenarios model decreased animal products, with the last three focusing on reducing beef specifically. Finally, the world average is shown for reference.

The image below each circle shows the land required for the scenario, again broken down by category. In red, you can see the large proportion of land required for beef production compared to the relatively small fraction of the calories due to beef consumption.





Slide 15

Some data from Meier and Christen can be used for calculating the land use requirements of different foods.



These data were calculated specifically for Germany.

Slide 16. Eshel et al. 2014.

Calculated land use, greenhouse gas emissions and water use for various types of animal protein, specifically for the United States. Beef has a high environmental burden for all metrics—notice that beef is off scale (see the numbers).

Slide 17. Shows another reference for land use calculations.

Can introduce the idea that there are various methods but beef always comes out highest. Recognizing this, Eshel et al,. did another study to model environmental benefits of replacing beef.

Slides 18-22

Eshel et al. (2016) investigated the environmental benefits of replacing the nutrition that people are currently getting from beef with plant sources. They first made a list of 65 common plant foods. Then, the choose 60 of those foods at random, 500 times. For each of the 500 sets of foods, they did three different optimizations to find the set of foods that would best replace the nutrition people would have gotten from the beef while minimizing land use, greenhouse gases, and nitrogen use, respectively. Nutritionally, replacement foods had to provide less than or equal to the 190 kcal/day they were getting from beef (since most people consume an excess of calories), greater than or equal to 11 g protein/day (since beef is typically eaten as a protein source), and less than or equal to 16 g fat/day (as the saturated fat in beef is generally considered not beneficial. An additional constraint was that the mass of the total of the replacement foods could not be more than double that of the mass of the beef.

The 1500 optimizations (500 sets of food, were then averaged, reflecting equal weighting of the three environmental issues (greenhouse gas production, nitrogen use, and land use). Peanuts and legumes figure prominently in the average replacement diet. Notably, these foods are generally considered healthy, and are both readily available and affordable.

(Extra slides for the beef replacement study at the end of the presentation, if you want more detail.)

**Activity: Calculate the estimate land required for various 2000 cal/day diets.**

Activity: To do in class

Open the Excel file LandUseCalcsWhattheWorldEatsExercise.

Go to the What the World Eats site by National Geographic. Choose a country and a time, and enter the total grams of food per person per day in D8. Then, working down column D, please fill in the % of grams that come from each food group. You may have to hover over a category in order to get the breakdown. For example, if you hover over Meat, you will see how much of the meat is beef, pork, etc.

Use google to find the population of the country you chose, and the area. Put those items in the spreadsheet. You will be able to compare the actual land area of the country to the amount required to grow its food, as estimated by these data.

**Food Demo: (Optional)**

Peanut sauce can be made by mixing ingredients in a saucepan on a hotplate. It will taste good on rice, rice cakes, raw veggies, or cooked veggies.

<https://meals4planet.org/recipe/thai-peanut-sauce-with-veggies-and-tofu/>