LECTURE ONE, WEEK ONE
OUR GLOBAL NEED FOR FOOD

Why study food?

- ❖ Basic human need critical to health
- ❖ Intimately tied to society and culture
- ❖ Changing now more rapidly than any other time in history
- ❖ Driven by water, climate change, energy, reducing CO2
- ❖ Food and its production raises many questions for 21st C living

Four Topics:

1. Food and Environment
    a. 4 lectures
    b. Covers the global need for food
    c. Consequences and effects of food production of global warming and climate change
2. Food for Health
    a. Nutrition
    b. Illnesses caused by deficits in nutrition
    c. Sports and role of nutrition
    d. Preventative nutrition, functional foods and processed foods
3. Food Security
    a. 5 lectures
    b. History of famine
    c. Global distribution of food
    d. Introduction to food production, marketing & trade
4. Food Issues
    a. 4 lectures
    b. Case study: chocolate & coffee
    c. Insight into marketing, processing of some foods
    d. Biotechnology, food allergies, issues surrounding GMOs

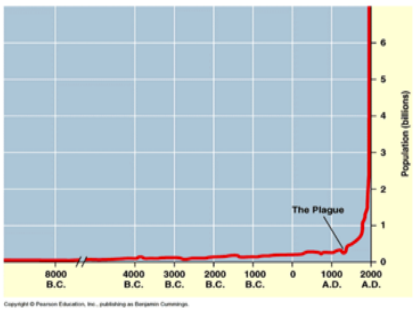
Examples of Food Supply Chains – Coffee & Chocolate

- ❖ Historical, social, economic, cultural and ethical aspects
- ❖ Health and marketing issues

GM foods

World Population Growth

- Most population growth will occur in developing countries



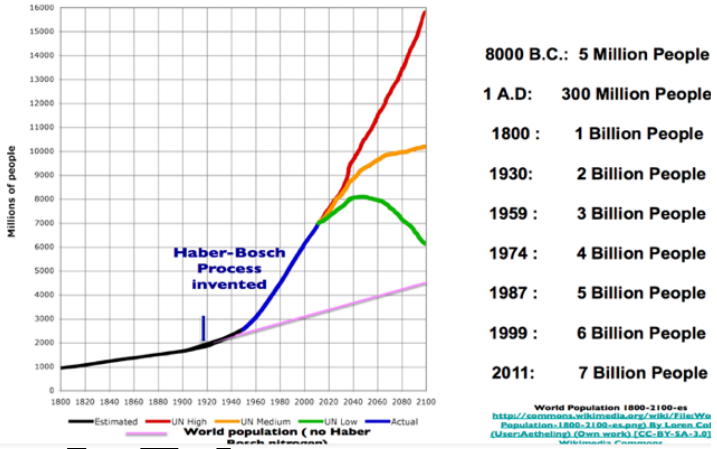
Haber & Bosch – Industrial Nitrogen Fixation → Ammonia

- $N_2 + 3H_2 \rightarrow 2NH_3$
- Haber developed conversion of $N_2 \rightarrow NH_3$ in 1909
- Bosch developed scale up to industrial levels by 1913
- Nobel prizes received in 1918 & 1913

- **Process = high temperature and pressure**
    - Ammonia – effective nitrogen fertilizer that is biologically accessible to plants
    - WW1 – NH3 conversion used for explosive manufacturing
    - Without this process, WW1 would've ended quickly since world's supply of nitrates previously came from Chilean saltpetre
        - Saltpetre: thick deposits of guano deposits (bat/bird shit = rich in phosphates and nitrates)
        - Chilean saltpetre was under British control

How Ammonia synthesis transformed the world

- 1908 – Haber fild patent on the "synthesis of ammonia from its elements"
- 100 years later – we live in a world transformed by and highly dependent upon Haber-Bosch nitrogen



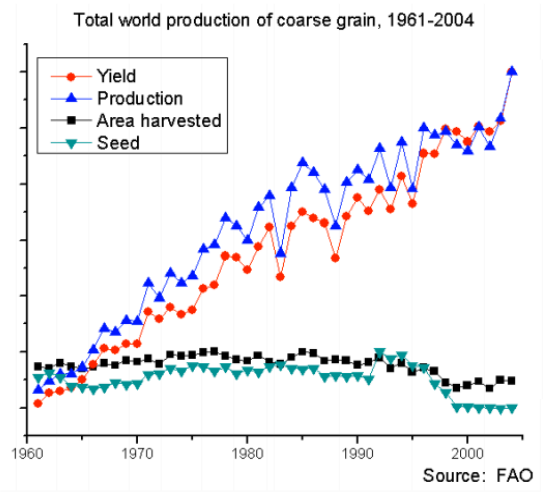
<u>Paul Ehrlich:</u>

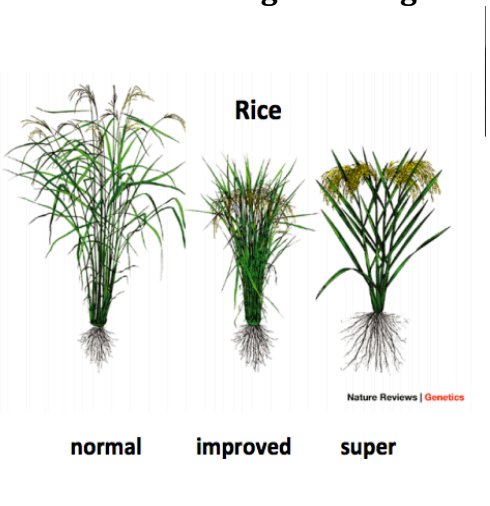
- 1969 – The Population Bomb
    - "The battle to feed all of humanity is over. In the 1970s the world will undergo famines – hundreds of millions of people are going to starve to death"
- Environmental problems, combined with overpopulation, overconsumption by the rich, and poor choices of technologies are major drivers for the potential of a global collapse of civilisation.
- Dramatic cultural change provides the main hope of averting calamity.
    - Collapse: a loss of **socio-political-economic complexity, usually associated by a dramatic decline in population size.**
        - Egypt and China – recovered from collapses at various stages
        - Easter Island & Classic Maya – appear permanent collapses
            - All previous collapses were local or regional: elsewhere, societies and civilizations persisted unaffected/
            - Sometimes (Tigris and Euphrates Valleys), new civilisations rose in successions – **generally, overexploitation of the environment was the proximate or ultimate cause.**

The Green Revolution – Norman Borlaug

- 1914-present, Nobel Peace Prize of 1970 & Father of the Green Revolution.
- Developed **drought & disease-resistant strains** of wheat in Mexico (1944-1960s)
- In use throughout Latin America, Africa, Middle East, and Asia
    - Estimated to have saved 1.3 billion+ people from starvation

Food Production: the main cause of environmental change and degradation





Producing foods through the Green Revolution Techniques:

1. Develop **high-yield crops like corn, rice, wheat**
2. **Large inputs of fertilizers, pesticides, water**
3. **Increase number of crops grown/year on a plot of land (more crop = less land)**
    - ❖ These techniques produce HIGH increases in crop, YET need lots of INPUT (ie. Water, fossil fuels, machinery, fertilizer, pesticide)
    - ❖ Uses ~10% of world's oil

Changes in Technology

- ❖ Farm machinery
- ❖ Fishing equipment
- ❖ Fertilizer
- ❖ Pesticides
- ❖ Irrigation
- ❖ GE foods
- ❖ Feedlots
- ❖ Fish farms
    - Each improvement brings new challenges

Can the growing population feed itself? Growing more food with less water?

- There is a limited amount of agricultural land in the world
- One hectare has to feed more and more people
    - 1950 – 1.7 removal = 2.5 billion
    - 2000 – 4.2 removal = 6.3 billion
    - 2050 – 7.0 removal = 10.3 billion

Converting forests into farms: in Santa Cruz, Bolivia

- 1975
- 2003

Deforestation: in Rondonia, Brazil

- 1975
- 1986
- 2000

CLIMATE CHANGE AND FOOD SECURITY

What is the potential impact of global warming on food supply?

- Rising temperatures: hotter climate will reduce yield
    - Agriculture today has been shaped by a climate system that has changed little in the 11,000-year history of farming
    - Most crops were developed for maximum production under these stable conditions, the higher temperatures will reduce crop yield, measured in bushels/acre harvested.
    - Crop ecologists assume that for every 1 degree temperature rise above the average, yield of corn, rice, and wheat will fall by 10%

The state of our atmosphere: increase in greenhouse gas concentration

- Increase in Nitrous Oxide
- Increase in CO2 – rise in sea level and temperature
- Increase in Methane
    - Global warming

The state of our global temperature:

- The 10 warmest years have all occurred since 1994

<u>Uncharted territory: temperature</u>

- Temperature is at the highest level in the last 11,000 years
- Within 1C of the max of the past million years
- Increases in global temperature: 1880-2005; rapid increase in both annual mean and 5-year mean between 1970s-2000s
- Average global temperature and atmospheric CO2 concentrations: 1880-2008

<u>Unchartered territory: sea level</u>

- Last time temperature was 2-3 degrees C higher, the ocean level was 25-35m higher
- At current rates, temperature will increase 1.3C by 2100

<u>Projected Impact of Climate Change:</u>

- 0-1 degrees: declines in crop yields, possible rising yields in high latitude regions
- 1-2 degrees-6 degrees:
    - **Food**
        - Falling crop yields in many areas, **particularly developing regions**
    - **Extreme weather events**
        - Extreme weather effects; **rising intensity of storms, forest fires, droughts, flooding, and heat waves.**
    - **Water**
        - Disappearance of small mountain glaciers, water supplies threatened in several areas, significant decreases in water availabilities in many areas, such as Mediterranean and southern Africa, **sea level rise threatening major cities**
    - **Ecosystems**
        - Extensive damage to coral reefs, **rising number of species facing extinction, loss of biodiversity and disruption to food chains**
    - **Risk of abrupt, major irreversible changes**
        - Increasing risk of dangerous feedback systems and abrupt, **large-scale shifts in the climate system**