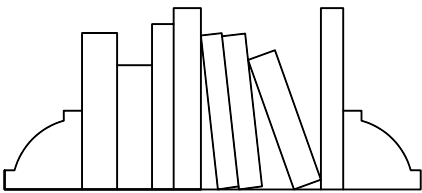# Population Issues

Lecture Outline:

4. FEEDING THE POPULATION
   A. Food Systems
   B. USA Agriculture
   C. The Green Revolution
   D. Subsistence Agriculture
   E. Animal Production
   F. The Oceans / Aquaculture
   G. Biotechnology
   H. Food Prospects
   I. Food Distribution and Trade
   J. Hunger, Malnutrition, and Famine

Learning Objectives:

When you are finished with this unit you should be able to:

1. Describe industrialized agriculture in the USA.
2. Describe the origins and impact of the Green Revolution.
3. List the distinctive features of subsistence agriculture.
4. Describe the food potential of the world's oceans.
5. Describe the pros and cons of transgenic crops.
6. Evaluate the prospects for increasing food production in the future.
7. Analyze global patterns of food trade, and explore the consequences of those patterns.
8. Define and describe the extent of hunger, malnutrition, and undernutrition in the world.

Terms You Should Know:

- Green Revolution
- Subsistence farmers
- Shifting cultivation
- Swidden
- Malnutrition
- Undernutrition
- Absolute poverty
- Famine
- Organic farming
- Intercropping
- Aquaculture
- Biotechnology
- Transgenic crops
- Hunger
- Industrial agriculture
- Traditional agriculture
- Overgrazing
- Desertification
- Genetic engineering
- Genetically Modified (GM) Organisms
- Recombinant DNA
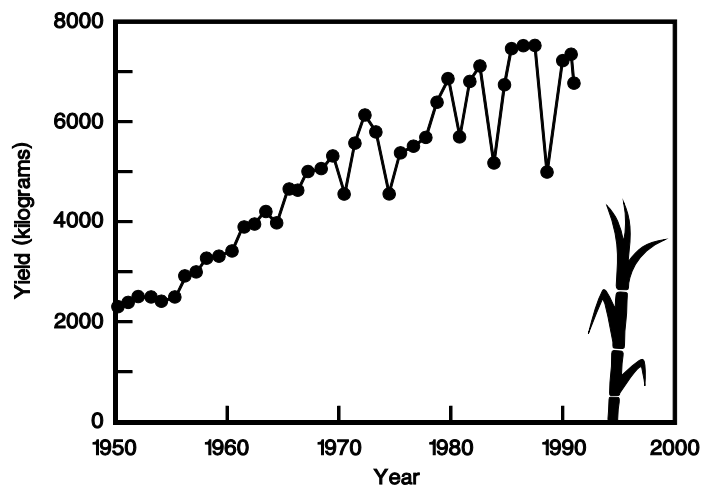
Reading Assignment:

Brennan and Withgott:
    Chapter 10; pages 251-279.

4. FEEDING THE POPULATION

A. FOOD SYSTEMS

- There are three traditional food systems

  1.

  2.

  3.

- All three food systems have expanded greatly since 1950 to meet human demands

- There are two major types of agricultural systems:

1.

2.

1. INDUSTRIALIZED AGRICULTURE

- high input

-

- practiced on about 25% of cropland

-

2. TRADITIONAL AGRICULTURE

Two types (low input):

1. Traditional subsistence

   ✓

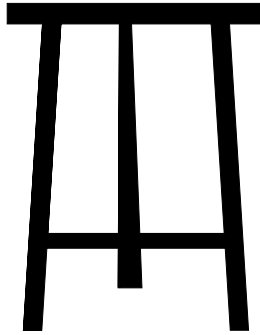   ✓

2. Traditional intensive

   ✓

   ✓

B. USA AGRICULTURE

- 2% of US work force produce enough food for 375,000,000 people

- Characteristics of Modern Agriculture in the USA

  – Machinery Intensive

    ✓

  – Chemical Intensive

    ✓

    ✓

  – Monocultures

    ✓

    ✓

    ✓

C. THE GREEN REVOLUTION

- Increases in cereal production at a faster rate than population growth

-

- 3 legged stool:

- Farmers must purchase all three

PROBLEMS:

- Most yield potential already reached; yield plateaus

-

- Benefits large landholders (displaces small farms)

-

- No impact on subsistence agriculture

D. SUBSISTENCE AGRICULTURE

SUBSISTENCE FARMERS:

- Live off small parcels of land that provide food, maybe some cash

-

-

-

- Farmers often ignored by world bank and own government because:

  –

  – do not riot in capital cities

a. Shifting Cultivation (SWIDDEN)

Shifting cultivation is the practice of:

1.

2.

3.

4. Allowing a natural cover to regenerate the productivity of the soil

- About 30% of the world's exploitable soils are farmed using shifting cultivation
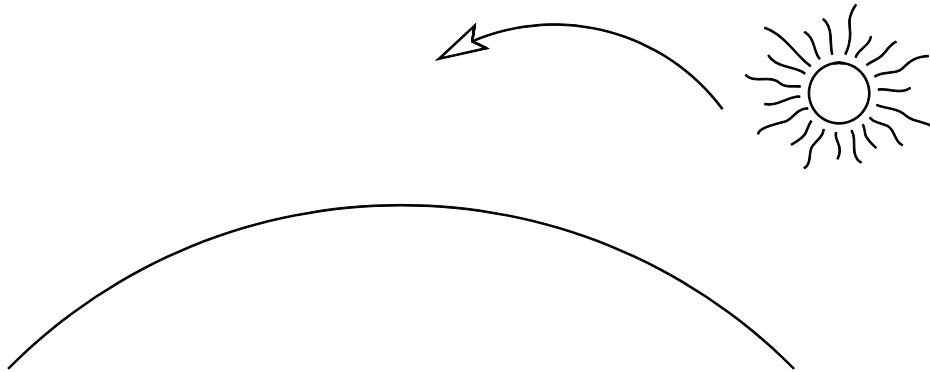
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- There are two types of agricultural systems:

1. Land rotation—which have permanent settlements but the farm land is rotated

2. Shifting cultivation—where settlements shift

- Shifting cultivation can occur under both forest conditions and savannas

EXAMPLE: Forest system

Small fields cleared:

- Clearing—

- Planting—

-

Intercropping:

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corn (C)	cassava (V)
rice (R)	yams (Y)
beans (B)	plantain (P)

-

- After harvest (usually two or three crops) the field is abandoned to forest

- Ideally, 15 to 50 years of forest growth before the land is again cleared for agriculture
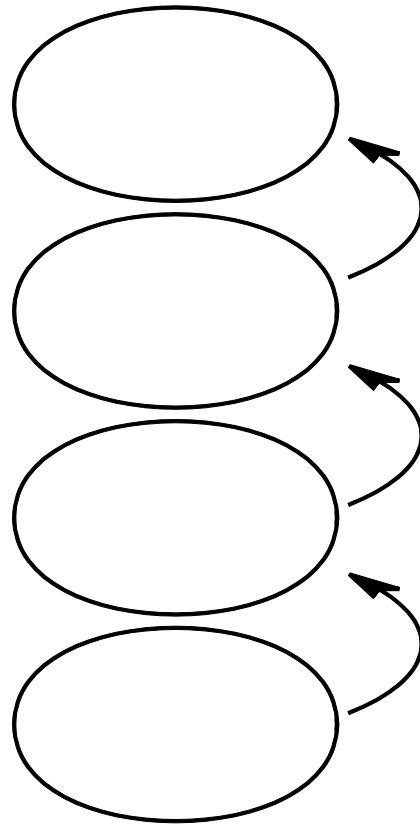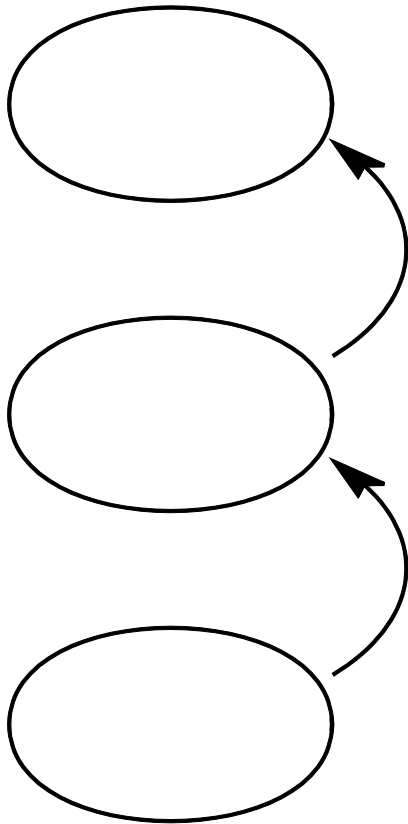
E. ANIMAL PRODUCTION

Livestock:

– sheep
– goats
– cattle
– buffalo
– poultry

- 25% of world's land area is devoted to feeding animals (compared to 11% of surface in cropland)

- In USA, 70% of grain feeds animals

-

    –

    –

-

- Meat production could double in the next 30 years

- Meat production today:

  -

  -

Food Choices = Energy Choices

Feed input to produce meat output:

Input (kg)	Output (kg)
20.0	
7.3	
4.5	
2.8	
1.1	

- Both rangeland and feedlot meat production have environmental problems

FEEDLOT PROBLEMS:

-
-

RANGELAND PROBLEMS:

-

OVERGRAZING — too many animals graze for too long and exceed the carrying capacity of a grassland area

RESULTS OF OVERGRAZING

-
-

- Soil compaction

- Promotion of woody shrub invasions

-

UNSATISFACTORY RANGELANDS

Country	% Unsatisfactory*
USA	
South America	
Africa	
Sahal	

* Unsatisfactory is considered rangeland classified as in fair or poor condition.

F. THE OCEANS / AQUACULTURE

- Estimated limit of ocean catch—

- Current average catch—

-

- Since 1989 global catch of fish, crustaceans, and mollusks has fallen 5% and stagnated

-

- Fish catch has fallen in 13 of the major 15 marine fishing regions of the world

    –
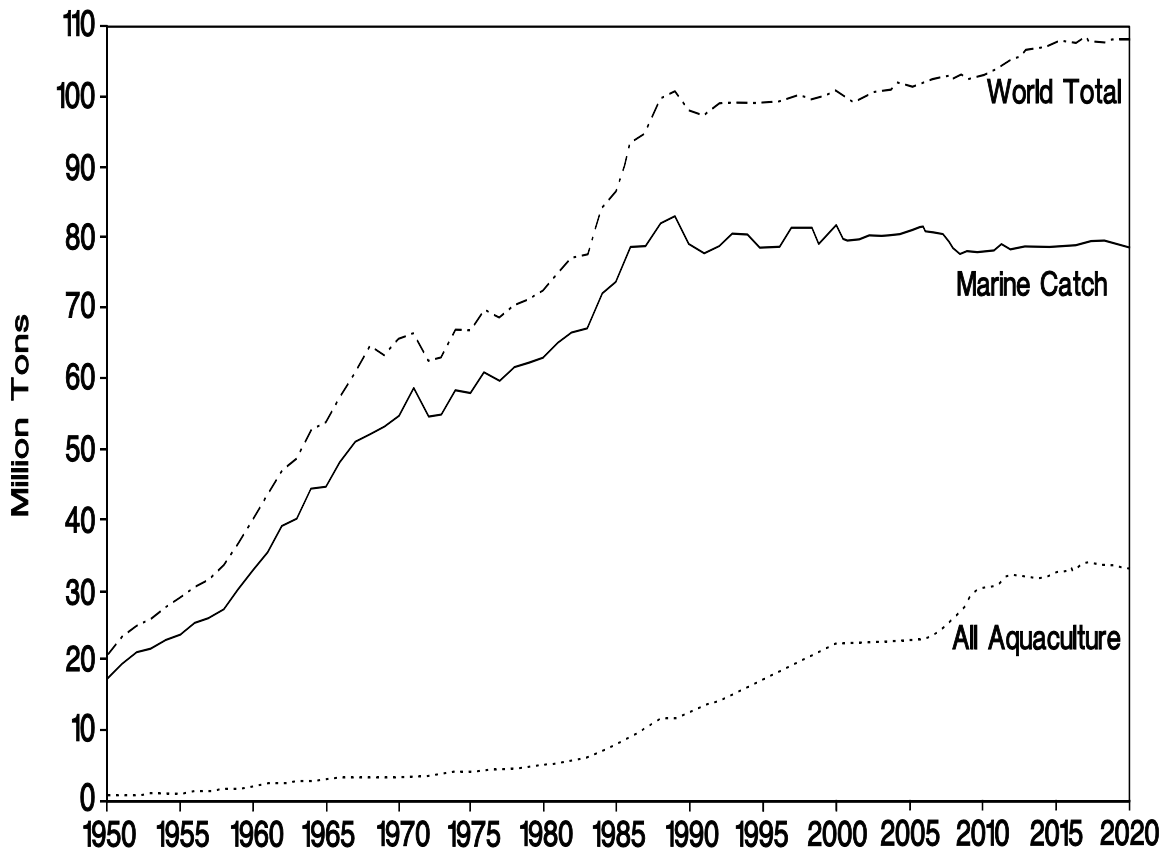
1. Fish as Food Supplies

- Traditionally fish have been considered poor man's protein $\longrightarrow$

- Fish supplies have stagnated

-

-

- Need better fishing management:

  –

  –

  –

AQUACULTURE—growing fish products under agricultural conditions (fish farming)

- Aquaculture is

- Based on:

  ocean stagnation + projected aquaculture growth

  –

- Based on price:
  - fish product consumption will

  - fish product consumption will

Benefits of Aquaculture:

- When conducted on a small scale it results in a reliable protein source

-

-

- Reduces the by-catch (unintended catch of non-target organisms) in the ocean

-

- Can be a very energy efficient food source (1,000X compared to ocean fish)

Negative Impacts of Aquaculture:

- Dense concentrations of fish increases incidence of disease → reduces food security

- Animal waste is produced in excessive amounts

  –

-

- In LDCs:

- If farmed fish escape into ecosystem they may interbreed with natives (salmon)

  –

  –

G. BIOTECHNOLOGY

GENETIC ENGINEERING — any process whereby scientists directly manipulate an organism's genetic material in the lab by adding, deleting, or changing segments of its DNA

GENETICALLY MODIFIED (GM) ORGANISMS — organisms that have been genetically engineered using a technique called recombinant DNA technology

RECOMBINANT DNA — DNA that has been patched together from the DNA of multiple organisms

-

-

- Basically a breeding technique that transfers genetic information across a species boundary

i.e., splicing a bacterium gene into a petunia

GM Foods — The Future?

- In 35 years GM foods have gone from an idea to big business

- Now we have designer plants and animals

- New traits:

  –

  –

GM Foods — The Impact

In USA (2010):

  –

– 74% of corn

–

In World (2010):

– 60% of soybeans

–

– 20% of canola

–

GM Crops — Acreage

Year	Acres
1996	
1998	
2001	
2005	
2010	

GM Crops — Where

- In 2010, 18 nations grew GM crops
- 96% of production in:

  –

  –

  –

  –

  –

- Major exporters →

GM Debate

- Science standpoint

- –
- –

- –

- Ethical standpoint

  - tinkering with food supply may be morally wrong

  - –

  - –

USA:

-

LDCs:

-

Europe:

-

PROS —

-

-

-

CONS —

-

-

-

-

Two cases:

    1. Butterflies on corn in USA

    2. Yellow rice for southeast Asia

H. FOOD PROSPECTS

"Green revolution will buy time for the world to come to its population senses"—Norman Borlaug

- Prospects are not very good!

- Let the data speak for itself:

World grainland, total and per capita — from Lester Brown, *State of the World*

Year	Total Grainland	Per Capita Grainland	Per Capita Change by Decade
	million ha	ha	%
1950	593	0.23	--
1970	673	0.18	-23
1990	720	0.14	-27
2000	720	0.12	-15 (-30)

World grainland, from Lester Brown, *State of the World*

Year	Total Production	Per Capita Production	Per Capita Change by Decade
	million tons		%
1950	631	246	--
1970	1,103	296	+19
1990	1,684	316	+ 7
2000	1,842	295	- 7 (-14)

I. FOOD DISTRIBUTION AND TRADE

- Historical tradition of self sufficiency

-

- Food sufficiency is presently possible at the global level; but not on a country-by-country basis

J. HUNGER, MALNUTRITION, AND FAMINE

HUNGER—lack of basic food required for energy and meeting nutritional needs

MALNUTRITION—lack of essential nutrients (amino acids, vitamins & minerals)

-

-

- 25% of the world's population suffer from effects of hunger and/or malnutrition

a. Cause of Hunger

-

ABSOLUTE POVERTY—lack of sufficient income in cash or kind to meet the most basic biological needs for

-

-

-

about 1,200,000,000 people

b. Famine

FAMINE—severe shortage of food accompanied by a significant increase in death rate

Two major causes:

1.

2.

Historically:

- – Drought caused famines from 1970 to 2010 in the Sahal of Africa

- – Warfare in

- • Food aid is used to relieve famines

PROBLEMS

- EROSION

-

-

- OVER POPULATION

-

- LACK OF WATER / DROUGHT

-

-

Ethical questions:

1. Should we give only to needy countries that have a chance of feeding themselves in the future?

2. Is it right for the more affluent in the world to eat meat raised on grain when we know that it is an inefficient way to convert crops to food for humans?

3. Should the US continue to keep agricultural lands out of production when food supplies could be given away?

4. Prices? Undercut markets...subsidies to farmers...cheap food policy