Agriculture

Agriculture: Terms

- “Agriculture is the deliberate modification of the Earth’s surface through cultivation of plants and rearing of animals to obtain sustenance or economic gain.”
- “Cultivate” means “to care for.”
- Any cultivated plant is called a crop.

The Pre-Agricultural World

- Human beings – or something very like human beings – have been around for several million years.
- But we’ve only been practicing agriculture for something like 10,000-20,000 years.
- Before agriculture there was what we call “hunting and gathering.”

Hunters & Gatherers

- About 0.005% of humanity today (maybe 250,000 people) live an exclusively hunter-gatherer lifestyle (lots of other people hunt or gather occasionally, but it’s not their main way of life).
- Based on what we know about them, and on archaeological evidence, we can make some statements about what most people did before agriculture:
  - Mostly small groups (less than 50 people); low population density.
  - Gathering is usually much more important than hunting (usually 60% to 80% of the food).
  - In most (not all) societies men hunt and fish, and women gather.
  - Acquiring food usually takes no more than 10% of people’s time.
  - Politics are informal, consensus based; little social stratification; beliefs are animistic.
  - Limited material culture; no permanent settlements.
  - Strong ties to land, but nomadic and mobile.
Origins of Agriculture

- We can never know where agriculture began – it began in prehistory, and it probably began in more than one place.
- However, historians, archaeologists, agronomists, geographers and other scholars have worked for over a century trying to determine just where the processes that lead to agriculture – and to civilization – began.

What is “domestication?”

- Some of the changes that take place when plants are domesticated:
  - Gigantism (bigger seeds or fruits)
  - Loss of speed dispersal mechanisms
  - Loss of bitter or toxic substances
  - Changes in floral structures or pollination schemes
  - Changes in flowering cycle
  - Diversity of form
  - Loss of mechanisms to protect against predators

For more information on domestication see: http://hcs.osu.edu/hcs200/Notes1.htm

Origins of Agriculture

- Carl Sauer’s theory:
  - Not in response to hunger.
  - Not among nomads.
  - Not in grasslands or river valleys.
  - In places of high environmental diversity.
  - In places of high plant diversity.
  - Beginning with vegetative reproduction (root crops), not grains.
  - Sauer’s conclusion: Southeast Asia 14,000-35,000 years ago

- More conventional theory:
  - As a consequence of gathering seeds, gatherers noted which plants produced best, and began (perhaps accidentally) to care for them.
  - Agriculture began with crops like grains, lentils and possibly dates.
  - Agriculture began in the river valleys – the Tigris & Euphrates, the Nile, the Indus, the Huang He, and the high valleys of Mexico & Peru.
  - More conventional conclusion: Near East 10,000-20,000 years ago
First Vegetative Planting
- According to Sauer, the earliest vegetative agriculture appeared in Southeast Asia, and probably involved root vegetables like taro and yams, and perhaps tree crops like bananas.
- Vegetative agriculture then diffused throughout Asia and eventually to the Near East and Europe.
- Other, perhaps independent inventions took place in Africa (oil palm, yam) and South America (manioc, arrowroot).

First Seed-Based Agriculture
- Seed-based agriculture began in at least three places according to Sauer:
  - Western India
  - Northern China
  - Ethiopia
- It diffused quickly from India to the Near East, then to Europe.
- Seed-based agriculture also developed independently in Mexico and Northern Peru.

Contrasting Theories
- Your book doesn’t mention them, but at least two other people should be included here:
  - Nikolai I. Vavilov (1887-1943)
    - Looked for “centers of diversity,” which he believed were also “centers of domestication.”
    - Collected more than 250,000 seed samples; identified eight agricultural hearths: Southeast Asia; China; India; Turkey-Iran; Mediterranean; Ethiopia; Mexico/Central America; Andes/Brazil/Paraguay.
• Jack R. Harlan (1917-1998)
  o Agronomist and geneticist; actually met Vavilov at a meeting in Washington in 1932.
  o Defined
    ▪ Three “centers”: the Near East, Northern China, and Meso America.
    ▪ Three “non-centers”: S.E. Asia, S. America, and Africa

**Subsistence vs. Commercial Agriculture**

- Subsistence and commercial agriculture differ in five ways:
  - PURPOSE (consumption vs. off-farm sales).
  - PERCENTAGE OF FARMERS (majority vs. minority of population).
  - MACHINERY (mostly hand vs. mostly mechanized).
  - FARM SIZE (small vs. large).
  - FARMS AND OTHER INDUSTRIES (mostly isolated vs. highly integrated into regional or global economies).

**Subsistence Agriculture: Shifting Cultivation**

- Also known as “slash and burn.”
- Most common today in tropical areas (adaptation to poor soils).
- Small-scale, no machines.
- Temporary – short occupation, long fallow period.
- Crops vary from region to region.
- Only 5% of the world’s population practice shifting cultivation.
- Farmers clear land and burn the debris.
- Poor soils can only support crops for two-three years.
  
  Image source: [http://science.nasa.gov/headlines/y2003/16may_biocorridors.htm](http://science.nasa.gov/headlines/y2003/16may_biocorridors.htm)

**Subsistence Agriculture: Pastoral Nomadism**

- Based on herding domesticated animals.
- Adapted to dry climates where other types of agriculture are basically impossible.

  Image source: [http://www.loc.gov/exhibits/empire/ethnic.html](http://www.loc.gov/exhibits/empire/ethnic.html)
Choice of animals varies – dromedary camels, sheep and goats in North Africa and Arabia, bactrian camels and horses in Central Asia, etc.

Nomads do not just wander around – they usually have precise migration patterns, and a strong sense of territory.

Some nomads practice **transhumance**: seasonal migration up and down mountains.

**Subsistence Agriculture: Intensive, Wet Rice Dominant**

- Practiced in areas of high population density – East, South and Southeast Asia.
- Extremely small farms, worked by hand (few or no machines), strongly focused on rice.
- Rice is unique: it can grow in water (well, in flooded fields), unlike other grains.
- Where climates are favorable, farmers can double crop – raise more than one crop per field per year.
- Wet rice (“paddy” or “sawah” grown) cultivation is complex:
  - Rice seed is planted in a nursery, and raised until ready to be transplanted.
  - Fields are prepared and plowed.
  - Fields are flooded.
  - Individual seedlings are planted, individually, in the flooded field.
  - Each plant is cared for individually until harvest, by hand, with special knives.


**Subsistence Agriculture: Intensive, Wet Rice Not Dominant**

- This is a very ancient form of agriculture – think of places like Medieval Europe, or rural Latin America, as well as more arid parts of South and East Asia.
- Widely practiced in areas where climate doesn’t support wet rice.
- Similar in many ways to areas where wet rice dominates, but emphasizes different crops (wheat, barley, corn, etc.).
- In these areas farmers practice **crop rotation** to increase yields.
European Crop Rotation

- Integration of livestock (sheep, cattle, goats, chickens etc.) and crop farming.
- Most crops raised are fed to animals.
- Most land is devoted to crops.
- Most money is generated from animals and animal products.
- Crop rotation is common.

Advantages:
- Livestock supply manure to fertilize the crops.
- Workload can be more evenly distributed throughout the year.
- Less seasonal variation in income.

Source: [http://www.epa.gov/esd/land-sci/trends/eco64/eco64_samp57.htm](http://www.epa.gov/esd/land-sci/trends/eco64/eco64_samp57.htm)

Commercial Agriculture: Mixed Crop & Livestock Farming

Commercial Agriculture: Dairy Farming

- Dairy products (butter, cheese, etc.) are extremely valuable.
- Mostly produced in Western Europe, North America, Russia, Australia and New Zealand.
- Because milk is extremely perishable, dairy operations traditionally located near markets – in the milkshed.
- Today, transportation makes it possible for milk producers to locate hundreds of miles from markets.
- However, the further from markets, the less likely dairy operations are to produce fluid milk.

Source: [http://clinton.senate.gov/issues_agriculture.html](http://clinton.senate.gov/issues_agriculture.html)
Grain Farming

- Grains are grasses – wheat, corn, oats, barley, rice, etc.
- Globally, the most important crop grown is wheat – more wheat is exchanged in international commerce than any other grain (much of the world’s rice doesn’t enter the international marketplace – it’s consumed within the producing countries).
- Wheat is usually produced in areas where it is too dry for mixed farming.
- The US is the largest grain producing region on earth.
  - Winter wheat region (wheat planted in fall, dormant through winter, grows and is harvested in late spring or summer).
  - Spring wheat region (wheat planted in spring, harvested in late summer).
  - Other wheat regions (Eastern Washington).
- Other major producers include Canada, Argentina, Australia, France and the UK.
- Large scale production only became possible in the 19th century, with the development of mechanized agriculture.

Livestock Ranching

- Ranching is, in some ways, the commercial version of pastoral nomadism.
- Ranching is a type of commercial agriculture adapted to areas which are too dry for other forms of agriculture.
- Ranching is not as profitable per acre as farming – if irrigation makes farming possible, ranching usually ends.
- Cattle ranching in the US:
  - Begins with Columbus's second voyage.
  - Cattle ranching small scale on the East Coast in the 16th, 17th, and 18th centuries.
  - In the 19th century, rapidly expanding cities became a major market for beef.
  - In the Western US, arid areas that couldn't be used for anything else could be used to produce beef cattle – the problem was getting the beef to market.

• The solution – long-distance cattle drives, from rural areas to the nearest railroad.
• By the end of the 19th century, cattle drives were basically over.
  o End of open range.
  o Expansion of railroads.
  o Changes in cattle breeding.
• Cattle ranching changed to mostly fixed location ranching.
  ❖ Some cattle are still raised on ranches, but most on shifting pastures.
  ❖ Many cattle now shipped to feed lots for fattening near their market.
  ❖ Ranching is also practiced in other developed countries:
    • Spain and Portugal.
    • Argentina, Brazil, Uruguay.
    • Australia.

Image sources: http://www.photolib.noaa.gov/coastline/line0419.htm ;
http://sofia.usgs.gov/sfrsf/rooms/nutrients/controls/bmp/
http://www.cr.nps.gov/history/online_books/hh/thro/throb.htm

**Mediterranean Agriculture**

❖ Adapted to the Mediterranean climate region – places with warm dry summers, and mild wet winters (this is a very odd pattern – most places get plenty of precipitation in summer).
❖ Most crops are grown for human consumption – not animal feed.
❖ Primary source of the world's olives, grapes, etc.
❖ Wheat and other grains also grown in traditional Mediterranean areas (but mostly for local consumption).
❖ Animals and animal products of less importance traditionally.

Truck Farming

- Truck farming has nothing to do with trucks or trucking! The word “truck” comes from an old English word meaning “to carry” or “to exchange.”
- Specialty fruit and vegetable farming – very similar to “market gardening.”
- Fresh fruits and vegetables – perishable produce.
- Farmers tend to specialize in a few profitable crops.
- Traditionally grown near markets.
- With modern transportation – areas like California's Central and Imperial Valleys, Arizona's Gila River Valley, parts of Texas, Florida, Georgia, etc. have become truck farming areas for the whole country.

Image source: http://www.montgomerycountymd.gov/content/ded/AgServices/tour2.html

Plantation Agriculture

- Plantations today are almost always in the tropics, less developed countries.
- Outside, often absentee owners.
- Local labor may be imported to an otherwise uninhabited area.
- Crops grown almost exclusively for sale in distant markets – mostly in developed countries.
- Specialization in one or two crops (for example, bananas, tea, coffee, oil palm, teak, sugar, rubber, tobacco, etc.).


Agriculture and the Environment

- Agriculture is severely constrained by
  - Climate
  - Terrain
  - Soil
- Yes, it's possible to grown tomatoes in Iceland – but it's expensive, and takes sophisticated technology.
- Agriculture can have a strong – even devastating – impact on the natural environment:
• Slash-and-burn agriculture (if poorly done, can ruin forest lands for years)
• Overgrazing (can cause soil loss, erosion)
• Desertification (agriculture practiced on marginal lands can degrade land, expanding arid areas)
• Irrigation
  o Salinization
  o Waterlogging


**Agriculture and Economics: Subsistence Agriculture**

❖ Population growth:
  • A rising population means that subsistence farmers must produce more food.
  • According to Esther Boserup (as discussed in your book), this means that they will use newer, more intensive forms of agriculture to increase yield.
  • Great idea – except that it's not possible in all areas, due to environmental factors.

❖ International trade:
  • The idea of talking about “subsistence” and “trade” seems contradictory – but many subsistence farmers do produce cash crops.
  • The most popular (and most profitable): **drugs**.


**Agriculture and Economics: Commercial Agriculture**

❖ Market Orientation: The Von Thünen Model
  • In 1826 Johann Heinrich von Thünen noticed something – identical physical characteristics (climate, soil) didn't necessarily mean identical crops.
  • The crops farmers chose to plant were determined by
    o Crop value
    o Cost of transportation
Von Thünen's model did not take into account any actual site factors – rivers, roads, etc. – but the model can be modified to deal with them. The model is still useful – it helps explain why farmers choose the crops they do, where it makes sense to produce low-value bulky commodities, and where it doesn't, etc.

- **Overproduction**
  - Commercial farmers suffer from low incomes because they produce too much.
  - In developed countries, modern crop varieties, machines, chemicals, etc. have increased yields enormously – and the greater the supply, the lower the price.
  - Most governments in the developed world have instituted farm policies to either protect domestic producers or limit production.

- **Off-farm migration**
  - In many areas of the developed world, it has become difficult to get people to stay in farming regions.
  - This leads to greater dependence on migratory labor, absentee ownership, and consolidation of farms and farming.

- **Loss of crop diversity**
  - Replacement of genetically diverse local varieties with hybrid (commercially produced) seed.
  - Loss of unique disease, climate and pest resistance.
  - Loss of genetic resources.