CHAPTER 10: FOOD & AGRICULTURE
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INTRODUCTION
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Big Ideas
- Agriculture is a primary sector economic activity
- Geographers group farms into several different types based on their distinctive
  environmental and cultural characteristics
- Important questions regarding agriculture:
  - What happens to farm products? (farm → markets → consumption)
  - Why do farming techniques vary around the world? (climate, soil, topography)

Significant Geography Concepts
- Regions: differ by level of development
  - LDCs: farm products consumed on or near the farm where they are produced
  - MDCs: farmers sell what they produce
- Space: physical environment limits agricultural practices
- Place: local environment and cultural conditions in each place create differences
- Scale and Connections: globalization of the economy creates international trade
Key Issue 1: Where did agriculture originate?
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Introduction to Agriculture | p. 347
- **Agriculture**: deliberate modification of Earth’ surface through cultivation of plants and raising of animals to obtain sustenance or economic gain
  - originated when humans domesticated plants and animals
  - **crop**: any plant cultivated by people
- **LDCs**: ½ of people are farmers → grow enough to feed themselves
  - 97% of the world’s farmers are in LDCs
- **MDCs**: fewer farmers
  - 2% of people in the US are farmers
  - advanced farming technology = provide food for US and other countries
- **SIG**: farmers use their knowledge of the environment to modify the landscape
  - choose an agricultural based on economics and cultural values
    - dietary preference, availability of technology, cultural traditions

Invention of Agriculture | p. 347
- **Hunters and gatherers**: lived in small groups of fewer than 50
  - *division of labor*: men hunted and women collected berries, nuts, roots
  - traveled frequently
  - migration depended on seasonal movement of game and growth of plants
- Today 250,000 people survive by hunting and gathering
  - Bushmen of the Kalahari: Botswana, Namibia
  - Live on the periphery of world settlement

Agricultural Revolution | p. 348 - 349
- **Agricultural revolution**: time when humans first domesticated plants and animals and no longer relied on hunting and gathering
  - 8000 BC: population grows rapidly due to invention of agriculture
  - **SIG**: larger, more stable sources of food = more survival
- Combination of environmental and cultural factors led to the agricultural revolution
  - **Environmental**: end of the last ice age led to better climates for growing/animals
  - **Cultural**: human behavior is responsible for origin of agriculture
    - nomads created permanent settlements and stored surplus
- **Crop hearths**: agriculture originated in multiple hearths around the world
  - *Southwest Asia*: earliest crop domestication → diffused west to Europe and east to Central Asia
  - *East Asia*: rice in Yangtze River in eastern China; Millet along Yellow River
  - *Sub-Saharan Africa*: sorghum in central Africa - yams, millet and rice developed independently of SW Asia
○ *Latin America*: beans and cotton in Mexico; potato in Peru → maize diffused north to North American and southward into tropical South America

● **Animal hearths**: animals were also domesticated in several hearths at different times
  ○ *Southwest Asia*: hearth for cattle, goats, pigs, sheep → important to ag
  ○ *Central Asia*: horse → diffused with the Indo-European language
  ○ **SIG**: use of animals for farm work, milk, meat, and skins

● **SIG of Multiple Hearths**: multiple origins means that from the earliest times, people have produced food in distinctive ways in different regions
  ○ diversity due to plants, climate, cultural preferences

**Comparing Subsistence and Commercial Agriculture | p. 350 - 351**

● **SIG**: LDCs practice subsistence agriculture -- MDCs practice commercial farming

● **Subsistence farming**: production of food for consumption by the farmer’s family (LDCs)

● **Commercial agriculture**: production of food for sale off the farm (MDCs)

● % of farmers in the labor force:
  ○ LDCs: 44% of labor force is farmers
  ○ MDCs: 5% of labor force is farmers
    ■ **SIG**: produce enough food for themselves, the region, and elsewhere

● use of machinery:
  ○ LDCs: work is done with hand tools and animal power
  ○ MDCs: advanced technology means fewer people/animals need to work
    ■ transportation improvements aid farmers (railroads, etc)
    ■ GPS to spread fertilizers, monitor herds

● farm size:
  ○ LDCs: small farms (2.5 acres)
  ○ MDCs: large farms (418 acres) due to mechanization
    ■ handful of large farms dominate commercial agriculture
    ■ losing farmland due to expansion of urban areas

**CHECK-IN: Key Issue 1 |  These are the big “take-aways” from KI 1**

1. Before the invention of agriculture, most humans were hunters and gatherers.
2. Agriculture was invented in multiple hearths beginning approximately 10,000 years ago.
3. Modern agriculture is divided between subsistence agriculture in developing countries and commercial agriculture in developed countries. They differ according to the percentage of farmers, use of machinery, and farm size.
Key Issue 2: Why do people consume different foods?
p. 352 - 359

Diet | p. 352 - 353
● consumption of food varies around the world, both in amount and nutrients
● MDCs: consume more food and from different sources than LDCs
● climate and cultural preferences influence what we eat
● dietary energy consumption: amount of food than an individual consumes
  ○ most calories come from cereal grains (i.e. wheat, rice, corn)
    ■ 90% of all grain production and 40% of dietary energy
  ○ Wheat: consumed in MDCs and Central/SW Asia
  ○ Rice: developing regions → East, South, and Southeast Asia
  ○ Maize: leading crop in the world
● protein is needed for growth and maintenance of the human body
  ○ SIG: MDCs and LDCs get their protein in very different ways
    ■ MDCs: meat products
    ■ LDCs: cereal grains

Nutrition and Hunger | p. 354 - 355
● food security: physical, social, and economic access at all times to safe and nutritious food sufficient to meet dietary needs and food preferences for an active and healthy life
  ○ only need 1800 calories per day
  ○ consume 2,800 calories per day on average
  ○ MDCs consume 3,600 calories per day
  ○ LDCs consume 2,600 calories per day
● undernourishment: dietary energy consumption that is continuously below the minimum requirement for maintaining a healthy life and carrying out light physical activity
  ○ 870 million people are undernourished → 99% of these live in LDCs
    ■ India has the most undernourished people (225 million)
    ■ China (130 million)
  ○ China has decreased its number of undernourished
  ○ South Asia and sub-Saharan Africa have increased

CHECK-IN: Key Issue 2 → These are the big “take-aways” from KI 2
1. Most food is consumed in the form of cereal grains, especially wheat, rice, and maize.
2. People in developed countries consume more total calories and a higher percentage through animal products.
3. Most humans consume more than the recommended minimum calories, but undernourishment is widespread in Asia and sub-Saharan Africa.
Key Issue 3: Where is agriculture distributed?

p. 360 - 373

11 Agricultural Regions of the World → 5 in Developing and 6 in Developed  |  p. 356-357

- 5 types of agriculture in developing regions
  - pastoral nomadism
  - shifting cultivation
  - intensive subsistence, wet rice dominant
  - intensive subsistence, wet rice not dominant
  - plantation

- 6 types of agriculture in developed regions
  - mixed crop and livestock
  - dairying
  - grain
  - livestock ranching
  - Mediterranean
  - commercial gardening

Agriculture in Developing Regions  |  p. 358

- people produce food for their own consumption
- **SIG**: agriculture varies between climates (tropics/drylands) and also between developing and developed countries → this shows a major flaw with environmental determinism
  - geographers are wary of placing too much emphasis on the role of climate
  - cultural preferences also explain agricultural differences

Pastoral Nomadism  |  p. 358-359

- **pastoral nomadism**: form of subsistence agriculture based on the herding of domesticated animals
  - adapted to dry climates (Central and Southwest Asia and North Africa)
  - examples: Bedouins of Saudi Arabia and North Africa
- animals provide milk, skins, hair
- pastoral nomads consume mostly grain, not meat
  - women/children plant crops at a fixed location while men wander with herd
  - size of the herd is an important measure of power
- choose animals based on local cultural and physical characteristics
  - camel: North Africa and SW Asia
  - horse: Central Asia
- do not wander randomly, but have a strong sense of territoriality
  - migration patterns based on water sources, seasons
  - **transhumance**: seasonal migration of livestock between mts / lowland pastures
- **SIG**: declining due to modern technology and need for land
  - government are trying to resettle nomads (China, Kazakhstan)
**Shifting Cultivation | p. 360-361**

- **shifting cultivation**: practiced in tropical regions with high temperatures and abundant rainfall → especially tropical rainforests of Latin America, sub-Saharan Africa, SW Asia
  - farmers clear land for planting by slash-and-burn
  - farmers grow crops on a cleared field for only a few years, then leave it fallow
- **swidden**: the cleared area, which is prepared by hand for planting
  - supports crops only for a few years, usually the second year after burning
  - when the swidden loses its nutrients, the field is abandoned for years
- crops vary by local custom and taste
  - rice (SE Asia), corn and cassava (South America), millet and sorghum (Africa)
- planting is not done in rows → multicropping is very common
- traditionally land was owned by the village as a whole, but today is privately owned
- **SIG**: land under shifting cultivation is declining due to deforestation of rainforests
  - logging, cattle ranching, and cash crops
  - leads to global warming
- critics of shifting agriculture:
  - preliminary step in economic development
  - should be replaced by more sophisticated and efficient ag practices
- defenders of shifting agriculture:
  - most environmentally sound approach for the tropics
  - does not damage soil, cause erosion, or unbalance an ecosystem

**Intensive Subsistence with Wet Rice Dominant | p. 362-363**

- **SIG**: shifting cultivation and pastoral nomadism are found in populations of low densities, whereas intensive subsistence agriculture is found in areas of high population density
- **intensive subsistence agriculture**: farmers must work intensively to subsist on a parcel of land
  - practiced in East, South, and Southeast Asia
  - smaller farms, careful practiced passed on for thousands of years
  - work is done by hand
  - prepare field by plow and then flood the paddy
  - most cultivation takes place in river valleys and deltas (flat, flooded)
- **wet rice**: rice planted on dry land in a nursery and then moved as seedling to a flooded field to promote growth
  - China and India: 50% of the world’s rice production
  - East, South, and Southeast Asia: 90% of world’s rice production
- **double cropping**: two harvests per year from one field
  - common in places with warm winters (southern China and Taiwan)
  - alternate between wet rice and dry crops (wheat, barley)

**Intensive Subsistence with Wet Rice Not Dominant | p. 364**

- climate prevents farmers from growing wet rice (interior India and NW China)
- wheat, barley, millet, oats, corn, sorghum, soybeans
• **crop rotation**: practice of rotating use of different fields from crop to crop each year to avoid exhausting the soil
  ○ allows for double cropping

• Communist Revolution in 1949: Chinese gov’t controlled land and set up communes
  ○ did not work, so now individuals sign contracts

**Plantation Farming | p. 364-365**

• **plantation**: large commercial farm in a developing country that specializes in one or two crops → mostly in the tropics (Latin America, Africa, Asia)
  ○ often owned and operated by Europeans or North Americans
  ○ crops are processed at the plantation before shipping (cheaper, less bulky)

• most important crops: cotton, sugarcane, coffee, rubber, and tobacco
  ○ cocoa, jute, bananas, tea, coconuts, and palm oil

• workers are usually imported and provided with food, housing, and social services

**Agriculture in Developed Regions | p. 366**

• **agribusiness**: commercial farming in which products are not sold directly to consumers, but instead to food-processing companies

• agriculture in MDCs varies by region and climate

**Mixed Crop and Livestock Farming | p. 366-367**

• **mixed crop and livestock**: integration of crops and livestock → most crops are fed to animals rather than consumed by humans
  ○ most common form of commercial agriculture in the US and in much of Europe
  ○ allows farmers to distribute workload evenly throughout year

• Corn Belt: region most important to mixed crop and livestock production

• use crop rotation to cycle crops from year to year
  ○ field is *not* left fallow, like in shifting cultivation

**Commercial Gardening and Fruit Farming | p. 367**

• predominant in southeastern US → long growing season and humid climate

• **truck farming**: grow fruits/vegetables and ship them to consumers in MDCs
  ○ often canned or frozen, sometimes fresh
  ○ highly efficient large-scale operations
  ○ hire migrant workers, specialize in a few crops

• specialty farming has now spread to New England
  ○ appeal to affluent customers
  ○ asparagus, peppers, mushrooms, strawberries

**Dairy Farming | p. 368-369**

• most important commercial agriculture practiced on farms near large urban areas of US
  ○ transportation factors = close to cities
  ○ **milkshed**: ring surrounding a city where milk can be supplied without spoiling
● dairy farming was traditionally clustered in developed regions
  ○ rising in developing countries (India is largest milk producer)
● **SIG**: improved transportation = larger milkshed radius (300 miles)
  ○ dairy farmers usually sell to wholesalers, who distribute to retailers
  ○ the farther a farm from a city, the smaller % of output devoted to fresh milk
● economic challenges for dairy farmers
  ○ labor intensive (milking cows twice a day)
  ○ winter feed is costly

**Grain Farming | p.370-371**
● grain is the major crop on most farms
● seed from grasses (wheat, corn, oats, barley, rice, millet)
● **SIG**: crops on a grain farm are grown for consumption by humans
  ○ this is what distinguishes them from mixed crop and livestock farms
● wheat is the most important crop
  ○ stored easily - used for flour
  ○ China, India, and US are largest producers of wheat
● inventions like the reaper and the combine increased productivity
● **winter wheat**: planted in autumn, hibernates in winter, and is harvest in early summer
  ○ Kansas, Colorado, Oklahoma (mild winters)
● **spring wheat**: planted in spring, harvested late summer
  ○ Dakotas, Montana (harsh winters)

**Mediterranean Agriculture | p. 371**
● lands that border the Mediterranean Sea → southern Europe, North Africa, western Asia
  ○ farmers in California, central Chile, and South Africa
● share a similar physical environment
  ○ border sea, west coasts of continents, hilly land
● most crops are grown for human consumption, not animal feed
● **horticulture**: growing of fruits, vegetables, and flowers
  ○ olives and grapes
  ○ wheat for pasta
● differences in California
  ○ fruit and vegetables
  ○ loss of agricultural land due to housing developments
  ○ requires massive irrigation

**Livestock Ranching | p. 372-373**
● **ranching**: commercial grazing of livestock over an extensive area
  ○ semiarid and arid land
  ○ practiced in developed countries
● cattle ranching expanded in 1860s due to increased demand for beef
  ○ expansion of the railroads led to a decline in cattle drives
• ranchers have range rights - graze on open land without owning it
  ○ US gov’t started selling open lands to farmers
  ○ farmers fenced in land, forcing ranchers to purchase land
• **SIG:** ranching generates lower income per area of land compared to farming
• commercial ranching is growing around the world
  ○ South America: Argentina (access to seaports)
  ○ China is leading producer of meat in the world
• evolution of ranching is the same everywhere:
  ○ herding over open ranges → fixed farming and ranches → commercial ranches

**CHECK-IN: Key Issue 3** → *These are the big “take-aways” from KI 3*

1. Agriculture can be divided into 11 major regions, including 5 in developing regions and 6 in developed regions.
2. In developing regions, pastoral nomadism is prevalent in drylands, shifting cultivation in tropical forests, and intensive subsistence in regions with high population concentrations.
3. In developed regions, mixed crop and livestock is the most common form of agriculture. Dairy, commercial gardening, grain, Mediterranean, and livestock ranching are also important.

**Key Issue 4: Why do farmers face economic difficulties?**

p. 374 - 389

**Challenges for Farmers in Developing Countries | p. 374-377**

• subsistence farmers must feed an increasing # of people due to rapid population growth
• traditional subsistence farmers are pressured to grow food for export instead of direct consumption → due to international trade approach to development (i.e. Rostow’s Model)

**Subsistence Farming and Population Growth | p. 374-375**

• Ester Boserup: economist who studied agricultural development
  ○ population growth influences distribution of types of subsistence farms
  ○ compels farmers to consider new farming approaches to create surplus
  ○ provide food for urban residents, who cannot grow their own
• new farming methods: plows, weeding, more manure, more terraces
• Boserup’s Five Stages in the Intensification of Farmland
  ○ *Forest Fallow:* fields cleared and used for 2 years, left fallow for 20 years (long enough for forest to grow back)
  ○ *Bush Fallow:* field cleared and used for 8 years, left follow for 10 years (long enough for small trees and bushes to grow back)
  ○ *Short Fallow:* fields cleared and used for 2 years, left fallow for 2 years (long enough for wild grasses to grow back)
- Annual Cropping: fields used every year and rotated between legumes and roots
- Multi-cropping: fields used several times a year and never left fallow

Subsistence Farming and International Trade
- to expand production, subsistence farmers need higher-yielding seeds, fertilizer, pesticides, and machinery
  - import supplies from other countries
  - problem: lack the funds to buy equipment from MDCs
- SIG: in order to generate funds to buy ag supplies, developing countries must produce something that can be sold to developed countries
  - MDCs will pay high prices for fruits/vegetables out-of-season
  - SIG problem: more land devoted to producing export crops means less land available for growing crops for domestic consumption

Africa’s Food-Supply Struggle | p. 375
- sub-Saharan Africa is struggling to keep food production ahead of population growth
- threat of famine in the Horn of Africa and the Sahel
  - farmers overplanted, herd size increased beyond land capacity
  - limited vegetation and scarce water
- government policies have worsened the crisis
  - keep prices low to make it affordable
  - this hurts farmers’ profits

Drug Crops | p. 376
- export crops grown in some LDCs can be converted to drugs
  - cocaine - from coca leaf (Colombia, Peru, Bolivia)
  - heroin - from raw opium gum (Afghanistan, Myanmar)
  - marijuana - from cannabis sativa plant

Food Prices | p. 376
- food prices are a greater challenge than food supply
  - doubled between 2006 and 2008
- high food prices due to four factors:
  - poor weather
  - higher demand
  - smaller growth in productivity
  - use of crops as biofuels instead of food

Challenges for Farmers in Developed Countries | p. 378-379
- commercial farmers produce large quantities of food, and face low prices for their output

Overproduction in Commercial Farming | p. 378
- produce more food than is demanded by consumers in MDCs
- more efficient than before
example: # of dairy farms has decreased, but milk production has increased

- demand is stagnant in MDCs because of low population growth
- three US gov’t policies to address overproduction
  - farmers encouraged to avoid producing crops that are in excess supply
  - gov’t pays farmers when certain commodity prices are low
  - gov’t buys surplus production and sells or donates it to foreign gov’ts
- irony: in MDCs farmers are encouraged to grow less food, in LDCs more food

Importance of Access to Markets | p. 378-379
- distance from farm to market influences the farmer’s choice of crop to plant
- **Von Thunen model**: explains the importance of proximity to market in choice of crops on commercial farms
  - von Thunen was an estate owner in northern Germany, 1826
    - based his model on his experience as a large estate owner in 19th century Germany
    - model is applicable on a national or global scale
    - assumes all land in a study area had similar site characteristics
      - von Thunen recognized model could vary based on topography
      - ex: river modify rings due to transportation routes
    - failed to consider that social customs and gov’t policies influence ag.
  - farmers compare two costs when considering which crops to cultivate:
    - cost of land
    - cost of transporting products to market
  - **SIG**: transportation is the most important factor
- von Thunen Model
  - *First Ring*: market-oriented gardens and milk producers
    - expensive to deliver and must reach the market quickly
  - *Second Ring*: wood lots → timber for construction and fuel
    - bulky product - needs to be close to market
  - *Third Ring*: various crops and pasture
    - commodity was rotated from one year to next
  - *Fourth Ring*: animal grazing
    - requires a lot of space

Strategies to Increase the World’s Food Supply | p. 380-385
- four strategies used to distribute food to everyone in the world:
  - increasing exports from countries with surpluses
  - expanding the land area used for agriculture
  - expanding fishing
  - increasing the productivity of land now used for agriculture

Increasing Exports from Countries with Surplus | p. 380
- trade in food has increased rapidly
- moving from the Western Hemisphere to the Eastern Hemisphere
- Latin America (Brazil and Argentina) are leaders for export of ag products
- major food importing regions
  - prior to 1980s: Europe, East Asia, and USSR
  - today: Japan, UK, China, Russia
- US is the world’s leading exporter of grain (especially corn)

**Expanding Agricultural Land | p. 380-381**
- **SIG**: today, few scientists believe that further expansion of agricultural land can feed the growing world population
- **desertification**: human actions cause land to deteriorate to a desertlike condition
  - excessive crop planting, animal grazing, and tree cutting
- excessive water threatens agricultural land
  - waterlogged roots, excessive salinity (salt)
- urbanization reduces agricultural land
- **prime agricultural land**: most productive farmland
  - loss of this in the US caused by urban sprawl

**Expanding Fishing | p. 382-383**
- historically, the sea has provided only a small % of the world’s food supply
  - fish, crustaceans (shrimp, crabs), mollusks, and aquatic plants
- water-based foods are acquired in two ways:
  - fishing
  - **aquaculture / aquafarming**: cultivation of seafood under controlled conditions
- human consumption of fish/seafood has increased greatly
  - LDCs responsible for % of this increase
  - still only 1% of calories consumed by humans
- fish production through aquaculture has increased
  - ¼ for human consumption
  - ½ for fish meal for poultry/hogs
- 18 major fishing regions in the world
  - 7 in the Atlantic and Pacific
  - 3 in the Indian Ocean
  - 1 in the Mediterranean Sea
  - inland waterways (China, North America, Africa)
- largest yields: Pacific Northwest and Asia’s inland waterways (China)
- overfishing is a problem in the North Atlantic and Pacific oceans
  - 90% decline in tuna and swordfish

**Increasing Productivity | p. 384-385**
- **SIG**: get more food from the same amount of land
- **green revolution**: invention and rapid diffusion of more productive agricultural techniques during the 1970s and 1980s
- introduction of new higher-yield seeds
- expanded use of fertilizers

- Rockefeller and Ford foundations sponsored studies → Norman Borlaug (1970s)
  - developed “miracle wheat seed” (a.k.a. golden wheat)
  - used in Indonesia, Taiwan and then diffused rapidly around the world
  - India: wheat production doubled in five years

- **SIG:** green revolution prevented a food crisis during the 1970s and 1980s
- need for more fertilizer and machinery, but LDCs don’t have the funds
  - govt’s need to subsidize cost of seeds, fertilizers, and machinery

- **genetically modified foods:** genetic manipulation of plants/animals to isolate and encourage the most favorable traits
  - worldwide GMOs: 77% of soybeans, 49% of cotton, 26% of corn
  - US GMOs: 94% of soybeans, 90% of cotton, 88% of corn

- ¾ of the food Americans consume as at least one GMO ingredient

- **SIG:** US has urged sub-Saharan African countries to increase food supply using GMOs

- opposition to GMOs in Africa:
  - health problems: can reduce effectiveness of antibiotics
  - export problems: Africa exports most of its food to Europe
    - Europe has labeling laws for GMOs and believe they are not as nutritious
    - African farmers fear European will stop buying their exports
  - increased dependency on the US: concerned they would have to purchase seeds every year from Monsanto

**Sustainable Agriculture | p. 386-387**

- **sustainable agriculture:** agricultural practices that preserve and enhance environmental quality → typically generate lower revenues than conventional farmers
  - example: organic farming

- **ridge tillage:** system of planting crops on ridge tops
  - lowers production costs and conserves the soil
  - need less machinery

- limited herbicides to control weeds
  - mechanical weed control

- integrate growing of crops and raising of livestock on individual farms
  - like the mid-1900s, when farmers were more specialized

**CHECK-IN: Key Issue 4 ➔ These are the big “take-aways” from KI 4**

1. Farmers in developing countries face challenges of meeting the needs of rapid population growth and growing food for export.
2. Farmers in developed countries face challenges of overproduction and access to markets.
3. Four strategies for increasing the world’s food supplies include increasing exports, expanding agricultural land, expanding fishing, and increasing productivity of land.
4. Sustainable agriculture involves sensitive land management, limited use of chemicals, and better integration of crops and livestock.