



Unit 5: Agricultural & Rural Land-Use Patterns



Class

Human Geography

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5.3 — Agricultural Origins & Diffusions

Before → searching for food took time for humans

After → humans developed nonagricultural technologies after learning to grow crops

Centers of Plant & Animal Domestication

First Agricultural Revolution / Neolithic Revolution: origin of farming

- *Subsistence farming* → farmers consumed the crops they raised using simple tools and manual labor
- Five centers/hearths: Southwest Asia, East Asia, South Asia, Africa, the Americas

Agricultural Hearths

Agricultural Hearth: each area where different groups began to domesticate plants and animals

Carl Sauer → people in various times and locations developed *agricultural hearths* independently

- First hearths → areas with high biodiversity on the edge of forests

Hunters in *Central Asia* were (*probably*) the first to **domesticate animals**.

- Growing crops came after
 - People first used *vegetative farming* (using parts of the stems or roots of existing plants to grow others)

Foragers: small, nomadic groups who had primarily plant-based diets and ate small animals or fish for protein

Major Hearths of Crop Agriculture

| TIME PERIOD | LOCATION | CROPS | EARLY DIFFUSION PATTERN |
|---------------------------|---|---|---|
| 10,000 → 12,000 years ago | Southwest Asia (<i>Fertile Crescent</i>) | Barley, Wheat, Lentils, Olives | North Africa, Southern Europe, Central Asia |
| 10,000 years ago | Southeast Asia | Mangos, Taro, Coconuts | Southeastern Asia |
| 9,500 → 7,500 years ago | South Asia (<i>Indus Valley</i>) | Barley, Cotton, Wheat, Peas | Indian subcontinent, Southwest Asia |
| 9,500 years ago | East Asia | Rice, Soybeans, Walnuts | North Central Asia, Korean peninsula |
| 7,000 years ago | Sub-Saharan Africa | Yams, Sorghum, Cowpeas, Coffee, African Rice | Western Africa, North Africa |
| 5,500 years ago | Mesoamerica | Squash, Peppers, Maize (Corn), Potatos, Cassava | North America, South America |

Fer tile Crescent → domestication first took place

Development of *agriculture* → allowed people to live in permanent, higher-density communities

- Communities were usually alongside rivers as a source of water, food (fish), transportation, and defense at times
 - Constant river flooding led to *soil fertility* → more productive agriculture and denser settlements

Increases in agricultural productivity spurred creativity and advanced in **all areas of human life**.

Diffusion of the First Agricultural Revolution

Fertile Crescent: first major hearth of agriculture (in Southwest Asia)

- Eastern coast of the *Mediterranean Sea* along the *Tigris* and *Euphrates* rivers to the *Persian Gulf*
- Crops and animals were domesticated in multiple regions with seemingly no interaction among the people → **independent innovation**

Impacts of Hearths & Agriculture

Major hearths of agriculture → first urban centers → first civilizations (large societies with cities and powerful states)

- Civilization → increased trade, larger empires, and conquest
- Societal development → people specializing in work, new occupations, new technologies
- Advent of advanced transportation → More globalization of agriculture

The Columbian Exchange

Columbian Exchange: the global movement of plants and animals between Afro-Eurasia and the Americas

- Came after the voyage of *Christopher Columbus* in 1492

Europeans → plants and animals across the Atlantic Oceans to and from the Americas

- Crops and domesticated animals moved across regions and countries
- Diseases also diffused across the world

Domestication: the deliberate effort to grow plants and raise animals adapted to human demands using selective breeding

- Creates desirable characteristics in organisms

Modern Diffusion

Industrial Revolution → Second Agricultural Revolution

- New machines → increase the food supply exponentially

Green Revolution → scientists created crossbred/hybrid seedlings in a laboratory
→ allow *semiperiphery* countries can support growing populations

5.4 — The Second Agricultural Revolution

Since the mid-18th century, **agriculture** has advanced technologically (due to *Industrial Revolution*).

- Uses innovation and science to meet an increased global demand for food
- **Second Agricultural Revolution** → used advances of the *Industrial Revolution* to increase food supplies and support population growth
 - Began in the 1700s
 - Agriculture benefited from *mechanization* with improved knowledge of fertilizers, soils, and selective breeding
- *Third Agricultural Revolution* → included the Green Revolution and an agribusiness model that controlled the development, planting, processing, and selling of food products
 - Began in the 1960s

Impact of the Second Agricultural Revolution

- Mechanization of agricultural production
- Advances in transportation
- Development of large-scale irrigation
- Changes to consumption patterns of agricultural goods

Technological innovations (*steel plow, mechanized harvesting*) → increased food production

- Increased global networks → More people with access to a greater variety of food → Increasing *life expectancies*

Property Rights and Farming Advances

Enclosure Acts: a series of laws enacted by the British government that enabled landowners to purchase and enclose land for their own use (previously *common land*)

- **Enclosure System** → communal lands are owned by a community rather than an individual
 - Creates labor surplus
- Similar movements occurred throughout Europe → allowed for larger farms, efficient production, crops for profit rather than *personal consumption*

Advances in food production technology → better diets, longer life expectancies, increased population

- Displaced farmers due to the *Enclosure Acts* → larger potential workforce for factories

Early Advances in Modern Agriculture

Iron/Steel Plow (1819) → Reduced human labor, increased strength to break through harder soils, increased amount of *crops grown per acre*, increased farm sizes

Mechanized Seed Drilling (18th century) → Planted and covered each seed quickly, resulted in increased yield per acre

McCormick Reaper/Harvester (1831) → Increased harvest, Reduced human labor, Reduced amount of crops that perished in the field before harvest

Grain Elevator (1849) → Increased storage space and food supply, Protected harvested food

Barbed Wire (1870s) → Provided inexpensive fencing to keep livestock in grazing areas, Demarcated property

Mixed Nitrogen and Nitric Acid Fertilizer (1903) → Increased *crop yields per acre*

Farming techniques → farmers could produce a greater variety of food products

- **Crop Rotation:** the technique of planting different crops in a specific sequence on the same plot of land in order to restore nutrients back into the soil
- Farmers began to understand *proper soil management* during the Second Agricultural Revolution

Improved irrigation systems → stable/controlled water supply → increased yields

- **Irrigation:** the process of applying controlled controlled amounts of water to crops using canals, pipes, sprinkler systems, or other human-made devices (rather than just *rainfall*)

Improvements in transportation and refrigeration for goods → Increased distance goods could transported, reduced time for agricultural products to get to domestic markets

- Foundation for the expansion of global trade in the *Third Agricultural Revolution*

Agricultural Changes and Shifting Demographics

- Fewer, larger, more productive farms
 - Decrease in the number of farm owners and need for agricultural laborers
 - Displaced farm laborers migrated to US urban centers in the 19th century

Today: only 3.6% of the US workforce is involved with farming industries

5.5 — The Green Revolution

M.S. Swaminatha → Indian geneticist (prominent leader in the Green Revolution)

- Agriculture is a source of employment and global outsourcing (not just *production of food*)

The Third Agricultural Revolution

Third Agricultural Revolution → born from science, research, and technology

- Expanded mechanization of farming, new global agricultural systems
- Used scientific & information technologies to further previous advances in agricultural production
- The *Green Revolution* considered the most important aspect of the *Third Agricultural Revolution*

The Green Revolution

Green Revolution: the advances in plant biology of the mid-20th century

- Dr. Norman Borlaug → “father of the Green Revolution”
 - Laid the foundation for scientifically-increasing the food supply to meet the demands of an increasing global population
 - Developed higher-yield, disease-resistant, faster-growing plant varieties
 - Modern method of plant breeding → Nobel Peace Prize in 1970
 - His work served as a model for the Green Revolution in spreading new agricultural technologies

Double cropping → grow more than one crop in a year in the same field

- Also increased use of fertilizer and pesticides
- Encouraged for farmers by Green Revolution scientists

Hybridization (seed hybridization): the process of breeding two plants that have desirable characteristics to produce a single seed with both characteristics

- Green Revolution scientists focused on creating *grain* varieties

New machinery (tractors, tillers, broadcast seeders, grain carts) → Introduced to developing countries

Genetically-modified organisms (GMOs) → humans use engineering techniques to change the DNA of a seed

- Increase yields, resist diseases, withstand chemicals to kill weeds and pests

Positive Impacts of the Green Revolution

Global food production increased, new technological advances, irrigation → Increased yields

Higher Yields

Crop yields began to increase without expanding cultivated land (mid-1950s)

- Kept pace with global population growth
- Helped to fight worldwide hunger and famine

Money for Research & Business

- Created high rates of investment in public & private sectors
 - Government & university funding for advanced scientific research
 - For-profit corporations created and marketed products

Food Prices

Food became more affordable due to greater supply

- Eased economic stress for developing countries
- More protest when prices rose again in 2005

Negative Consequences of the Green Revolution

Environmental Damages: Increase crop yields → More strain on the environment

- Soil erosion, environmental pollution
- Soil was drained of natural nutrients (more dependency on artificial fertilizers)
- Polluted drinking water, extinction of species, health issues
- Fossil fuel requirements for new technologies

Gender Inequality: Men benefited mostly from decision-making powers

- Men owned land, had access to financial resources, and educated on newer farming methods

Economic Changes: more research and production → higher costs

- Decreased profit margins → Less corporation investment → Dying of the movement
- Unequal access to resources and technology → Uneven development

The Green Revolution's Struggles in Africa

- Africa has a more diverse climate → Best fertilizers were more expensive
- Africa has harsher environmental conditions
- Africa lacks well-developed transportation infrastructure → costs of investments were high

Africa had high population growth → Lessened the impact of the *Green Revolution*

- Private foundation and governments worked to develop a new *Green Revolution* in Africa

5.10 — Consequences of Agricultural Practices

Modern agriculture → Commercial agriculture has replaced subsistence farming.

- Small enterprises → Large-scale businesses

Environmental Effects of Modern Food Production

Land Cover Change

Land Cover Change: the study of how land is used and the impact of changing land use

- Loss of agricultural land to the expansion of urban areas
- Geographers use data and satellite imagery to map and analyze changes in land use

Pollution

- Chemical fertilizers, insecticides, pesticides, herbicides → polluted air, water, and land
- Leads to health issues in farmers

Desertification

Desertification: alteration of the natural vegetation in arid areas causes fertile land to become infertile

- Caused by removal of forests or overgrazing livestock

Soil Salinization

Salinization → salts from water used by plants remain in the soil

- Due to improper use of irrigation or water high in salt content
- Decreases the ability of plants to uptake water and nutrients
 - Lower yields, can render soil useless

Protecting Natural Ecosystems and Conservation Efforts

Individuals, NGOs, and government agencies are working to conserve and counter the effects of landscape destruction.

- Governmental regulations

- Improved education for farmers and the general public (*consumers*)

Humans Altering the Landscape for Agriculture

Agricultural Landscapes: landscapes resulting from the interactions between farming activities and a locations natural environment

- **Agroecosystem:** an ecosystem modified for agricultural use

Terracing

Terrace Farming → building series of steps alongside a hill

- Creates flat surfaces → increases arable land, collect rainfall for crop sustenance, limits soil erosion

Managing Water

Irrigation: the process of applying controlled amounts of water to crops using dams, canals, pipes, sprinkler systems, or other manufactured devices rather than just relying on rainfall

- Increases food production and standard of living

Dams → turn streams/rivers into reservoirs for large quantities of water

Aquifers: underground reserves of fresh groundwater used to water crops

- Wells are used to access water

Reservoirs: artificial lakes created by dams across streams and rivers

- Common source of irrigation for US crops

Center-Pivot Irrigation → watering equipment rotates around a pivot and delivers specific amounts of water, fertilizer, or pesticides to the field

- Create large, circular patterns in fields *visible from above*

Misused irrigation can cause environmental damage.

Draining Wetlands

Wetlands: low-lying areas that contain a significant amount of water at/near the surface

- Fertile and able to be converted to farmland

Positive Impacts of Wetlands

- Provide biodiversity in both plants and animals
- Natural filters to protect surface water & groundwater
- Trap sediment and prevent bank erosion
- Avert flood damage
- Buffer local water supply
- Reduce greenhouse gases by storing carbon

Clearing Trees & Vegetation

Deforestation: the removal of large tracts of forest

- Occurred throughout human history as a common solution to the need for additional farmland

Desertification: a form of land degradation that occurs when soil deteriorates to a desert-like condition

Shifting Cultivation

Slash-and-Burn Agriculture: an early agricultural practice and type of shifting cultivation

- All vegetation in an area of forest is cut down and burned in place
 - Ash → nutrients to the soil
 - Land → farmed for a few years

Dust Bowl → 35 million acres of arable land became useless due to bad farmer practices and topsoil blowing away

Pastoral Nomadism

Nomadic herding → an extensive agricultural activity that involves groups of people moving often and raising animals as their main means of survival

- Pastoral nomadism → farmer keeps the animals in one area only until the supply of food reaches the point that further grazing will do permanent damage to the land

Societal Effects of Agricultural Practices

Changing Diets

- More shifting to Western diets
 - More meat & processed foods
 - Greater environmental & health impact

Role of Women in Agricultural Production

- Significant impact in helping with collecting and preparing food
- Limited access to resources & training

Economic Purpose

Agricultural products → food, fiber, fuel, raw materials

- Add to the economic value

5.11 — Challenges of Contemporary Agriculture

Farmers must utilize the opportunities and overcome challenges to be successful.

- Physical environment is the most obvious factor influences production & consumption patterns

Agricultural Innovations

Biotechnology & GMOs

Biotechnology: the science of altering living organisms (*often through genetic manipulation*) to create new products for specific purposes

- innovation to improve the quality & health of plants and animals

Impacts:

- GMOs can be more nutritious, weather-resistant, pest-resistant, less susceptible to spoilage
- Farmers reduce chemical usage to control disease, weeds, and pests

GMO crops were first introduced in the 1970s.

- May be too expensive for poor farmers to use
- May lead to the development of superpets or superweeds
- May have potential long-term risks to consumers

Precision Agriculture (AKA *precision farming*): part of the movement that some see as a *Fourth Agricultural Revolution*

- Uses a variety of cutting-edge technologies to apply inputs with pinpoint accuracy to specific parts of fields in order to maximize crop yields, reduce waste, and preserve the environment

Aquaculture

Population growth has increased the demand for food.

- Led to environmental degradation

- Overfishing → the depletion of fish in oceans and lakes

Aquaculture/Aquafarming: the practice of raising and harvesting fish and other forms of food that live in water

- **Blue Revolution** → *aquaculture* becoming the fastest growing form of food production on the planet
 - Responsible for ~50% of the world's seafood

Environmental Issues Related to Agriculture

Agricultural Chemicals & Fossil Fuels

Chemicals → most environmental impact in farming

- Artificial fertilizers can be used to replace natural nutrients in the soil
- Pesticides, insecticides, and herbicides can be used to kill unwanted insects/plants
- Machines running on fossil fuels

Depletion of Water Supplies

Freshwater can be wasted through *inefficient irrigation*.

- Overwatering
- Pipe leakage
- Excessive water use in arid locations

Improper use of water supply → salinization, water depletion

Loss of Biodiversity

Biodiversity: the variety of organisms living in a location

- **Agricultural Biodiversity** → variety & variability of plants, animals, and microorganisms that are used directly or indirectly for food and agriculture

Improved varieties of crops are developed → farmers abandon older crop varieties

- Farmers grow less varieties or crops
- *Monocropping/Monoculture* → specializing in one crop

Soil Degradation & Erosion

Grazing animals have a large impact on the landscape.

- Large, open areas → Allows grazed areas time to recover when wandering
- Restricted areas → Moved between enclosures for grassland recovery

Overgraze → density of animals > expansive grasslands can support

- Vegetation will not refresh itself after the animals leave
- Permanently damages the land

Overgrazing and overuse and land → soil susceptibility to wind/water erosion

Sustainability & Agriculture

Maintaining soil fertility, sustainable grazing, tilling practices, managing chemical levels, water conservation, renewable energy → keeps the environment *sustainable*

Farmers can use *GIS* to manage chemical applications, reduce impact on soil, and slow runoff/slow erosion.

Changes in Food Production & Consumption

Fair Trade

- More money for small farmers in *poorer countries*
- Less support for large transnational corporations that manage trade of agricultural products

Organic Foods

Organic Food → non-GMO, produced without pesticides/synthetic fertilizers, use sustainable growing practices

- Most consumers believe that organic is healthier
 - Organic farming is more labor-intensive → More jobs and more expensive product
- **USDA:** Animals must be fed 100% organic feed (ranchers cannot administer antibiotics or hormones to the animals)

Organic agriculture → Need for more land for the same quantity of food

- Naturally-occurring chemicals can be used that are harmful to health

Value-Added Specialty Crops

Value-Added Crops: crops for which consumers are willing to pay more because of special qualities or because they are difficult to acquire

- Organically-grown crops and meats
- Rare subtropical plants
- Grass-fed beefs, free-range chickens and eggs

Value-Added Farming → farmers process their crops into high-value products rather than simply selling it as it comes from the field

Local-Food Movement

Local-Food Movement: seeking out food produced nearby

- Advocates (*locavores*) → supports local farmers, reduces fossil fuel use to transport products

- Farmers markets became more popular
 - Cater to local customers with *specialty crops*

Urban Farming

Urban Farming: the production of farm goods within an urban area with the goal of providing locally-grown food

- Assume a *level of commerce* → the products will be sold and not used for personal consumption
 - Less distance between producers and consumers (fresh products)
- **Community Gardens** → popular variation of the urban farming model
 - Share agricultural products with family, friends, and those in need
- **Vertical Farms** → grow crops inside in stackable trays using *greenhouses*, *artificial lights*, and *hydroponics*
 - **Hydroponics** → crops to grow without soil using mineral-enriched solutions

Community-Supported Agriculture

Community-Supported Agriculture (CSA) → brings producers and consumers into a partnership

- Ensures local supply of fresh products

Customers buy a share and subscribe to a certain amount of crops for a season.

Challenges of Feeding a Global Population

There is enough food for everyone in the world, **BUT ~1 BILLION PEOPLE DO NOT GET SUFFICIENT FOOD.**

- Food distribution networks, cost of food → *Food shortages*

Food Insecurity

Food Insecurity → households lack access to adequate food (due to *limited money, etc.*)

- People must decide between purchasing food or other necessities
 - Children can suffer greatly due to the negative impact on learning
- **Food Security:** reliable access to safe, nutritious food that can support a healthy and active lifestyle

Food insecurity → poverty, unemployment, underemployment (all interconnected)

- Non-core countries → high population growth, political instability, environmental challenges

Problems with Distribution Systems

Food Distribution System: a network of trade and transportation that get food from farms to consumers

- Exist at multiple scales
 - *Local Scale:* farmers and consumers are hindered by their inability to get to a market
 - *Regional/Global Scale:* transportation issues

Adverse Weather

Slight changes in weather → Large effects of crops

- Crop yields and livestock can be affected by climate change

Land Use Lost to Suburbanization

Expansions of cities and suburbs → Threatens existing farmland

- Farmland is converted to suburban housing, shopping centers, business parks, etc
 - Leads to continuous loss of fertile land

Most cities were originally developed as *agricultural centers*.

- Cities are located near fertile land
 - Surrounding farmland is troubled due to urban development
 - **Suburbanization:** the shifting of population from cities into surrounding suburbs

Factors Affecting Food Production

Location of Food Processing Facilities & Markets → relative distance and transportation infrastructure affecting how farmers produce and distribute crops

- **Food Processing:** the transformation of agricultural products into food or taking food items and transforming them into a different type of food
 - Facilities closer to harvest → Fresh products & lower labor costs

Economies of Scale

Efficiency of farming operation → Reduced cost

- Calculating based on scale to find total profits

Distribution Systems

Many products are perishable → *just-in-time delivery systems*

- Reduces needs for storage space

Different distribution systems at different scales → Farmers may have to adapt their production

Government Policies

Government policies → Affect migrant laborers, change financial assistance programs, provide investments, regulate product, implement taxes

- International trade can also affect production from farmers

- Countries can impose **tariffs** (taxes on imports) and **quotas** (limits on the quantity of a good imported) to protect domestically-produced goods

Debt-for-Nature Swaps → banks forgive a portion of a country's debt, country invests in agricultural conservation