IV. AGRICULTURAL GEOGRAPHY AND RURAL SETTLEMENT

A. Introduction
1. World Land Area(24% too Cold; 27% too dry; 37% too mountainous; 4% too swampy) = 8% Arable Land to feed 6.2 billion.
2. Classifying Economic Activity
   a. Primary Activities- hunting, farming, mining, herding, forestry
   b. Secondary Activities- (change the form of raw materials- all manufacturing)
   c. Tertiary Activities - (provide goods and services-link producers and consumers) all services(financial, entertainment, lawyers, teachers, health services)
   d. Quaternary Activities - research, information processing and dissemination
   e Quinary Activities - corporate management--CEOs

B. Origins of Agriculture Areas of Plant Domestication Theses
1. Carl Sauer Thesis(11 seed hearths)
2. Joseph Spencer & William Thomas Thesis (6 primary and 5 secondary seed hearths)

C. Primary Seed Hearths---S.E Asia, E. India, N. W. India, E. African Highlands, and S. Mexico

1. Secondary Seed Hearths---N. Central China, Near East, Western Sudan, Andean Highlands, Eastern South America

2. Animal Domestication (14,000 years ago)

D. First Agricultural Revolution (12,000 years ago)
1. Crops (root crops, yams, bananas, beans maize, squashes, wheat, barley)
2. Improved Seeding Methods
3. Food Surpluses
4. Diffusion of Early Agriculture
5. Subsistence Farming - Current Locations (Northern South America, Central Africa, S. E. Asia)

6. Shifting Cultivation, Slash and Burn, Milpa or Patch Agriculture - Current Locations (Central Africa, Central America Tropical South America, S. E. Asia)

E. Second Agricultural Revolution (Late Middle Ages-Industrial Revolution)

1. Modified Tools, Soil Preparation, Fertilization, Improved Food Storage
2. Industrial Revolution-Tractors, Machine Harvesting(helped sustain revolution)
3. Crop Specialization - "Why Do Farmers Grow Particular Crops In Particular Places?"

4."Von Thunen's Spatial Model of Farming" (1826) in an Isolated State
   a. Situation Factors in Crop Choice Based on Market Location
   b. A Commercial Farmer Compares the Cost of Land vs. the Cost of Transporting Products to Market
   c. Specific Crops are Grown in Different Rings Around the Area Cities
      1) Zone #1 - dairy, vegetables, fruit, horticulture
      2) Zone #2 - wooded area for heating and cooking
      3) Zone #3 - field crops, grains, soybeans
      4) Zone #4 - livestock, ranching, sheep herding
      5) Zone #5 - wilderness
5. Von-Thunen Model variables
   a. Uniform soils, climate, and elevation
   b. No modern transportation
   c. Only real factor is distance from market to determine prices
   d. Von-Thunen Principle = "A commercial farmer compares the cost of land vs. Cost of transporting products to market"

F. Third Agricultural Revolution (1920-still in progress)
1. High level of mechanization (combines, reapers, pickers)
2. Increased use of chemicals (inorganic fertilizers, herbicides, fungicides , pesticides)
3. Food Manufacturing (processing, canning, refining, packaging)
4. Green Revolution (hybrid seeds, agro-chemicals-S.E. Asia, S. Asia and Latin America)

5. Food Manufacturing (processing, canning, refining, packaging refrigeration revolution)

6. Industrial Agriculture - "Agribusiness" - an integrated and organized system from production, storage, processing, to marketing

7. Food Chain - a sequence of living things through which energy and other matter moves in an ecosystem (inputs, production, outputs, distribution, consumption)

G. Industrial or Commercial Agriculture

1. Origins

A. Western Europe - Industrial Revolution

B. Colonial empires - raw materials were exported to European coffee, tobacco, sugar cane

2. Characteristics of Commercial Agriculture

a. Small Percentage of Farmers in the Labor Force

b. Heavy Use of Machinery

c Large Farm Size

d. Output Sold to Processors

e. Integration with Other Businesses

3. Types of Commercial Agriculture (in More Developed Countries)

a. Mixed Crop and Livestock Farming

b. Dairy Farming-Milksheds

c. Commercial Grain Farming

d. Livestock Ranching

e. Mediterranean Agriculture

f. Plantation Agriculture (rubber, tea, cotton, sugar cane, coconut, pineapple, palm oil, bananas)

g. Commercial Gardening and Horticulture

h. Truck Farming (fruits and vegetables)

I. Illegal Drug

j. Rice Growing

k. Aquaculture (Japan, S.E. Asia and U.S.)

H. Industrial Agricultural in the United States

1. Origins and Diffusion (the Von Thunen Effect)

2. Regions of Specialization in the United States

a. Dairy Belt-Ubiquitous

b. Corn Belt-centers around Iowa and Illinois

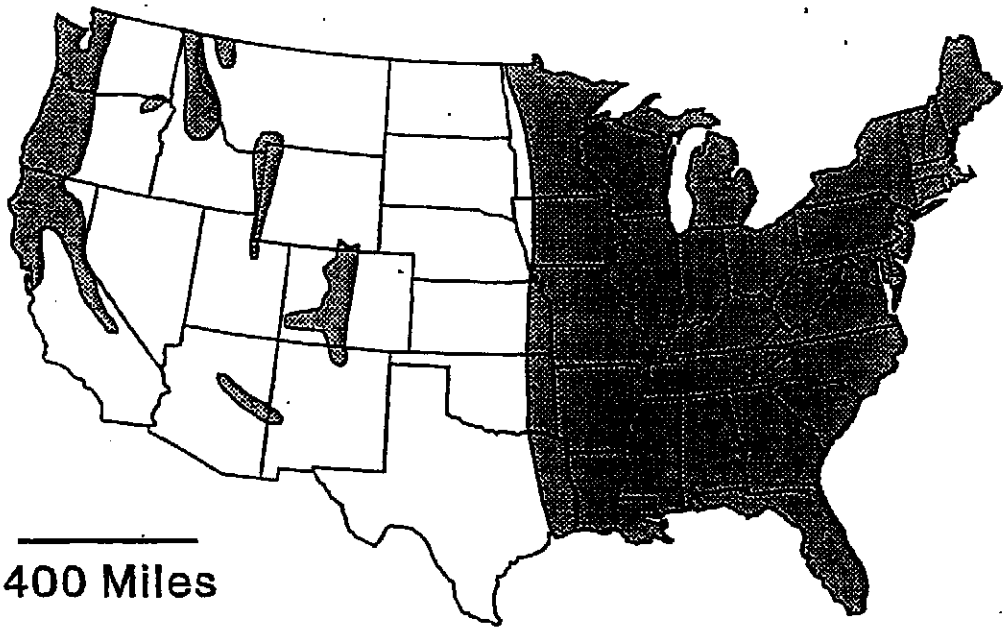
c. Spring Wheat Belt-centers around N. Dakota
d. Winter Wheat Belt-centers around Kansas
e. Rice-California and Arkansas
f. Soybeans-high correlation with corn
g. Citrus-Florida, California and Texas
h. Cotton -Texas, Mississippi and California
i. Tobacco-Kentucky, N. Carolina andVirginia
j. Broilers-Ubiqitous and Appalachians
k. Sugar Cane-Louisiana and Hawaii
l. Sugar Beets-variety of locations
m. Sorghum-south central U.S.
n. Peanuts-Georgia
o. Grapes-Wines-California and New York
p. Fruit Belt-western Great Lakes
q. Beef Cattle-Ubiquitous
r. Sheep-western U. S. and Alaska

3. Agriculture and the Environment
4. The Farm Crisis-the disappearing "family farm"
5. Sustainable Agriculture-Methods
6. Farm Subsidies- payments "not to produce"?
7. Food Aid to the Poor Countries
8. Humid vs. Arid America—100 degree meridian

I. Rural Settlement

1. Types of Rural Settlement
   a. Dispersed Settlements-houses far apart
   b. Nucleated Settlements-houses together
2. Housing and Cultural Landscapes
   a. Functional Differentiation
   b. Environmental Influences(igloo vs tents)
3. Structures and Materials
4. Traditional Dwellings and Diffusion of Housing Types
   a. New England
   b. Southern Styles
   c. Modern Dwellings (ranch, split-level)
5. Hamlets--smallest clusters(12 or less)
6. Village Forms
   a. Linear Village
   b. Cluster Village
   d. Walled Village
   e. Grid Village

Moisture Balance



400 Miles

*Available data do not allow Alaska and Hawaii to be shown at this scale.

Source: Adapted from *Argus*, 1995

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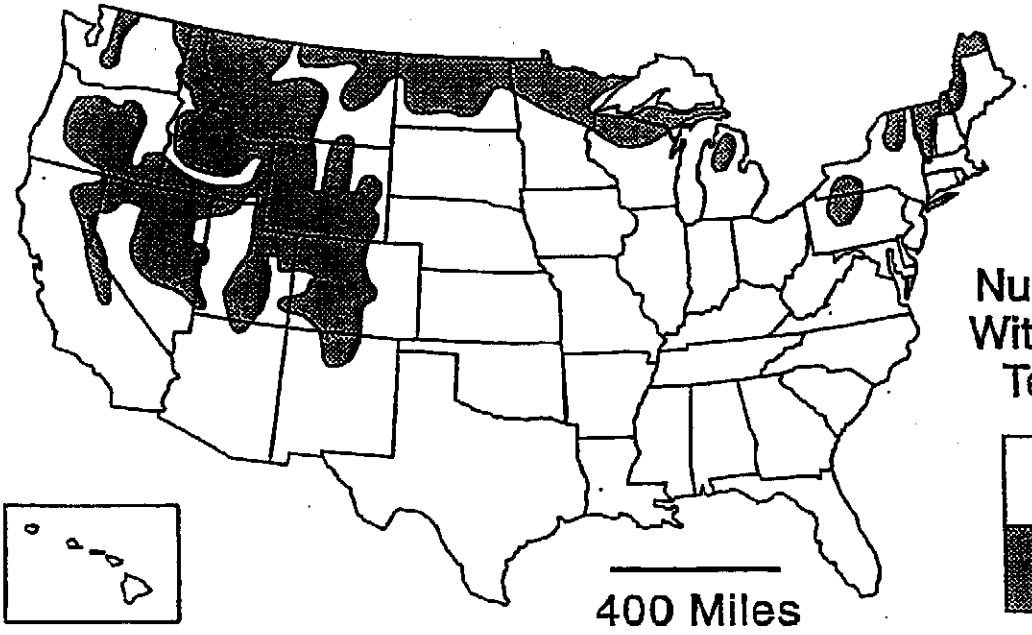
Four Month Growing Season



Same scale for Hawaii

Source: Adapted from *Argus*, 1995

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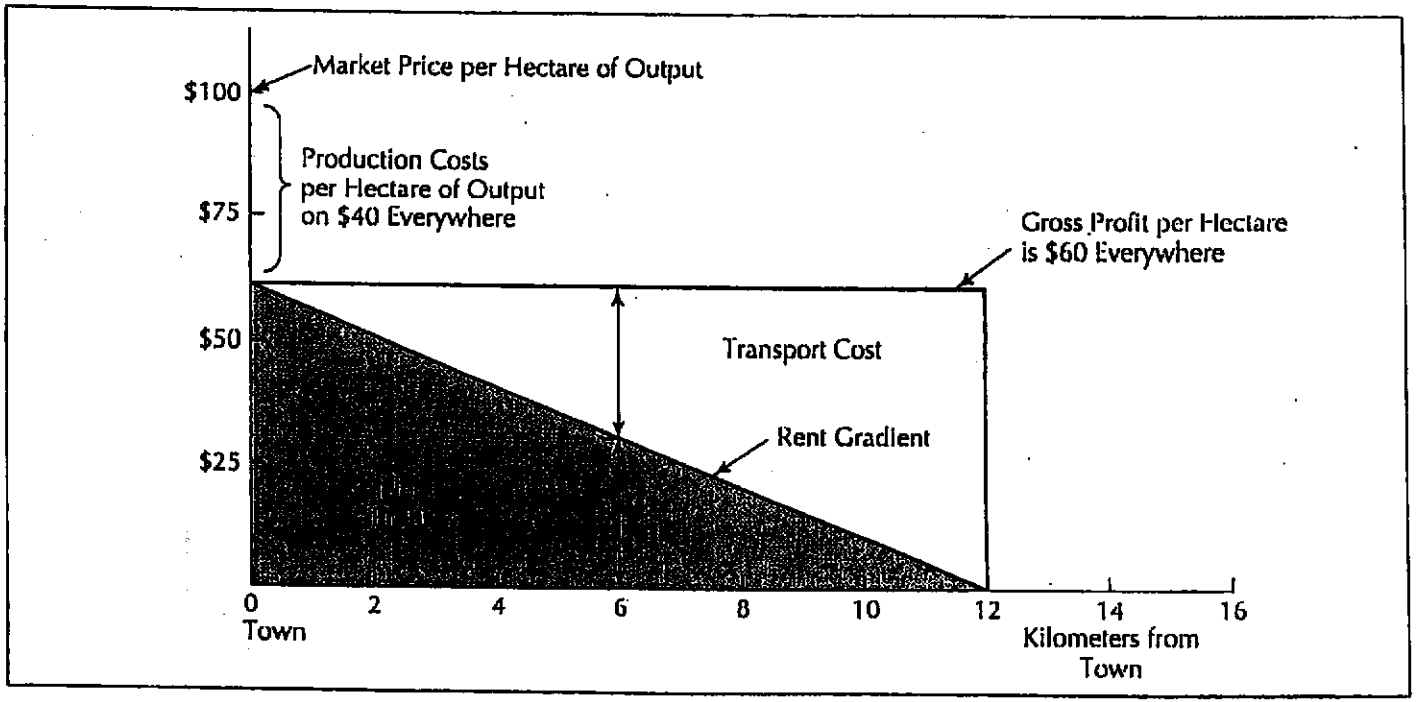
von Thünen's Equation in a Diagram



Stutz and de Souza The World Economy (1998, page 264)

Geography of Agriculture

Around ten to twelve thousand years ago, human began to domesticate plants and animals for food. Before this first agricultural revolution, people relied on hunting and gathering to obtain food supplies. While there are still groups of hunters and gatherers in the world, most societies have switched to agriculture. The beginnings of agriculture did not just occur in one place but appeared almost simultaneously around the world, possibly through trail and error with different plants and animals or by long term experimentation. Between the first agricultural revolution thousands of years ago and the 17th century, agriculture remained pretty much the same.

In the seventeenth century, a second agricultural revolution took place which increased efficiency of production as well as distribution which allowed more people to move to the cities as the industrial revolution got under way. The 18th century's Europe became sources of raw agricultural and mineral products for the industrializing nations.

Now, many of the countries which were once colonies of Europe, especially those in Central America, are still heavily involved in the same types of agricultural production as they were hundreds of years ago. Farming in the twentieth century has become highly technological in more developed nations with geographical technologies like GIS, GPS, and remote sensing while less developed nations continue with practices which are similar to those developed after the first agricultural revolution, thousands of years ago.

About 45% of the world's population makes their living through agriculture. The proportion of the population involved in agriculture ranges from about 2% in the United States to about 80% in some parts of Asia and Africa. There are two types of agriculture, subsistence and commercial.

There are millions of subsistence farmers in the world, those who produce only enough crops to feed their families.

Many subsistence farmers use the slash and burn or swidden agricultural method. It's a technique used by about 150 to 200 million people, and is especially prevalent in Africa, Latin America, and Southeast Asia. A portion of land is cleared and burned to provide at least one and up to three years of good crops for that portion of land. Once the land can no longer be utilized, a new patch of ground is slashed and burnt for another round of crops. This is not a neat or well-organized method of agricultural production by it is effective for farmers who don't know much about irrigation, soil, and fertilization.

The second type of agriculture is commercial agriculture, where the primary purpose is to sell one's product at market. This takes place throughout the world and includes major fruit plantations in Central America as well as huge agribusiness wheat farms in the Midwestern United States.

Geographers commonly identify two major "belts" of crops in the U.S. The wheat belt is identified as crossing the Dakotas, Nebraska, Kansas, and Oklahoma. Corn, which is primarily grown to feed livestock, reaches from southern Minnesota, across Iowa, Illinois, Indiana, and Ohio.

J.H. Von Thünen developed a model in 1826 (which wasn't translated into English until 1966) for the agricultural use of land. It has been utilized by geographers since that time. His theory stated that the more perishable and heavier products would be grown closer to urban areas. By looking at the crops grown within metropolitan areas in the U.S., we can see that his theory still holds true. It is very common for perishable vegetables and fruits to be grown within metropolitan areas while less-perishable grain is predominantly produced in non-metropolitan counties.

Agriculture uses about a third of the land on the planet and occupies the lives of about two and a half billion people. It's important to understand where our food comes from.

There are major events in the history of the world that are quite transforming, the invention of agriculture in the Neolithic times was one of those events. The invention of agriculture enabled the human population to differentiate itself from the higher primates. By applying agricultural technologies in very simple forms, humans were able to increase the carrying capacity of the earth's surface by many, many times. Every culture on the surface of the earth engages in agriculture in some form. We obviously need food to eat, and cultures have developed practices for storing food until times of shortage and for moving food from areas of high productivity to areas of high consumption.

In addition to the circulation of food, other aspects of food production attract the attention of human geographers. The spatial patterns of the dietary laws that govern consumption and production of crops and animals around the world have fascinated many geographers. Carl Sauer's seminal work, the *Agricultural Origins and Dispersals*, published by the American Geographical Society in 1952, is the springboard for all contemporary geographical discussions about the origins of agriculture. Sauer believed there were eleven separate centers of plant and animal domestication. This great invention probably occurred first in the areas of the tropical seashores where settled fishermen were able to produce enough surplus so that they could invest some of their wealth and time into the experimentation and nurturing of plants and animals. Sauer and others argue that large herd animals may have been domesticated first for ceremonies and then later used for other purposes. They conclude this because the religious personages in the early agricultural communities had the time to rear young herd animals to the stage at which they could actually participate in religious ceremonies. But of course, no one really knows for sure. The movement of humans around the surface of the earth diffused plants and animals to nearly every possible environment. Some of the movements are well documented; others are only vaguely understood.

The increasing availability of animal energy expanded humans' ability to till the soil. Techniques of harnessing animals evolved from the early forms of tying plows to the heavy horns of cattle to the advanced harnessing system for horses. Europeans developed the heavy horse collar which enabled the weight that the animals were pulling to be transferred to their powerful shoulders and away from their windpipe and neck. This made the horse much more effective. The use of large draft horses enabled farmers to till heavier, more productive soils, which ensured better yields of grain. Better yields meant more food for animals and eventually large, more powerful animals. Although agricultural technology evolved in all parts of the world, the process was slow. Farmers were reluctant to experiment with new, risky ventures for fear of crop failure and famine.

There are two things that must be considered when teaching the contemporary regional patterns of agricultural production. One is the relationship between agriculture systems and the climatic zones, and the second is the complicated set linkages among the production areas and the consumption areas. All forms of economic activity are involved in the shift of agriculture products to food.

Most atlases and textbooks contain a version of a map based on the map drawn by Derwent Whittlesey and published by the *Annals of the Association of American Geographers* in1936. Unfortunately, no agricultural geographer has attempted to modernize this map, and therefore it must be used with caution. This map attempts to portray the major agricultural regions in the world. One way to deal with this part of the course is to have your students study this map making sure they understand the key. The map shows a pattern of about thirteen varieties of agriculture that reflect environmental zones. For example, the nomadic herders are found in the arid regions of north and south Africa, the eastern horn of Africa, southwest Asia, central Asia and northern Eurasia. Shifting cultivation is focused primarily in tropical forests and on the savanna margins of the forests in South America, Africa, and Southeast Asia, and particularly Indonesia.

What Whittlesey calls *rudimentary sedentary cultivation* really should be thought of as *subsistence agriculture*. Another of his categories is *intensive subsistence tillage*, one form making heavy use of rice and another form really using wheat rather than rice. These circulation systems are essentially the same, but each utilizes a little different crop mixture due to the climatic differences. Livestock ranching, like nomadic herding and shifting cultivation, does seem to follow major climatic zones.

If students look at the map with some fundamental understanding of environmental zones, they will see very clear patterns. However, this map is only the beginning, because farmers have greatly modified the environment and even destroyed major components of it to bring this pattern into reality. The forests that once covered Europe have long been cleared, as have the forests that once covered part of North America east of the Mississippi. The tilling of the soil breaks up and eradicates the indigenous or natural vegetation. The crops that grow in particular places are dramatically modified from their original ancestors and in many cases bear little resemblance to the native plants that were in the area before agriculture. Wheat, for example, the dominant plant on the northern plains of the United States, has its origins in southwest Asia. The corn that blankets the Midwest of the United States and the Danubian basin had its origin in Mesoamerica.

The concentration of a crop is illustrated by commodity maps in an atlas such as *Goode's*. Wheat, for instance, is produced in the central and northern plains of North America and in the area around the Rio Plata Pampas of Argentina. In Europe, it is found from the British Isles to Syria. Other concentrations are found in the Ukraine and to the Far East along the Trans-Siberian Railroad. Wheat is also grown in the Indus and Ganges Valleys and in northern China. Further concentrations exist in southeastern and southwestern Australia. Wheat, the staff of life, is traded in a worldwide pattern from these areas of successful production to areas of population concentration where the it is converted to flour. The map of wheat movements in *Goode'sWorld Atlas* is critical to an understanding of the many connections. North America, South America, and Australia are major exporters of wheat. Most of the exported wheat goes to Europe, the Middle East, and China.

Maize or corn, another major crop that is exported, is heavily concentrated in North America, which is the largest production region. Secondary regions are in the Danubian basin and in China and Java. Corn is also grown in southern Brazil and Argentina and in parts of Africa. African corn, however, does not enter world trade. Most corn flows out from the American Midwest, down the Mississippi, out the port of New Orleans, and through the Panama Canal to major consumption regions in China. Another flow from North America moves to the Middle East and western Europe. Unlike wheat, which is consumed directly by humans in the form of bread, corn is usually fed to animals and consumed indirectly by humans.

Rice is the third major grain that moves in world trade. Enormous concentrations of rice production occur in south China and Indochina. Surpluses from these areas flow to Africa, Europe, and to the Middle East. Rice is also produced to a lesser extent in the Mississippi Valley where it enters world trade, again, flowing largely to Africa and Europe.

Other commodity flows of interest are the movement of coffee and tea from the tropics to the mid latitudes. Likewise, there is a flow of sugar from the coastal regions of South America and islands of the Caribbean and southeast Asia, and the northeast coast of Australia.

Currently, there is controversy about the flow of food around the world. Many governments think of food as a strategic material and want to ensure that their local production is adequate should warfare interrupt the flow of international trade.

In addition, farmers using their political clout have raised barriers to prevent the import of food from areas in which food is produced more efficiently. One of the significant developments in international trade and food in the 1990s has been the growing resistance in Europe to importing American crops that have been produced using the technologies known collectively as genetic engineering. While selective breeding of crops and livestock has been going on consistently for thousands of years, the breakthrough of genetics in the last 25 years has enabled more sophisticated manipulations of the characteristics of the crop through gene splicing and introducing genetic material from other plants into the seed corn. This has alarmed many people around the world, both in production areas and in consumption areas. If this opposition to genetically modified crops increases, tremendous problems will develop because of the growing reliance of American farmers on the superior productivity of the new crops.

Like other forms of economic activity, agriculture is influenced by transportation costs or the friction of distance. The major variable of bio-climatic influences is modified by the accessibility factor. It has been observed many times that on areas of seemingly homogeneous landscape, a pattern of land use will have developed that is dependent upon transportation costs.

The most fundamental model of that pattern was developed by von Thunen in the nineteenth century to describe and explain land uses on the north German plain. The von Thunen model has been described in all the popular textbooks. The illustration presented here is one of many. The important thing about the von Thunen model is the way in which it enables students to think about accessibility and to break free from explanations of agriculture that are based on out-moded notions of ethnicity and environmental determinism. The model is particularly useful in explaining the sequence of agriculture that occurred with the settlement of North America when a combination of so-called frontier crops — which were primarily wheat and small grains mixed with ranching, particularly cattle ranching — was developed. These activities moved from east to west across the continent with the expansion of the urban system and improved transportation. Therefore, even though the most ideal bio-climatic zone for wheat production would be the Ohio Valley and the great prairies of Iowa, Illinois, and Indiana, wheat is grown on the high plains farther west in the arid region. Again, wheat is grown there not because those areas have the best growing climate, but because it is the crop that will yield a profit in that site and not suffer from competition with other agriculture types.

Extensive agriculture at the edge of the von Thunen models or rings involves large land areas. An average-sized farm in Saskatchewan is 1000 acres, while a farm in North Dakota is 1300 acres. In contrast, farms engaging in intensive commercial agriculture close to the market may average 40 acres or less in size. Maps of relative value per acre of farmland show the von Thunen principal quite clearly. Land close to markets has much higher value than more distant land.

About half the world's population still lives in rural regions dominated by agriculture. The architecture of these settlements varies from place to place, although it is possible to see broad patterns. The building materials reflect local conditions as well as the availability of commercially produced products from elsewhere. There is a relationship between the form of the architecture and the function that is quite visible in certain areas. Because most agriculturists live in villages, it is important to view in some detail the nature of these rural settlement patterns.

Villages are frequently referred to as *nucleated settlements*. This is in contrast to *dispersed settlement*, which is the basic pattern that exists in the Midwest where individual farmhouses are separated from one another, and the farmers live on their own property.

Nucleated settlements, in general, conform to fundamental cultural features in the landscape. They reflect the social structure within the village, as well as the local environmental situation, such as road, dike, or levy along a river. Most frequently, the older villages were defensive in nature. The houses were close together and surrounded by some sort of wall Even though the threat of invasion is over in most places, these villages persist in their compactness and lack of a regular street pattern.

Geographers have classified villages according to their shape or form. Linear villages, with houses lined up along a road are called *strassendorfs*. Other villages are described as *round village*, a *cluster village* or a *walled village*. The village pattern was, of course, transferred to the United States with the initial colonial settlements in New England and Pennsylvania. However, with the movement over the Alleghenies and Appalachians into the interior, the preference for village settlements was broken. The Northwest Ordinance Act established rules for selling land owned by the federal government. It also established a way to survey the territory and called for the settlement of farmers on their own land. This is usually associated with Thomas Jefferson's idea of democracy and belief that the scattered farmers were more independent than those living in villages.
In various part of the world, agriculturists built villages using materials that were at hand. In areas where there was plenty of wood, the houses were built of wood. Where wood was not available, farmers used various types of brick. Sun-dried brick, or adobe, is very common in the sunny areas. Fired, or baked brick, is more common in the areas where the adobe is less suitable. Houses were also built of stone, and in some locations, poles and sticks were woven together and plastered over with mud.

The basic point of all this is that agriculturists were close to the environment and used whatever materials they had at hand. As transportation improved and manufactured products could be brought into areas, vernacular styles and building materials tended to disappear under the pressure of mass production.

The size and the structure of villages and other forms or rural settlement reflect the availability of space and local environmental conditions. The North American farmstead is larger than many villages in Africa, Asia, and Europe. Likewise, the North American farm has a highly differentiated set of buildings reflecting the function of the activities. The premodern village tended to be much more compact with a building used for several different functions.

Introduction to Modern Agriculture

The second agricultural revolution reached its peak during the hundred and fifty years from the post Civil War era to 2000. This period saw the development of barbed wire, various forms of harvesting machines (particularly Cyrus McCormick's reaper), and the tractor — first with a steam engine and then with a gasoline engine — which replaced draft animals. The revolution's major impact was the reduction in the number of people needed to operate farms.

The third agricultural revolution, beginning approximately about 250 years after the start of the second, has three distinctive features. The first is the removal of the lines between agriculture as a primary activity and secondary and tertiary activities. Farmers and agriculturists now engage in the primary activity of crop production, some sort of secondary activity of manufacturing or processing the crops, and tertiary activities of marketing and advertising their products through co-ops and other marketing organizations. The second distinctive feature of this agricultural revolution is more intensive mechanization; biotechnology is the third. Mechanization began replacing animal and human labor in the United States during the late nineteenth century. After World War II, mechanization spread to Europe and other parts of the world. Machines have gotten larger, more powerful, and more efficient.

The biotechnological phase began with chemical farming — the substitution of inorganic fertilizers and manufactured products for manure and humus to increase soil fertility. Chemicals were also used to control pests, and a wide variety of herbicides, pesticides, and fungicides have been produced in a never-ending effort to enhance the yields. This became widespread in the United States in the 1950s and spread to Europe in the 1960s and to the rest of the world during the last three decades of the twentieth century.

Food processing — adding economic value to agriculture products — is the third part of the revolution, and the part that is achieving (or attracting or gaining) the most energy and investment. While the first two phases of the revolution are focused on inputs into the agricultural process, the third is focused on output. Farmers frequently talk about the third phase as "value added," and of course it's the third part that involves agriculturists in secondary and tertiary activities. One of the indications of this has been the use of the term "agribusiness" in the United States to describe the blending of old agricultural farm-centered cultures to this new, more integrated form of production and culture. One of the most significant features of the third revolution is the elimination of the difference between urban and rural life styles.

The industrialization of agriculture in general has caused a number of changes in agrarian societies. First, there has been change in the application of rural labor as machines replace or enhance the efficiencies of human labor. In a sense, the industrialization of agriculture creates surplus labor in the rural areas that can be used for other urban activities. Second, there is the development and introduction of new and innovative inputs such as seeds, chemicals, and different kinds of technologies that supplement or replace locally produced products. Third, there has been a development of substitutes for some kinds of agricultural products. Fourth, new uses for agricultural products have been developed. The conversion of corn to sugar for use in soft drinks is an example.
The third revolution began in the1960s when a combination of technology was made available to countries in Asia and Mexico in an effort to improve the diets of people these regions. Publicists labeled this the "Green Revolution," and it has attracted much attention. But the Green Revolution is just one part of the exporting or diffusion of industrial agriculture from the core to the periphery. In general, we can think of this as a globalization of industrial agriculture or the development of a unified agricultural system that involves most of the populations of the earth.

It all began in the mid 1940s when the Rockefeller Foundation of the United States sent some agriculturists from the United States to work in Mexico to see if they could export some of the technology developed in the United States that increased wheat production. The results were phenomenal. Within seven years new forms of wheat seeds were available and in the1960s the effort was transferred to other countries. The man most associated with this is Norman Borlaug, who for most of the past five decades has lived in developing nations, teaching the techniques of high-yield agriculture. He received the Nobel in 1970, primarily for his work in reversing the food shortages that haunted India and Pakistan in the 1960s.

The Green Revolution was based on the development of new higher yielding hybrid seed varieties, a technology that was developed in the Midwest in the 1930s. The aggregate increases in production were significant. In Asia, rice production grew 66% between 1965 and 1985. India became self-sufficient in wheat production by the 1980s. In addition to the higher yields, agronomists developed plants that were shorter so they used less nutrients to produce straw. The Green Revolution included the new plants, both higher yielding and some with different characteristics, irrigation, fertilizers, pesticides, and capital improvements. Successful farmers were those who were able to implement the entire package. They gained significant amounts of wealth, while their neighbors who were unable to invest at this rate found their competitive edge in the economy worsening.
Despite the dramatic increase in food supply and reduction in hunger in the world as a result of the diffusion of Green Revolution technology, there have been numerous people who have found reasons to criticize this innovation. The division between rich and poor that existed in the rural areas of the developing countries was made wider by the Green Revolution. Some observers argue that the economic conditions that arose from the political power created by the Green Revolution more than offset the gains that were accomplished in increasing the food supply. Others argue that the crops produced by with Green Revolution technology are less nutritious, less flavorful, and less palatable. They also point out that the fertilizers and chemicals used in the revolution come from fossil fuel, a nonrenewable resource. Critics also feel that the Green Revolution can increase erosion and environmental contamination. The need for capital from the West to implement the changes to infrastructure has put pressure on the economies to grow more crops for export and take land away from production of crops for local consumption. It's also pointed out that the Green Revolution focus has been on rice, corn, and wheat, which are crops that are of particular interest in Asia and Mexico, but have had little impact in Africa. In addition, the return on the investment is lower in Africa, because the agriculture is based on a different sort of crops, and soil fertility is considerably less than in Asia and Mexico.

Whatever the critics say, it is clear the Green Revolution was successful. The countries in which it was put into place have been able to feed their populations. While the technology may have created problems, the alternative would be food shortages and hunger. Neither is a viable alternative.

The latest revolution in agriculture is being spread about the world from the core to the periphery through a variety of agencies. First among these agencies are the international efforts developed by the core nations over the years, primarily the World Trade Organization (WTO), the European Union (EU), and the North American Free Trade Agreement (NAFTA). These organizations promote the diffusion of technology, but also support organizations that can usually be called developmental.

Governments have for many years regulated the flow of food goods in and out of their countries to maintain production, consumption, and their own national corporate profits. This is accomplished primarily by offering either direct or indirect subsidies to agricultural producers to keep foodstuffs affordable. Over the years, farmers in the United States, for example, produced tremendous grain surpluses. These surpluses were purchased and stored by the government to sell at a time when prices increased. However, grain cannot be stored indefinitely, so the government would either donate or sell it a very low cost to other nations. This had the effect of undermining the price for locally grown grain in the receiving areas and hurt local producers. Therefore, agriculture can never be thought of in purely economic terms. Politics are the order of the day.

In addition to being concerned with their internal food production, core states have also engaged directly and indirectly in the agricultural sectors of other nations. Aid for food and agriculture development is widespread and popular around the world. When the receiving states asked for the aid, the charitable organizations and the donor states were happy to send it. Many large-scale agricultural development projects have been initiated around the world, but not all been successful. One of the lessons learned from attempting to increase food supply through external aid is that large-scale environmental modification schemes generally have been unsuccessful. Small-scale projects sensitive to local, cultural situations and environmental concerns seem to be more successful over the long run.
A useful way to envision the industrialization of agriculture is as a complex circulation system based on the urban industrial cores. The nature of agriculture changes and becomes more urbanlike as land devoted to agricultural activities becomes more tightly connected to the urban industrial cores. Agriculture has divisions of labor and the farm workers are not self-sufficient. They buy their food in grocery stores, and get all the inputs from off-farm sources.

When thinking about the organization of industrial agriculture, the most important concept is *agribusiness*. This refers to a system of economic and political relationships that organize food production from the development of the genetic makeup of the seeds to the retailing and consumption of the agricultural product.

Agribusiness is organized into flows of political and economic power that are focused on commodity or food chains. A food chain is usually composed of inputs, production, outputs, distribution, and consumption. There is an associated landscape with each of these factors. Many of these commodity or food chains link a variety of physical environments together. They also link areas of production and consumption served by manufacturing areas.

In a sense, agribusiness occurs at a global scale in the same way that a subsistence village worked in the preindustrial area. In the subsistence village, forms of production, processing, distribution, and consumption were organized at the local scale. Occasionally, several villages interacted and exchanged surpluses. Now, with industrialization and the intense increase in circulation technology, entire regions of the world are linked together in the form of production, processing, and consumption.

The Europeans developed the first global system that linked together food production in the colonial territories with consumption in the European sector. Early in the colonial period, a food regime began in which wheat production in the Shenandoah Valley was linked with consumption in France. In the nineteenth century, Australia, Canada, and New Zealand specialized in producing food for Europeans. As we have seen, traditionally there is a correlation between types of agriculture and bioclimatic zones. The growth of any organism in the plant kingdom is dependent on water, solar energy, and nutrients from the environment. Therefore the environment makes a major impact. By harvesting timber and grazing flocks in the highlands, farmers modified the landscape around the Mediterranean Sea. Erosion was increased and major decreases in fertility occurred. Other ancient civilizations also impacted their environment through irrigation and the consequent increase of salt in the soil. Agriculturists still make major impacts on the environment. Once the soil vegetation cover is broken, the soil is susceptible to wind and soil erosion. This continues on steep slopes or in areas where wind is intense. In addition, agriculturists have used varieties of chemicals that have huge impacts on nonagricultural life. the use of chemicals such as DDT is widespread.

Perhaps the most dramatic impacts have occurred on the margins of arid regions where agriculturists, for a variety of reasons, have expanded into areas that have thin topsoil and vegetation. Overgrazing and tillage caused a change in the nature of this landscape that increased the rate of erosion thereby creating desert-like soils on the surface. The desertification process was accelerated by short-term climatic fluctuations in some areas, but primarily human activity is the cause.

It's a cliché to say that farmers have had more impact on the environment than any other sector of the economy. Whether this is true or not is impossible to measure. What is clear is that agribusiness has new

technology that uses living organisms or parts of organisms to make or modify products, to improve plants or animals, or to develop microorganisms for specific uses. Biotechnology is distinct from the Green Revolution because it uses gene manipulation, tissue cultures, cell fusion, embryo transfer, cloning, and a variety of techniques unknown to the agriculturists of the 1950s. Biotechnology has been able to produce what are sometimes called superplants that produce their own fertilizers and pesticides and are resistant to disease an their development of microorganisms. Through cloning, it is possible to take tissues from one plant, insert them in another to form new plant, and produce millions of identical plants thereby reducing the chances of variation in yields from particular seeds.

While the critics talk about cloned material making plants more susceptible to diseases, elm trees with resistance to the Elm Virus have been successfully cloned and planted in great numbers in the American Midwest. The debates about biotechnology certainly are vociferous, and there is really no way for a geographer to determine which side is going to be correct. It is clear that biotechnology is a continuation of the industrialization of agriculture. It is also based in private ownership and capitalism. Biotechnological processes are patented. Seeds that are patented cannot be grown by the farmers unless they pay the company that developed them. There are also some notions that if these crops are exported to the developing world to increase the efficiencies in agriculture, there will be a social disruption caused by the new seeds. As with any change, there is no reason to expect its benefits will be equally distributed. It seems the issue with biotechnology is what are the options of not exporting these more efficient crops and not using this technology.

What is the proper place of an agricultural geography unit in an AP Human Geography course? There are several streams of geographic thought on the topic of agriculture. Cultural geographers of the tradition of Carl Sauer have contributed immeasurably to our understanding of the history of agriculture, the process of agricultural invention, and the diffusion of crops and livestock around the surface of the Earth. In addition, the landscape school of cultural geography has developed strategies for analyzing the imprint of agriculturist on the land through studies of settlement patterns, house types, fences, and land division and the associated infrastructure that constitutes the rural landscape.

Economic geography has focused our attention on the processes of the production, consumption, processing, and redistribution of agricultural products, and on the ways in which the political economy of a state or the state system have dominated the world and manipulated agriculture to maintain various schemes of class and social status.

In essence, this chapter should enable students to understand

- ***The processes that have produced the food they eat***
  They should understand that they are part of a global system of production, transportation, processing, and consumption, and that they as consumers have a direct impact on the production of agricultural products in an amazingly diverse set of locations. Even though they never set foot on a farm, as consumers they are part of the agribusiness system.

- ***That the invention of biotechnological approaches to agriculture will have great impacts on their lives***
  While the technology and innovations driving this are not at all geographical, they will eventually move over space in processes that are understandable with the lens of the geographer. Therefore, they will be able to make predictions about changing relationships and production and consumption as the biotechnology revolution unfolds.

- ***That the issue of hunger is not so much an issue of production but rather distribution***
  Tremendous surpluses of food exist at the same time that conditions of hunger prevail in other locations. The inequitable distribution of food is a result of the inequitable distributions of power, this topic is open to research with the insights and techniques of political geography.

- ***Finally, that the processing and sale of agriculture products take place within the neighborhoods of urban residents or within the jurisdictions of political units they belong to.***
  Issues such as zoning, the impact of the need for workers drawing migrants into new locations, the environmental impact of agricultural processing play big roles in the quality of life in urban locations (environmental impact of production also has a large impact on the quality of life all around the world).

Thus, every student is inextricably bound into the web of agribusiness. All of us are consumers. Many of us have agribusiness processing facilities in our neighborhoods. All of us share a concern for the impact of agribusiness on the environment as a whole.

...ent and diffusion of agriculture

The first topic in Chapter V of the summary outline, the development and diffusion of agriculture, is covered well in most human geography textbooks. Most textbooks follow the presentations of economic land agricultural activity that is based on the notions of the nineteenth-century geographer Edward Hahn that were modified and further articulated in the United States by Carl Sauer. The structure of the AP course and most textbooks follows conventional thinking that classifies economic activity into primary, secondary, and tertiary activities. Primary activities are those that are using the resources of the environment directly such as hunting and gathering, farming, and timbering, mining, and fishing.

1. ***Neolithic Agricultural Revolution***
   - There are major events in the history of the world that are quite transforming; the invention of agriculture in the Neolithic times was one of those events.

2. ***Evolution of energy sources and technology***
   - The increasing availability of animal energy expanded humans' ability to till the soil.

3. ***Regions of plant and animal domestication***
   - All the popular textbooks and atlases have maps and charts that portray the assumed regions of plant domestication. These maps are important because they illustrate the areas where the wild ancestors of modern crops might be found. The genetic material in the world of our ancestors is considered precious, because it is essential for creating new varieties of domesticated plants.

Major agricultural production regions

1. ***Agricultural systems associated with major bio-climatic zones***
   - There are two things that must be considered when teaching the contemporary regional patterns of agricultural production. One is the relationship between agriculture systems and the climatic zones, and the second is the complicated set linkages among the production areas and the consumption areas.
   - The map of wheat movements in *Goode's World Atlas* is critical to an understanding of the many connections.

Rural land use and change

1. ***Land use and location models***
   - It has been observed many times that on areas of seemingly homogeneous land..., a pattern of land use will have developed that is dependent upon tran...tion costs.

2. ***Settlement patterns and urban-rural connection***
   - About half the world's population still lives in rural regions dominated by agriculture.

3. ***Environmental and social impacts of intensification***
   - The size and the structure of villages and other forms of rural settlement reflect the availability of space and local environmental conditions.

D. **Impacts of modern agricultural change**
   - The second agricultural revolution . . . saw the development of barbed wire, various forms of harvesting machines . . . , and the tractor . . . which replaced draft animals. The revolution's major impact was the reduction in the number of people needed to operate farms.

1. ***Green Revolution***
   - The third revolution began in the1960s when a combination of technology was made available to countries in Asia and Mexico in an effort to improve the diets of people these regions.

2. ***Consuption, nutrition, and hunger***
   - Despite the dramatic increase in food supply and reduction in hunger in the world as a result of the diffusion of Green Revolution technology, there have been numerous people who have found reasons to criticize this innovation.

3. ***Industrial/commercial agriculture***
   - A useful way to envision the industrialization of agriculture is as a complex circulation system based on the urban industrial cores.

4. ***Environmental change: desertification, deforestation, etc.***
   - Perhaps the most dramatic impacts have occurred on the margins of arid regions where agriculturists, for a variety of reasons, have expanded into areas that have thin topsoil and vegetation...