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ABSTRACT

Designed for use as supplementary instructional material in a cultural anthropology course this learning module introduces the student to some of the major trends associated with agriculture and its impact upon cultural evolution and complexity. The first section of the module describes major innovations such as animal power, irrigation and the plow, which ushered in the era of agriculture; and technological advances which supported the expansion of agricultural societies. The advances in agricultural technology brought about by the industrial revolution are described next, discussing their impact on traditional economic structures. A section on Third World issues related to agriculture examines agrarian reform and the role of multinational corporations. Next, a section explores recent developments in agriculture in the west such as capital intensive agriculture, the use of pesticides, fertilizers and corporate farms. Finally, the worldwide problem of hunger and the need for an alteration of economic priorities is described. Performance activities related to information presented in the module are included. (LAL)

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Agriculture

A Modular Approach

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Introduction:

This module has been prepared as a guide to a specific area within Cultural Anthropology. Your task will be to read the materials, perform the tasks at the end of the module, and to cross check your answers with the information in the module upon completion of the performance activities. It will be your responsibility to keep up with the reading assignments in the textbook, and to take lecture notes, and film notes.

The module is designed to give you a basis for mastering a specific amount of information, and has been field tested with over 1000 students who have demonstrated by their performance on examinations, that the modular approach can increase the probability of student mastery. The theoretical perspective which is employed is based upon cognitive psychology, gestalt psychology, behaviorism, and programmed learning.

Agriculture was an extremely important technological phase. Its legacy of urbanization, specialization of labor, and increased cultural complexity are still very apparent today. The module will examine some of the major trends associated with agriculture and its impact upon cultural evolution and complexity. Specific attention will be paid to those areas that relate to contemporary society, and the problems of the lesser developed countries.

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AGRICULTURE

The ability to plant and harvest crops accelerated the evolution of culture, as the growth of cultivating technology led to complex changes in social and political institutions. The era of AGRICULTURE was ushered in by such major innovations as the harnessing of ANIMAL POWER, the use of IRRIGATION and the development of a TRUE PLOW. Agriculture's cultural and technical complexity far surpassed horticulture. As food production increased and surplus production became common, methods were developed to use crops in large scale trade and commerce. At the same time, reliance upon a specialized labor force increased and major differences in lifestyles emerged. Almost all classical civilizations were based upon some form of agriculture. Dependence upon wider cultural contact grew as trade in agricultural items flourished. Generally, as cross cultural contact increased, cultural change was accelerated. Strides in technology and related advancements overlapped to form networks which supported the continued evolution and expansion of agricultural societies.

SPECIALIZATION OF LABOR, CENTRALIZATION OF AUTHORITY, and POPULATION INCREASES led to the formation of urban centers. The residents of these centers were responsible for meeting the technological and material requirements of agricultural states. The lifestyle of city dwellers was richer than that exhibited by those who toiled in the fields

or on the massive public works projects of the time. Residents of urban centers were dependent upon the labor and production of country dwellers for their food. People in urban areas dealt in services and traits which were linked to acquired drives, rather than to basic survival traits. Workers in the early phase of agriculturalism had a LOW STATUS. Their ranks were frequently made up of, or augmented by, slaves. LABOR was identified as a crucial link in the means of production; control of the labor force was accomplished through secular and sacred oppression.

When ANIMAL ENERGY is used as a supplement to human energy to pull plows and break up the soil, it creates conditions which increase yields. As the soil is turned by a plow, nitrogen producing organisms and flora and fauna are mixed into the soil matrix. The resulting habitat is richer in supporting nutrients. Competing plant forms are turned over and into the soil to enrich the organic base. One individual using a plow with an animal can work a large area of land. As refinements in technology increased, the types of soils which could be tilled also increased. This opened land which previously was not suited for agricultural production. Plowing caused changes in the very nature of the countryside, stimulating cultural change as well. Animal power increased the amount and types of land under cultivation, but human labor continued to be essential to agricultural production for the digging of canals and ditches, and the planting, harvesting and weeding of crops.

Specialization and new innovations were responsible for creating a cultural climate which expanded in both material and non-material directions. As demands for specialized traits increased, a value was attached to the producers and consumers of these traits. Tremendous feats of engineering were accomplished, and projects of monumental scale were undertaken. Cities, great highways, aqueducts, viaducts, irrigation systems and temples were completed. All relied upon human labor and all utilized political and ritual power as organizing forces.

Many of the crops which were cultivated began to exhibit interesting characteristics. Their original or wild VARIABILITY decreased; a mutual dependence between plants and their human cultivators arose. Domesticated plants outproduced wild strains. However, for many strains, as the range of variability narrowed, overall resistance to disease lessened. A complex cycle of mutual support was established. This basic biological cooperation or SYMBIOTIC relationship allowed populations to survive, but the ever present spectre of crop failure through disease continued.

Agriculture caused cultures to increase in size. The consequent need for land, labor and other raw resources intensified competition between agricultural societies. From a socio-political standpoint, it became important to generate power to protect a society from competing agriculturalists and from those seeking access to more sophisticated technology. Workers were pushed to generate the vast

resources required for large-scale military expeditions. A common goal of many expeditions was elimination of rivals in power and commerce and the acquisition of land, resources and labor.

It can be said that remarkably little innovation in agriculture occurred before the 19th Century other than the importation of crops from distant lands and the continued refinement of breeding in plants and animals. BREEDING was accomplished by selectively mating plants or animals having economically desirable traits. The amount of land used for agriculture increased greatly, but the technology available remained basically STATIC, with continued reliance upon human and animal labor.

The 19th Century marked the transition to more complex forms of technology in agricultural production. Reliance upon newer technological traits grew while crop yields increased as machinery began to outperform animal and human labor in plowing, harvesting and processing. The INDUSTRIAL REVOLUTION stimulated great advances in agricultural technology. SECULAR, dialectical and scientific reasoning led to a dependence upon observation and experimentation as contrasted to the earlier use of sacred dogma. Vast numbers of jobs were created. These jobs helped to draw many people from rural settings into urban factory areas. As industrial production increased, a need for more raw materials forced some countries to seek supplies from foreign sources. Colonialists utilized the labor force of

the colonized countries to extract wealth and raw resources. This stimulated advancements in other technological areas. In many of the countries which were colonized, the traditional economic structure was based upon the SUBSISTENCE method of crop production with small farmers and peasants growing only enough food to support their own families. Under colonialism, such farmers were usually allowed to produce only one economically viable crop, such as coffee, tea, rice, rubber or cotton. Farmers could not use such crops for their own subsistence. Having neither the time, energy nor land to produce subsistence crops in addition to the required primary crop, they became DEPENDENT upon the colonial landowners for food, shelter, clothing and other traits. Food was imported in many areas because traditional subsistence crops had been replaced by cash crops which could not be used as diet staples. Peasants discovered that they could then be starved into submission by the large land owners.

In countries that were colonized, the position of the small farmers and peasants was much worse. They often were tied to the land, their options limited by the great physical restraints of colonial regimes. In Latin America, haciendado systems emulated feudal societies: small farmers and their families were part of the property holdings of the hacienda owners. In Asia, landowners considered the peasants as property. Many of the native populations of Africa were forced off of valuable agricultural land by

European settlers. Groups of pastoralists, horticulturalists and early agriculturalists were driven from their lands to less fertile areas. Those that were allowed to remain became dependent upon the landowners for their survival.

AGRARIAN REFORM or the redistribution of land to the populace has become a burning issue in much of the Third World. It has developed into open confrontations in the America's. Agricultural societies have tended to crystalize class positions and power; with the advent of media, a populace can compare their lifestyles to that of the rest of the world. Many of these developing countries have three percent of their population controlling ninety percent of the land and resources. Hostility which was directed toward the prior colonial network has become fixated on the small elites which control land, crop production and even the basic methods of subsistence.

Agrarian reform has become the battle cry of the next decade for the America's. A large amount of AGRIBUSINESS in these societies is linked in some fashion with MULTINATIONAL CORPORATIONS. Cheap labor, a lack of restraints against dangerous agricultural chemicals and the lure of high profit margins have created a situation which puts international agribusiness and its political allies in a position of supporting the status quo within these countries. At some point, crop production will be interrupted by warfare and agribusiness will be impacted, either through temporary loss of income or nationalization.

The labor of farm families nurtured the development of agriculture in America. Small farmers moving into the frontier areas displaced native populations. Ironically, many of these farmers had come to the United States to flee oppression. Upon arrival they found that "free land" had a price. They moved west and attempted to resume farming. The Native American populations resisted, but were eventually driven off their land. However, the small farmer was also in trouble. Technology was a help to the farmer: better farm machinery and implements, plus access to shippers, opened up greater trade possibilities. The RAILROADS, quick to realize their power, created an exploitive system of freight charges. Land speculators used their influence with shippers to bankrupt a large number of small farmers, while others used the marketplace to manipulate farm product prices. These farmers found out that their labor had been used to develop the land, and that they were ultimately driven from it by the large combines.

The form of agriculture which has developed in the West and which is envied by much of the world is called INTENSIVE AGRICULTURE. Whereas some cultures rely upon labor intensive agriculture, Western agriculture is CAPITAL INTENSIVE, as vast inputs of capital are needed to purchase the required input of technology. Contemporary intensive agriculture is based upon the application of technology as the primary factor in production. Without an appropriate and highly specialized technology, large-scale production

cannot take place. The majority of plant strains which are commonly used in modern agriculture are weak; considerable technologic inputs or traits are required to sustain or nurture them. Their yields are marvels of specialization. Intensive agriculture requires machinery which is highly specialized. Factors which influence the type of machinery used include soil type, crop, stage of development, size of planted area, terrain and the capital resources of the farmer. It is not unusual for contemporary farmers to own a rather large inventory of specialized machines; in fact, intensive agriculture depends upon it. Machines are different from animals: they require continuous inputs of capital for fuel, and additional expenditures for maintenance. Animals can often forage for food from available plant life, and can be used for both labor and sustenance. When a machine becomes obsolete, it cannot be eaten.

PESTICIDES are commonly associated with agricultural production. They are used to limit the number of competing life forms which attempt to invade the biological community of a field. Domesticated plant energy is meant for human use; competing life forms are attacked with chemicals. A large number of organisms have grown resistant to commonly used pesticides, causing stronger and stronger combinations of chemicals to be used. We are extremely dependent upon food which is grown with the aid of pesticides. To eliminate pesticides without a replacement would cause a world crisis or food shortage. A large number of pesticides are

carcinogenic and mutagenic; long term exposure to these will increase cancer rates and birth defects. More than one hundred pesticides are commonly used in intensive agriculture. Most of the chemical pesticides are petro-chemically based. As a consequence, their cost is also increasing. HERBICIDES are used to eliminate competing forms of plant life. They create many of the same problems as pesticides, in that they are toxic, expensive and can cause major damage to humans. Agent orange was originally developed as a herbicide. It is currently used in another form in the domestic U.S.A.

FERTILIZERS are vital components in intensive agriculture. The use of synthetic fertilizers destroys the normal ability of a field's biological community to produce nutrients. Chemical fertilizers create a BIOLOGICAL DEPENDENCE. A farmer cannot stop the use of synthetic fertilizers without risking a decrease in yield. It has been estimated that two years' use of synthetic fertilizer causes a biological change in the soil matrix which can delay for up to seven years the soil's return to its original state. When the SOIL MATRIX is changed by synthetic fertilizers, native and domesticated hybrids will not produce without additional nutrients.

In the past, farm machinery, land and other inputs were within the economic grasp of many farmers. Agricultural machinery today is highly complex, specialized and exceedingly expensive. Today the possibility of an American

family successfully entering or maintaining a single-family farm is rather remote. Until recently single-family farms were responsible for most of our agricultural production. Today, large corporate farms are the norm. Many small farmers go heavily into debt to purchase equipment and to harvest greater yields. Fluctuations in farm prices and interest rates have not helped the small farmer; many have become so overextended that they have lost their land. Two thousand corporate farms now produce more than 70 percent of the food grown in the United States; the trend will continue. Supermarket chains and food processors moving into farming have created a trend toward oligarchical control of food production, processing and distribution. Farming has become a business, and profit is the most important element.

The less economically developed nations contain seven/tenths of the world's population. Unfortunately, the demand for imported food in these countries exceeds the amount of food available on the world market. The effect is that 500 million people in the world (one out of eight persons), are chronically UNDERNOURISHED. Some demographers are predicting a doubling of the world's population by the year 2000. Unless food production and distribution increases dramatically, massive famines are probable. The present food balance in the world is precarious; the spectre of extreme conditions is increased by the probability that crop failures will occur. If world food production decreases

by as little as 1% to 5%, 1% to 5% of the world's population may starve, unless reserves and redistribution networks are available. Based upon present world population size, a loss of 5% translates into 50 million people.

GRAIN is the primary staple of the world's diet. The following is a rough approximation of net exports and imports of grain averaging the years 1960, 1966, 1972-73, 1973-74 (millions of metric tons):

North America	Exported	69.75
Latin America	-0-	-0-
Western Europe	Imported	22.5
Eastern Europe	Imported	10.5
Africa	Imported	3.75
Asia	Imported	34.5
Australia, New Zealand	Exported	7.5

(Source: CIA Document OPR-401, August 1974)

It is apparent that the world relies upon GRAIN PRODUCTION in the United States to meet its demands. Since the 1974 (CIA) study, dependence upon imported grain has intensified in Eastern Europe, Asia, Africa and Latin America. The reasons behind this increase in importation are complex. Population in Third World countries is increasing because of high birth rate, lowered infant mortality rates, and increased life spans. Projected population increases and distribution patterns show that this trend will continue:

Year 1970 - #3.6 Billion Total	Year 2000 - #6.4 Billion Total
China 21%	China 18%
Developed Countries including USSR 30%	Developed Countries including USSR 21%
Less Developed Countries 49%	Less Developed Countries 61%

(Source: CIA Document OPR-401, August 1974)

In the United States, the per capita consumption of grain is approximately one ton per year. Much of the grain is used to raise animals, thus the consumption level is based upon raising animals for protein and then consuming the animals. It has been suggested that the way to increase grain reserves is to stop feeding animals and to use the grain more directly. The type of land which grows much of the cereal grain for animals does not match the soil and climate requirements for cultivating most plant strains which can be consumed directly by human populations. If farmers tried to replace many of the specialized species with others on a large scale, major crop failures would result. According to U.S. Department of Agriculture estimates, the U.S. is capable of a fifty percent increase in feed-grain production by 1985. This increase would be primarily in non-human grains. Increases can occur if normal weather conditions continue, and if inputs of fertilizers, pesticides, herbicides and machinery are available at affordable prices. A major variable which influences agricultural production is WEATHER. Many physical geographers are of the opinion that the world is moving into a cooling phase. In addition to a cooling trend, it has been predicted that fluctuations in formerly regular weather cycles will occur. Food production would drop dramatically if temperatures were to fall.

Most Third World people live in cities or in urban areas. Urban masses are in a poor geographical position to

produce food. The following chart shows some major Third World cities and their estimated populations:

Bangkok	5 Million
Buenos Aires	9 Million
Cairo	6 Million
Calcutta	8 Million
Jakarta	5 Million
Mexico City	12 Million
Sao Paulo	8 Million
Seoul	6 Million

It is obvious that a considerable number of people are compacted into urban areas. They are dependent upon food supplies which are growing increasingly expensive. Unlike country or rural dwellers, they don't have the same options for production. Urban dwellers can exert pressure on governments, because governments are usually located in cities.

A major alteration of economic priorities and continued advancement of agricultural technology on a world-wide basis will be necessary if we are to avoid large scale famines and the social upheavals which would surely accompany them. The United States will be increasingly pressured to share its food production with the rest of the world. It would be naive to ignore this threat. The choices are relatively limited: unless the United States promotes development of greater world-wide food resources, and continues to carry an increasing burden of agricultural production while sharing more of its domestic crops with the world, it will be increasingly vulnerable to external pressures via threats of warfare, or massive population migrations.

Genetic measures, such as the creation of new plant forms which can thrive in traditionally hostile habitats, might ease some of the pressure. It is likely that this form of genetic engineering will not be able to be put into operation either fast or widely enough to avert some major confrontations pertaining to food. As we have become more dependent on plant foods for survival, the strains which we utilized became less resistant and more vulnerable to external pressure. Most of the plant forms which are used for food can only exist in a highly refined or narrow econiche. The possibility of these plants being able to resist natural selective agents decreases in direct proportion to their narrowness and exposure to possible selective traits. Since human populations depend upon these plants for their survival, the biological implications for plant failure could extrapolate into the direct loss of food. The consequences of a genetic calamity involving plant or food production would be proportional to the amount of failure and the location of the failure. Many plant biologists are extremely worried that natural selective agents pose a greater damage to human survival than the hazards of modern warfare.

Performance Activities

Please fill in the blanks:

1. The era of A _____ was ushered in by such major innovations as the harnessing of animal power.
2. I _____ of fields and the use of a true plow were associated with agriculture.
3. U _____ centers were formed during the horticultural and agricultural phases.
4. Specialization of L _____ and the centralization of authority were responsible for meeting the technological and material requirements of agricultural states.
5. Workers in the early phase of agriculturalism had a L _____ status.
6. L _____ was identified as a crucial link in the means of production.
7. Animal E _____ was used as a supplement to human energy to pull plows and to break up the soil.
8. V _____ decreased as crops were cultivated.
9. A cycle of mutual dependence or support between domesticated plants and humankind arose; this was termed a S _____ relationship.
10. B _____ was accomplished by selectively mating plants or animals having economically desirable traits.
11. The Industrial R _____ stimulated advances in secular or dialectic knowledge about crop production.
12. The traditional economic structure of Third World cultures was originally based upon the S _____ format.
13. Peasants having neither the time, energy, nor land to produce subsistence crops have become D _____ upon landowners for many of their basic needs.
14. A _____ reform means a policy whereby the land is redistributed.
15. Agribusiness in Third World cultures is frequently linked with multinational C _____.

16. The R _____ in the 19th Century created an exploitive system of freight charges.
17. I _____ agriculture relies upon massive inputs of capital.
18. Pesticides, herbicides, and fertilizers are frequently based upon P _____ chemicals.
19. Chemical fertilizers create a biological D _____.
20. According to research, 500 M _____ people in the world are chronically undernourished.
21. G _____ is the primary staple of the world's diet.
22. A major variable which influenced agricultural production is W _____.
23. Plant production is threatened by natural S _____ agents.

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