Theme II

Food Production

Time line

Vegetational Changes in West Asia: 28,000 BCE

Beginning of Domestication of Animals: 20,000 Before Present (BP)

Transition to Agriculture: Post-11,700 BP

Beginning of Agriculture: 10,000-5000 BCE

Early Agricultural Regions:

West Asia: The Fertile Crescent

Beidha

Jericho

Zagros Mountains

Anatolia and Europe

SanliuafaYeni Mahalle

CatalHoyuk

Mesoamerica

Tehuacan Valley

China

Hemudu Culture

Peiligarg Culture

Photograph: Threshing Wheat in Ancient Egypt
Credit: Carlos E. Soliverez
Source: https://commons.wikimedia.org/wiki/File:Trilla_del_trigo_en_el_Antiguo_Egipto.jpg

UNIT 4 DOMESTICATION OF PLANTS AND ANIMALS*

Structure

4.1 OBJECTIVES

In this Unit we will discuss the meaning and implications of an activity essential to the beginning of agriculture i.e. Domestication of Plants and Animals. After going through this Unit, you will be able to:

- Explain the meaning of the term 'Domestication' with reference to the early plants and animals selected by more sedentary human groups;
- Identify the environmental context for the beginning of domestication of plants and animals;
- Explain why different animals were selected for domestication;
- Give reasons for selection of particular plants domesticated by humans in the early phase; and
- Interpret the theoretical insights on the causes for the beginning of agriculture in different parts of the world.

4.2 INTRODUCTION

In everyday life there is an unquestioning acceptance of agriculture as a way of replenishing our food requirements. However, for area specialists like botanists and zoologists, environmentalists and archaeologists and prehistorians, questions related to the origins

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of agriculture remain a matter of debate. Hunting and gathering were activities that were undertaken naturally due to a combination of biological and cultural changes, particularly improved cognition and the cultural ability to make tools and weapons. Our existence as hunter-gatherers continued for a fairly long period of time in co-relationship with the changing seasons and climatic conditions of the Pleistocene epoch (also known as the Last Ice Age). The Pleistocene epoch is also identified as the age of humanity because it coincides with the evolution of humans. Geologically, it is part of the most recent period in the history of the earth which began around 2.6 million years ago and ended about 11,700 years ago.Thus, as recent studies show human communities had gathered knowledge of the potentialities inherent in plants and animals but had not faced a compulsion to give up their foraging strategy. However, the food procurement strategy of hunter-gatherers did undergo a change towards the end of the Pleistocene epoch transforming significant numbers of foragers into pastoralists and farmers. The process of domestication of plants and animals that made agriculture possible will be examined in this Unit on the basis of various perspectives and theoretical insights provided by scholars.

The domestication of plants and animals entails human intervention in the reproduction process of plants and animals. It involves removal of biological obstacles that exist, in plants in the form of brittleness of rachis (stems) that causes easy dispersal of the seed in nature; the toughness of husks or glumes in edible plants; and the adaptation of certain cereal grasses to particular environment like the hillside and slopes rather than the more fertile floodplains. Similarly, the wild species of the'domesticable' animals like sheep and goat were larger in size and there was a high proportion of adult male animals as some case-studies in southwestern Asia have shown. Thus, there had to be human intervention in the age-sex profiles of animals before they could be put to use for purposes other than hunting.The process entailed identification of 'domesticable' plants and animals and the displacement of some of them from their natural habitat. This contributes to their availability in newer places, and at times in better forms. It also makes them more attractive and useful to human beings. This is a very visible process and can be detected on the basis of three primary classes of evidence:

a) The availability of animals and plants outside their natural range.

b) Morphological form and structural changes.

c) Increase in numbers of animals and plants.

It is true that there is a natural process of replacement of plants that takes place through movement of air, due to rain and floods, by way of bird and animal droppings as also through **pollination**. Similarly, animals do migrate seasonally as also following major environmental episodes. This brings them to newer terrains. Thus, newer strains develop in plants and animals due to exposure to new climatic conditions and due to cross-fertilization. This is specifically true of plants. However, human ingenuity was needed to make these plants and animals more useful to human communities. It is this process of growth of mutual interdependence of 'men, plants and animals' that we will examine in this Unit.

4.3 ENVIRONMENTAL CHANGES IN EARLY HOLOCENE

The process of domestication required human intervention and control over species of plants and animals. It should be remembered that this was neither a completely post-Pleistocene adaptation nor did it suddenly change the life of hunter-gatherers into one

based on sedentary existence in villages. Environmental changes have played a very crucial role in the morphological make-up of plants. This was particularly true of the late Pleistocene epoch around 20,000 years ago when there occurred very discernible changes in specific plants and animal species.There were worldwide climatic changes towards the end of the **Pleistocene** epoch i.e. around 11,700 BP. These changes have now been described in terms of the onset of neo-thermal environmental conditions that fluctuated between warm and cold; dry and moist. The Bolling-Allerod Interstadial i.e. the abrupt warm and moist period during the last glacial period,which lasted for about 2,000 years from *c.*12,700 to *c.*10,950 BCE, saw a massive increase in world temperature with accompanying increase in sea-levels. These changes brought to an end the cold episode of the Wurm glaciation (*c.*11,700-11,500 years ago). It was the last glacial period in the Alpine region. It was followed by the Younger-Dryas Interval of *c.* 10950 to 9650 BCE. This phase witnessed a brief period of extreme cold and was followed by warm conditions again which continued to be on a rise thereafter. These changes led to major changes in world geography. The retreat of the massive boulders of ice-sheets in Scandinavia caused depression of the earths' crust; Britain was separated from Europe due to flooding of the North Sea; large areas of North America and northern Europe were available for human settlement due to the retreat of the ice-sheets for the first time after nearly 1,00,000 years.

The shift in temperature and rainfall affected vegetational changes in different parts of the world. Recent research has established that the atmosphere of the early **Holocene** was richer in carbon dioxide than at any time towards the end of the Pleistocene epoch. The Holocene plants were thus, more productive due to increased photosynthesis, biomass and seed yield and more tolerant of extremes of climatic conditions (Fagan, 2016: 282).The megafauna of the Pleistocene, best represented by animals such as the mammoth, the woolly rhinoceros and the bison in Central and Western Europe, grew extinct. The reindeer moved to the colder regions of the Alps and Apennines, following movement of the ice-sheets. They were replaced by smaller animals like red deer and the roe deer. Similar changes were at work in the tropical regions. There was a general increase in the population of the gazelle, wild sheep, goat, bovine animals and wild pig. Thus, the early Holocene hunter-gatherers coped with climatic fluctuations and food shortages by broadening their diet and by becoming dependent on a **broad-spectrum economy** consisting of specialized hunting, seasonal gathering and fishing, and fowling activities. The **Mesolithic** economies in different parts of the world exemplify some of these adjustments and adaptations. The fossil remains of plants and animals, the tool-kit of the hunter-gatherers and fisherfolk of the Mesolithic and their mortuary behaviour indicate the shifts in the cultural existence of human communities in the early Holocene.

4.4 DOMESTICATION OF PLANTS

The vegetational changes in West Asia after 28,000 BCE can be seen in the wider and dense range of large seeded grasses. There were two kinds of large-seeded grasses. One variety consisted of grasses in which the spikes were loose and brittle. The seeds of these grasses therefore dispersed even before the plant had ripened. Initially, the hunter-gatherers would have collected the seeds of these plants by tapping the stem with a stick. If these seeds were sown, 'selective pressure' in favour of plants of a shattering variety or with natural means of dispersal would be at work. The Russian agricultural scientist Nikolai Vavilov (1887-1943) had earlier suggested that the principal changes in cultivation are inherent in the method of cultivation. Generally, the move is from unconscious selection to conscious selection. Engel Brecht, the plant geographer has pointed out that several plants and crops grown today were once selected unconsciously. Some of the important examples are plants like gourd, tomatoes which

earlier grew as 'habitation weed' due to unconscious discarding of seeds; barley and rye in Central Asia were a weed of wheat at low levels. The most striking secondary crop was millet, the seeds of which were so small that the plant failed to attract the early cultivators (Darlington, 1969: 68). However, subsequently they would have preferred plants with a tough spike.

Figure 4.1 : Spikes of Cultivated Emmer Wheat

Figure 4.2 : Wild Einkorn Wheat

Sources:https://upload.wikimedia.org/wikipedia/commons/5/5f/Usdaemmer1.jpg
https://upload.wikimedia.org/wikipedia/commons/f/f3/Wildeinkorn.jpg

Wenke has described the changes taking place in cultivated wheat. According to him 'Domestication of wheat, one of the world's most important crops, involved both human manipulation and natural hybridisation between related genera. Human intervention appears to have been aimed at producing free-threshing, non-shattering varieties. The simplest wheats are "diploid" meaning that they have two sets of seven chromosomes. Hybridization with related species produced tetraploid wheats, with four sets of chromosomes. Hybridization eventually produced hexaploid wheats, with six sets of chromosomes, which occur only in cultivated species of wheat. By mixing genetic material from various species, early farmers produced forms of wheat that could adapt to diverse habitats' (Wenke and Olszewski, 2007: 248).

These were grasses in which the seeds dispersed only when the plants ripened. Sowing of seeds of plants with tough spikes however required additional efforts. These seeds had to be sown away from other wild, self-seeding plants in order to avoid competition among plants. This required clearing up of small plots of land in regions where rainfall was adequate or that were close to reliable sources of water like lakes, springs and rivers.

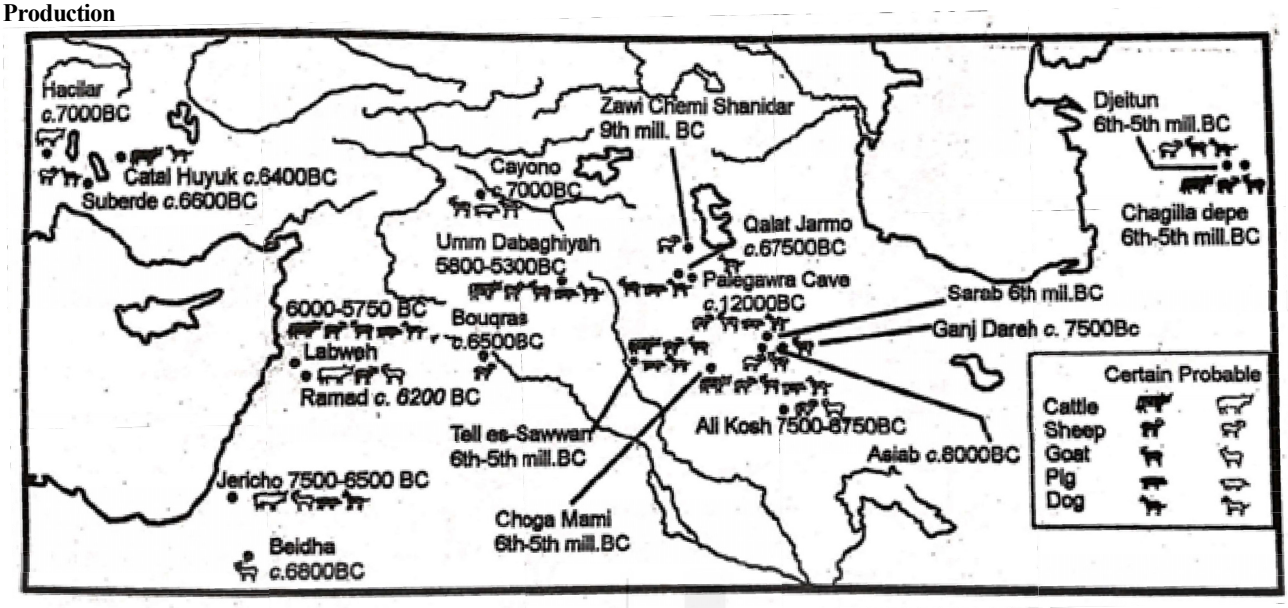
Human intervention was indispensable for the domestication of plants. It widened the gene pool of these plants. The early process of cultivation of plants can be seen at work in the early agricultural sites of Israel and Syria such as Netiv Hagdud and Abuy Hureyra respectively, where the advanced hunter gatherers experimented with cultivation of plants as early as 10,500-10,000 BCE. The presence of seeds and plants such as wild einkorn and emmer wheat, barley and rye show that these were selectively cultivated at a very early date when humans were primarily nomadic. Similar developments followed in southern Turkey, northern Iraq and northwest Iran. A similarity in the process of domestication of plants could be seen in the way in which the seeds had been brought to more level ground near reliable sources of water or to places with adequate rainfall in which these plants could thrive. The remains of cereals provide the evidence for this. These plants have tough spikes and are indistinguishable from the wild varieties. They are found in places away from the natural habitat of these species.

4.5 DOMESTICATION OF ANIMALS

A domesticated animal is one that is bred in captivity for economic gain to a human community. The latter maintains complete mastery over the breeding, territory and food supply of the animals. The history of the domestication of animals shows that the process must have begun among the hunter-gatherers. The young ones of the animals they hunted attached themselves to people when abandoned or left alone. This was due to 'imprinting' i.e., the tendency of animals to follow the first living being during an impressionistic period in their infancy. The hunting-gathering communities could have sporadically reared the animals that they could use as decoys in the hunt. This was perhaps the manner in which the dog had been domesticated around 20,000 BP. Controversy persists whether the domesticated dog was the offspring of the wild dog or wolf. The dog, however, proved to be extremely useful as an aid or an assistant in the hunts of the Upper-Palaeolithic (40,000-11,700 years BP) and Mesolithic (approx. 8,000 BCE) communities.

The advanced hunter-gatherers would have found it easier to tame, herd and domesticate the animals that were more submissive and were therefore potentially 'domesticable'. The animals that were herded could be made more submissive by various means, such as slaughter of the more aggressive males in the herd or castration.The initial steps in the domestication of animals must have been as hesitant as in the domestication of plants. The history of domestication of animals is now being reconstructed from fresh morphological and genetic data. Such research also shows that the process must have begun among the hunter-gatherers and not all the animals that people hunted could be tamed, herded and domesticated. Some scholars have therefore argued that animals that were eventually domesticated were physiologically and behaviourally pre-adapted to being tamed without losing their ability to reproduce. The animals that bred well in captivity must have been selected for domestication. For instance, when animals were herded people would have opted for submissive or aggressive and unmanageable animals. An intervention in the breeding systems of these animals by slaughter or castration of aggressive adult-male animals would have, over time, produced a race of submissive creatures. It can therefore be observed that an unplanned breeding method preceded the careful artificial selection that produced different breeds of the same domesticated species.This is how communities domesticated pig, goat, sheep and cattle in different parts of the world.

Although the domesticated animals must have certainly provided ready food during times of crisis, it does not seem that a scarcity of food had caused the domestication of animals. The first of the tamed and herded animals could have been used in ritual sacrifices. These animals got incorporated into the social structure of humans and were the first 'objects' of ownership. The domesticated dog, sheep, cattle and pig, were thus driven along with their owners as 'livestock', rather than being followed and hunted like wild animals. In the early phases of domestication, goat, sheep and cattle could only be used for meat and hide. Wild cattle produce little milk and wild sheep was not woolly but hairy. It is only with domestication that the milk and wool producing strains emerge in these animals. But these traits take time to surface. Measurable morphological changes need about thirty generations after domestication before they become visible (in small species this process takes two or three years and in large mammals about four or five years from one generation). However, with the onset of the new strains, there was greater regularity in the domestication of goat, sheep and cattle for meat, hide, wool and milk. Dogs and pigs that had been tamed more than 18,000 years ago functioned as scavengers of human debris. The pig especially did not require large quantities of vegetable fodder and ate the same food as the hunter-gatherers.



Map 4.1 : Domestication of Animals in West Asia (Reproduced from History of Humanity, Vol. I, p. 393)

Source: MHI-01: Ancient and Medieval Societies, IGNOU Study Material, 1990, Block 1, Unit 2, Map 1, p. 31.

The transition to agriculture was made after the end of the Pleistocene epoch around 11,700 years BP. At this time the hunter-gatherers adapted their subsistence strategy to suit the changes in climate as well as in animal and plant life. Hunting and gathering activities became well regulated, specialised and demanded an intimate knowledge of plants and animals. A better understanding of the available wild plants and animals was, therefore, a precondition for the beginning of agriculture. The use of more efficient tools like the broad and flat harpoon, sickle and the reaping knife and the introduction of the new ones like mortar, pestle and other thrashing and pounding instruments indicate that in many parts of the world people were exploring newer ways of acquiring food. Generally speaking, archaeologists have associated the beginning of agriculture with a relatively new stage of cultural evolution – the **Neolithic** period (10,000-5,000 BCE). By about 6000 BCE substantial sections of the world's population had given up hunting gathering and were pursuing farming and pastoral activities.

Check Your Progress Exercise-1

1) Explain the gradual process by which human communities adapted to the new environmental conditions.

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2) Do you think beginning of agriculture was a sudden event or a consequence of gradual increase in the interdependence of humans, plants and animals?

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3) Name some of the earliest domesticated animals and how did they prove useful to humans.

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4.6 TRANSITION TO AGRICULTURE: THEORETICAL APPROACHES

The preceding discussion indicates that the domestication of plants and animals was not the result of a sudden departure from hunting-gathering activities. Prolonged exposure to varying climatic conditions and the vegetation and the animal life that supported these had increased the horticultural and zoological knowledge of human communities. Thus, the archaeological period that is best representative of the cultural adaptation of humans to a more sedentary existence based on early domestication of plants and animals is the Mesolithic period.[1] The Mesolithic cultures represent a slow adaptation of communities with a Palaeolithic background to a changed neo-thermal environment better suited to the adoption of a farming economy. Highlighting its significance G. Clark says, 'The change in the relationship between men, animals and plants that precipitated the transformation of social systems was accomplished not by Neolithic but by Mesolithic communities. It was precisely as an outcome of this process that men became Neolithic' (Clark, 1977: 42). The most significant development associated with the Neolithic period is the transition to agriculture with the use of new 'grounded and polished' tools and with accompanying changes in the form of appearance of a village economy and society. Thus, in many parts of the world, food gathering was gradually replaced by food production. For Gordon Childe food production represented 'an economic revolution' 'the greatest in human history after the mastery of fire' (For details, see Clark, 1977).

Several explanations have been offered to explain the beginning of agriculture. These explanations are based on speculations, hypothesis and field-work driven by the urge to know the nature of cultural transformation that humanity experienced following the end of the Ice Age. Rising populations as seen in the archaeological evidence of increasing

[1] In West Asia, Mesolithic period began in approximately 11,000 BCE and lasted until about 8500 BCE and in Europe from 8000 -3500 BCE.

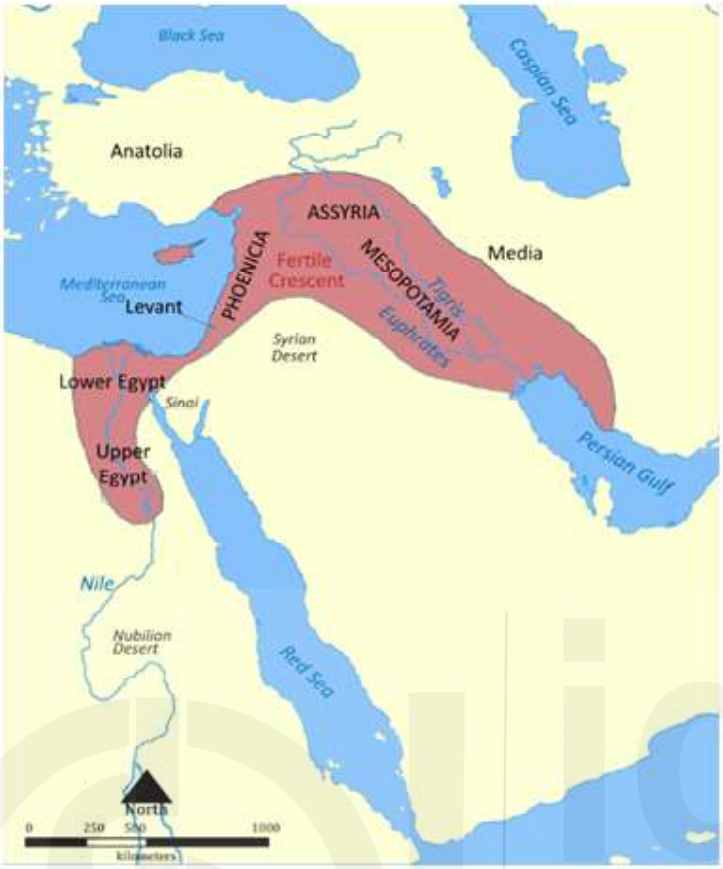
number of villages and cemeteries indicated that humanity was now culturally equipped to deal with the exigencies of nature. However, there were other questions to be asked. Did agriculture begin at a particular place and time and get diffused elsewhere? Was agriculture the 'invention' of a single genius or a lucky accident of nature? Were plants and animals domesticated simultaneously or one after another? And several more. Inherent in these questions was the belief that agriculture had been accepted by large sections of people in different parts of the world. At the same time, specialists were concerned about the fact that majority of the world's populations had given up a time-tested activity like hunting-gathering to adopt some form of agriculture knowing that there were immense risks involved in the rainfall-based farming or dry farming of the early phase. This has compelled them to examine the advantages and disadvantages of these two methods of food procurement.

Altered selective pressures in the form of gradual increase in population, environmental changes etc. did necessitate modifications in the subsistence activities. Palaeontological record suggests that in the biological world, change mainly results from altered selective pressures which necessitate adjustive modifications on the part of the human communities (Cohen, 1977:1). At the same time, it is necessary to understand that there were considerable shifts within the general structure of hunting-gathering economies throughout the Pleistocene epoch due to the impact of the selective pressures on flora and fauna as also evolving humans. The impact on humans was not just physiological but also neurological and behavioural, in the form of improved cognition and improved social existence. The degree and extent of impact of selective pressures was more intensive during the Pleistocene than during earlier geological epochs. Moreover, they affected larger number of people subsisting in diverse ecological contexts.

4.6.1 Climatic Stress Hypothesis – The Oasis Theory

The Soviet agronomist Nikolai Vavilov, American geographer Carl O. Sauer, and British archaeologist V. Gordon Childe were among the first ones in the 1920s and 1930s to discuss the origins of agriculture. Childe's analysis was concerned with economic interpretation of archaeological data. The available data referred to intense desiccation in southwestern Asia and North Africa and the shrinking of lakes and other sources of water after the end of the Pleistocene epoch.There was a need for a radical post-glacial re-adaptation of economic life if human communities were to survive the increase in starvation levels. Thus, Gordon Childe's climate stress is variously described as the 'Oasis', desiccation or the propinquity theory dealt with how human endeavours in pre-history were determined by the exigencies of climate. He was of the view that farming began in some parts of the ***Fertile Crescent*** (Southwest Asia) due to severe climatic changes. The dramatic reversals in climate in this region followed the northward movement of the rain-bearing clouds. These conditions caused severe drought and increased the starvation levels. Thus humans, plants and animals got concentrated in the oasis that were small patches of green separated by large tracts of deserts. The 'enforced juxtaposition' that the changing warm and dry conditions caused, encouraged a symbiotic relationship between all three – humans, plants and animals.

The 'oasis theory' was based on the idea that socio-economic events like the beginning of agriculture do not take place on a worldwide scale simultaneously. They occur in restricted blocks of area measuring a few hundred miles. It is only after the completion of the experiment in such areas that the idea of cultivation got diffused to other regions.The beginning of agriculture in Childe's estimate had brought about a Neolithic Revolution. According to him,'Food production the deliberate cultivation of food plants, especially cereals, and the taming, breeding, and selection of animals was an economic revolution – the greatest in human history after the mastery of fire' (1952: 23).



Map 4.2 : The Fertile Crescent

Credit: Nafsadh, 2011

Source: https://upload.wikimedia.org/wikipedia/commons/7/7b/Map_of_fertile_crescent.svg

4.6.2 Nuclear-Zone Hypothesis

The climatic hypothesis has continued to engage the attention of scholars ever since the extent of climatic change in the immediate post-Pleistocene epoch with some either doubting or arguing that the climate change had in fact taken place towards the end of the Pleistocene during the Younger Dryas episode when there was an increase in the cold and arid spell.

> The Younger Dryas episode is the period of abrupt, rapid and intense cooling which started approximately 12,800 years ago in the late Pleistocene epoch. The fall in temperature happened as the northern continents were well on their way to warming and losing their ice cover. The warming was however interrupted by the sudden return to cold conditions which led to the extinction of many animal species such as the mammoth (extinct group of elephants). It also pushed the Northern Hemisphere, and especially northern Europe, back into cold conditions. The cold climatic conditions lasted little more than 1000 years and disappeared as abruptly as they had appeared as by 11,500 years ago, warming toward current climate conditions had resumed.

Robert Braidwood, the eminent archaeologist of the University of Chicago, USA, undertook field work in the 1950s in the western slopes of the Zagros mountain region to study the nature and impact of climatic changes in the immediate post-glacial period. Based on extensive investigations in which he was assisted by specialists like botanists, earth scientists, zoologists and archaeologists, he ruled out any kind of drastic change in the climate of the region. However, there was definite evidence for plant and animal domestication in places where these were abundant as wild species. Had climatic change been the only factor responsible for beginning of agriculture then similar change towards domestication should have taken place during the earlier periods of interglaciation in the

Pleistocene when the climate had warmed up substantially. Since no such cultural change had been undertaken in the earlier periods, it was necessary to rule out climate as a crucial determinant of change in the post-glacial period.

Robert Braidwood argued that there was a gradual evolution to the stage of food production. According to him farming began in the 'nuclear zones' or natural habitats i.e. areas that had abundant animal and plant species. The availability of the 14-C dating method had enabled his team to determine the date of the various sites where early food production had been undertaken. It is important to note that this new dating technique was not known when Childe had undertaken his analysis. In a site close to Jarmo, dated back to about 11,000 years ago, Braidwood found wild but edible plants and animals, highlighting that people were still dependent on hunting wild ancestors of sheep, goat and gathering wild wheat and barley here.Two thousand years later, i.e. 9,000 BP, Jarmo had evolved as a village. Based on such evidence, he proposed a 'Nuclear Zone' theory that was applied to various cultural levels in the origin of agriculture, beginning with food gathering till the food producing stage. In his estimate the process of change had to be seen in the context of changing human culture which he defined in terms of 'ever increasing cultural differentiation and specialization of human communities'. This kind of change had not taken place earlier because 'culture was not ready to receive it' according to him. Conversely, at the end of the Pleistocene, humans were culturally adept at exploiting their natural habitat for their advantage.

Thus, the transition to agriculture was mainly due to a combination of changes in human culture. Most scholars, including Braidwood, considered agriculture to be a 'revolution' and a very desirable human achievement which had made security and leisure possible for prehistoric people. However, in this cultural model, the assumption that the vitality of human nature caused the agricultural revolution remains untestable.

4.6.3 Demographic Hypothesis

Lewis Binford (1968) challenged the cultural hypothesis and suggested that a major change like the beginning of agriculture can occur only if there is sufficient stimulus in the form of demographic pressure or tension. He differentiates between internal and external demographic pressures. In Binford's view, population is likely to increase in optimal areas i.e. areas that are well provided for. In the case of Southwest Asia and coastal Peru, the rising sea-levels at the end of the Pleistocene pushed the population of hunter-gatherers towards fishing. Population increased with the change in subsistence activities leading to population densities beyond the carrying capacity of the environment. Demographic pressure was maximum on the margins of the optimal habitats. This kind of 'internal' population increase could only be contained with the splitting-off of the daughter population to the marginal areas in the periphery of the optimal areas. These were occupied by less sedentary groups of hunter-gatherers.The arrival of more sedentary groups from the optimal zones disturbed the equilibrium between population and food resources. The external demographic pressure, that is the population pressure caused by the arrival of new-set of people rather than a biological increase in numbers, caused a shortage of resources to subsist on. The resulting imbalance made an adaptive shift in economic activities necessary. Thus, cultivation was a consequence of demographic pressures following the Pleistocene climate changes. Cultivation and emigration were partial solutions to deal with the problem.

J.T. Meyers (1971) extended the demographic model to a good but spatially constricted environment that permitted a fairly sedentary life based on exploitation of wild plants and animals. However, when the population grows too numerous the internal pressure on resources is met through cultivation of plants and herding of animals. Citing the case

of upland valleys of Mexico and the surrounding valleys, he felt that both the high mountain walls and tropical jungles at the exit of the valley would restrict emigration as a solution to rising populations. The problem, in his estimate, had to be managed through internal adaptation. The work done among the hunter-gatherer communities has certainly established that increasing sedentism does contribute to increase in the fertility rate among the former. But it is difficult to define the semi-arid valleys of central Mexico as optimal environments.

In Mark Cohen's (1977, 2009) view, human response rather than environmental change was more crucial for the beginning of agriculture. He agrees with Ester Boserup (1965) that increase in population contributes to intensive farming. Boserup had argued against the Malthusian theory of population change that dependence on agriculture causes an increase in population. Mark Cohen refers to increasing threshold levels of population throughout the Pleistocene epoch. Population increase among hunter-gatherers led to territorial expansion and infiltration of marginal areas to the extent that the avenues for further expansion were exhausted. Once population increase reached the critical threshold-level when hunting-gathering could not be followed successfully, it was used to undertake farming. In other words, horticultural knowledge had increased considerably during the different stages of hunting and gathering. But it was not put to practice because labour was not adequate for it. After the end of the Pleistocene epoch hunting and gathering could not be continued because of lack of hunting zones but intensive farming could be done with additional input of labour. This explanation highlights the significance of population expansion throughout pre-history and not just during the post-Pleistocene epoch. However, many researchers are sceptical of this claim. Population did grow to an extent but on the time-scale of food-production, population increase must have been more or less, constant and manageable.

While the significance of demographic pressures cannot be neglected, it is also important that we acknowledge the fact that high densities of population do not necessarily lead to transition to agriculture. A scarcity of resources induced by increasing density of population must have occurred in several parts of the world during the late Pleistocene epoch without resulting in adaptive changes. Because the time-scale of demographic increase does not match the extent of cultural change as seen in the beginning of cultivation, critics observe that population increase alone cannot determine socio-economic changes. In any case there is no evidence for population pressure leading to the origins of agriculture in prehistory.

4.6.4 Ecological Hypothesis

Carl Sauer (1952) rejected the climatic stress model entirely and instead offered an ecological model in which human intervention was given utmost primacy. He bases his argument on the following premises: '1. Agriculture does not arise due to food shortages. People on the verge of starvation do not have the leisure time to experiment with improving food plants. 2. The "hearths of domestication" are to be found in areas of marked diversification of plants and animals, regions characterized by both diversified terrain and a variable climate. 3. Domestication did not begin in the river valleys, which are subject to floods and aridity and require irrigation. 4. The earliest agriculture was practiced in 'wooded lands'. 5. The earliest agriculturalists had already achieved special skills that predisposed them to domestication. 6. The inventors of agriculture were already sedentary, since growing crops require constant attention. Planting a field, then leaving it until harvest time would have invited predators and led to the loss of the harvest' (Wright,1990:120).

For precursors or progenitors, Carl Sauer looks to the Mesolithic where we have

evidence of communities living near the sea and fresh-water streams and undertaking fishing as also advanced hunting-gathering activities. Thus, in his estimate the early agriculturists could have been fishermen, an idea also shared by Robert McC Adams (1966). In their estimate fishing predisposed people to agriculture since it allowed greater sedentism and enabled people to stay in a particular place for a longer time. Sauer suggested that fishermen living in a mild climate alongside fresh waters were more innovative. The leisure time that fishing provided encouraged them to exploit the neighbouring regions for plants. The plants that provided starch foods and substance for toughening fishing nets and lines and making them water-resistant, that is the root crops, were domesticated first. The earliest farmers utilized vegetative reproduction (i.e., using root crops, or by stem cutting and replanting) and thus learnt to 'plant' before they learned to 'sow'. The initial crops were bananas, ginger, yams, and certain palms such as sago, sugarcane, etc. It is also in this region that dogs, pigs, geese, and ducks were first domesticated (Sauer,1952:120). The appearance of domesticated dogs and pigs in southwestern Asia is explained by Sauer as a result of diffusion from the southeast.

The difference in acquiring these two differently located staples – fish and grain (one available in water and the other on ground) at a time when populations were gradually rising encouraged an advance towards greater dependence on farming. Carl Sauer claimed that he had adopted an ecological model, however he was more concerned with finding the early 'hearths' or centres of food production. In his 'water-source-centred model' he gave primacy to root-crop agriculture over seeding and the diffusion of the idea of domestication from southeast Asia to southwest Asia. This model ultimately remains untested except for parts of Southeast Asia. In West Asia cereal production and herding of animals had taken place with no preceding attempts at root-crop production.

An ecological model was then extended by Leslie White (1959), who refuted the idea that food production was a sudden development. Adopting a gradualist approach, he observed that the hunter-gatherers knew their environs well enough to know the potential 'domesticability' of some of the plants and animals. Thus, beginning of cultivation represented the change in the relationship of human communities and plants. White extended Childe's argument that climatic and physiographic factors in the form of the post-glacial warm conditions induced an increase in population and migration of people. As people settled in new areas, there was an imbalance in need and supply of resources that encouraged them to put into practice the horticultural knowledge that they had acquired over time and pushed them to look for new techniques. Robert McC Adams' perspective offers a cultural and ecological model in which changes in local eco-systems stimulate local adaptations including beginning of agriculture.

Kent Flannery (1965, 1968) and Lewis Binford's analysis and more recently the research undertaken by students of Gordon Hillman like Romana Unger-Hamilton at the Institute of Archaeology, London, have established the relevance of local studies in establishing the sequence of developments following the end of the ice age. From about 1968 attempts were made to put forward more elaborate theories about the origin of agriculture. Geological research and archaeological excavations had revealed fresh evidence from different parts of the world. It showed that environmental changes affected different parts of the world differently. The understanding that the onset of the Holocene epoch saw sudden and sharp variation in temperature especially in Southwest Asia was no longer acceptable. At the same time, environmental change as a factor was not completely abandoned. Focus, however, shifted to other factors like population growth and social consequences of a more sedentary lifestyle.

David Harris (1969) was of the view that population does not normally outgrow resources. But it did in prehistory at the end of the ice age due to environmental degradations. Environmental changes affected the mobility of advanced hunter-gatherers, encouraged sedentism and caused population stress. Because of environmental shifts, human population in certain parts of the world tended to settle in areas which he refers to as transitional zones between forest and steppe, savanna, river or coast or on the margins of upland and lowland. The transitional zones enjoyed an eco-system where there were a large variety of plant and animal species. In these zones, people could 'settle-in' and exploit a variety of plant and animal species through farming and herding.

Systems Model

Kent Flannery (1968, 1969) has adopted a gradualist approach to explain the transition from hunting and gathering to agriculture. The view could be traced back to Charles Darwin's description (1868) of the first steps in cultivation. It stressed on the continuities rather than the contrast between hunting, gathering and agriculture. The change in the method of 'food procurement' was explained in systemic terms i.e. in terms of analysing the continuous interaction of environmental, demographic and cultural variables.

Flannery's hypothesis is based on three assumptions:

1) That the hunting-gathering population had increased before food production.

2) That the early experiments in food production began in the marginal areas bordering the optimal zones of the mountain zones of Iran, Iraq and Turkey and the woodland zones of Palestine.

3) That there were many centres of food production from the beginning. The pre-agricultural people were adapted not to specific environments but to specific animals and plants available in different environments. Thus, the mobile groups of hunter-gatherers exploited different environments. They also carried the seeds of mutant variety of plants and planted them in the new terrains that they visited.

In the 'Systems' theory, that was applied both to the Zagros Mountains and the southern uplands of Mexico, Flannery attached primacy to the seasonal movement of hunter-gatherers that enabled them to experience the flora and fauna of different zones. In the Darwinian theory of **Natural Selection**, plant species are guided by the principle of 'negative feedback' i.e. a principle operating in nature that the same plants available in different areas ripen at different times. The hunter-gatherers who had for long observed the phenomenon had scheduled their hunting-gathering strategy similarly, by arriving in different **eco-niches** seasonally. Availability of different plants and animals regulated the movement and size of the group. People thus became dependent on a 'broad-spectrum' economy, rather than one based on a few plants and animals.

Since the relationship between human society and its environment is shaped by culture as the primary mechanism of adaptation, the hunter-gatherers optimized their foraging strategy by selecting specific plants and animal species. Often carrying the mutant variety of plants to new places, the hunter-gatherers widened the area in which a particular plant grew. For example, wheat was brought to Zagros mountain region while upland Mexico saw the plantation of maize. When introduced in new niches these plants disturbed the equilibrium. Thus, through their efficient foraging strategy the advanced hunter-gatherers were responsible for the introduction of the **'positive feedback'** principle in plants due to which they could be grown at the same place during different times of the year. With hybridisation and combination with other plants like beans and squash, maize could now be procured almost the whole year round in Mexico as also in places where

it was not available earlier. The old pattern of existence of hunter-gatherers that demanded seasonal movement was gradually replaced by a subsistence pattern based on prolonged stay and food production. Scholars like Colin Renfrew (1973) have also accepted the systems theory as an explanatory model for culture change.

The theories and ideas about the origins of agriculture have sometimes been categorized as either 'push' or 'pull' models. In the push models, hunter-gatherers are either pushed, or forced, to become farmers. These theories emphasise on climate or population as variables and highlight the pressure exerted by these variables in pushing society towards new cultural adaptations. The pull models refer to the inherent traits of certain plants and animals that attract or pull human communities towards them by the benefits of a new lifestyle or behavioural changes in humans.

4.6.5 Social Hypothesis

The social models draw upon social compulsions of exchange and the need to conduct feasts and ceremonies by individuals and groups in order to garner social ties. The members of hunter-gatherer society were drawn into a relationship of barter and exchange in food as well as non-perishable goods. The need to produce in order to exchange was therefore the driving force behind increasing sedentariness of society based on food production. The new arrangements led to greater social cooperation and sharing and therefore reduced the risk of starvation. Thus, in the opinion of Barbara Bender (1975) social relations initially change due to the need for distribution and exchange. In more recent times, Brian Hayden (1995) has argued that agriculture played an important role in augmenting the leadership role of individuals who successfully competed with others in organising feasts for members of the group. These individuals increased their social standing and prestige by organising feasts and reducing the element of risk of starvation. Thereby a relationship based on reciprocity was replaced with one based on inequality and hierarchy. This social hypothesis is important but difficult to document and test. There is considerable evidence for increase in social inequality in the early Neolithic societies of the Near East. But it is not yet known whether it was also a cause for the beginning of cultivation.

Check Your Progress Exercise-2

1) Why is the beginning of domestication of plants and animals a debatable issue?

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2) Identify the points of emphasis in the different theoretical approaches pertaining to the beginning of agriculture.

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3) Can you perceive the similarities and differences in the theoretical insights provided by different scholars related to origins of agriculture? Comment on any two hypothesis.

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4.7 SUMMARY

By now you would have understood that it is very difficult to arrive at the exact nature of the origin of agriculture. There is no single accepted theory for the beginning of agriculture. Research is still ongoing. The most persistent question that has intrigued scholars is whether agriculture originated in difficult environments under conditions of scarcity of natural resources or in optimal or abundant environments where there was less risk in undertaking new experiments. In recent times, Douglas D. Price and Anne B. Gebauer (1995) have argued that experiments such as domestication of plants and animals are successful where risks are limited. The ongoing research in environmental changes, demographic shifts, greater cultural interaction and social dynamism shows the how and why of the Neolithic transition remains, like the question of human origins, among the intriguing questions in prehistory. Undoubtedly however, about 12,000 years ago several groups of foragers chose to take up pastoralism and farming on a regular basis.

4.8 KEY WORDS

Broad-spectrum economy : an economy that is based on exploitation of a variety of diverse resources for fulfilment of dietary needs.

Eco-niches : also known as ecological niches, the term is used to describe the relational position of a species or population.

Fertile Crescent : the regions in the Middle East West Asia which curves like a quarter-moon shape, from the Persian Gulf through southern Iraq, Syria, Lebanon, Jordan, Israel and northern Egypt.

Holocene : the most-modern or recent stratigraphic unit within the geological record. It covers the time interval from 11,700 BP until the present day. The term Holocene, which means 'entirely recent', was first used by Gervais (1867–69) to refer to the warm episode that began with the end of the last glacial period. The term was formally adopted by the International Geological Congress (IGC) in 1885 to refer to this episode and to the appropriate unit in the stratigraphic

record. Along with the preceding Pleistocene, the Holocene is now formally defined as a Series/ Epoch within the Quaternary System/Period.

Mesolithic : a transitional period between the early hunting-gathering economy of the Palaeolithic and the agricultural economy of the Neolithic when we have the early attempts at taming and herding of animals and careful selection of plant species.

Natural selection : a principle in nature that prevents the end result of an action from repeating itself.

Neolithic : an archaeological period representing beginning of agriculture on the basis of more advanced ground and polished tools.

Pleistocene : geological epoch from *c*.1.6 million years ago to 15,000 years ago.

Pollination : transfer of pollen from stamen (male part of plant) to a pistil (female part of the plant) which gradually enables fertilization and the production of seeds.

Positive feedback : it is a principal in nature that allows the end result of an action to repeat itself.

4.9 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise-1

1) Your answer must include the following points: climatic change, its effect on the morphology of fauna and flora, evidence of newer forms of tool kit of humans, ways of acquiring and producing food, deployment of animals by humans. See, Sections 4.2-4.5.

2) See Sections 4.4 and 4.5.

3) Dog, pig, goat, sheep. Explain their usefulness in terms of hunting, livestock, milk, wool etc. See Section 4.5.

Check Your Progress Exercise-2

1) No single theory has been accepted. See Section 4.6.

2) See Sub-sections 4.6.1-4.6.4

3) See Sub-sections 4.6.1-4.6.4

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PDF:

https://www.academia.edu/14869132/Theories_about_Origin_of_Domestication_and_Agriculture

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4.11 INSTRUCTIONAL VIDEO RECOMMENDATIONS

Mankind: The Story of All of Us: Domesticating the Dog
https://www.youtube.com/watch?v=mCLQ_8I1paY

Mankind: The Story of All of Us: Birth of Farming
https://www.youtube.com/watch?v=bhzQFIZuNFY

UNIT 5 EARLY AGRICULTURE IN DIFFERENT REGIONS*

Structure

5.1 OBJECTIVES

In this Unit, we will discuss the beginning of agriculture and early agricultural practices in different parts of the world. After reading this Unit, you should be able to:

- Identify the regions which experienced the early emergence of agriculture;
- Explain the factors that led to the diversity in the nature of agricultural practices in different regions; and
- Understand the importance of the development of agriculture alongside foraging and nomadism.

5.2 INTRODUCTION

The transition to farming and stock-raising was very crucial for the social and economic organization of human communities. Agriculture did revolutionize human existence particularly because now there was greater possibility of a storable surplus to meet the demand of growing numbers and to serve as an emergency buffer. However, hunting and gathering and a mobile way of life was not given up entirely and continued to serve the subsistence needs of communities in many parts of the world. Several scholars have contested the description of beginning of agriculture as representing a Neolithic Revolution, particularly when the term is used to describe the suddenness and abruptness of change. However, there is wide agreement about the revolutionary significance of agriculture in terms of its impact on subsistence existence and settlement pattern.

Archaeological evidence from different parts of the world has established that a wide range of ecological and socio-economic forces, such as increase in world temperature and its impact on vegetation and faunal population and increasing density of human

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population had compelled the latter to tap the potentiality inherent in several 'harvestable' food resources like snails, crab, mussels and fish. In such a context, as Kent Flannery (1973: 276) observes, even wild cereal grasses would have seemed appetizing despite the labour involved in their harvest and preparation. Certain plants and animals were manipulated in such a manner that they became useful to human communities on a sustained basis. It is mainly in this context that beginning of agriculture is considered an irreversible phenomenon. There was a regional variation in the timing and nature of early agriculture. The topography, climate and overall the ecology of the early agricultural sites determined the time gradient observed in early agriculture. In this Unit we will explore both, the regional variations as well as the broad cultural similarities observed by area specialists in the nature of early agriculture. It is not possible to cover all the regions of the world, here we have reflected West Asia, Europe, Mesoamerica and China as representative for different parts of the globe.

5.3 BEGINNING OF AGRICULTURE IN WEST ASIA

West Asia has engaged the attention of archaeologists and other specialists for the rich insights that it provides for understanding the beginning of agriculture. Numerous scholars including Gordon Childe, Robert Braidwood, Lewis Binford, Kent Flannery, Anthony Moore and Ofar Bar-Yosef have debated about the different dimensions of early farming here. The difference in their approach notwithstanding, as seen in Unit 4, the work of all these scholars have brought to light the enormous richness of this region in terms of the remarkable strides taken by the early settlers in transforming the landscape to make it habitable for human existence. The geographer James Henry Breasted called the region the 'Fertile Crescent' – indicating the natural propensity of specific centres of agricultural production here to provide sustenance to early farmers.

As we observed in the previous Unit, the life of hunter-gatherers in West Asia was affected by climatic fluctuations towards the end of the Pleistocene i.e. around 11,700 BCE and the onset of the Holocene epoch thereafter. New evidence from deep-sea cores, surface sediments and the pollen recovered from the lakes of West Asia show that the climate was cool and dry in the last segment of the Pleistocene. An increase in temperature and rainfall immediately after the end of the Pleistocene was followed by an increase in dryness or aridity around 9000 BCE. Yet, at the beginning of the Holocene, the climate was cooler and humid. These conditions were particularly favorable for human settlement. The forest zone had expanded throughout the coastal mountains of Eastern Mediterranean region due to an increase in rainfall. The mountains and lower hills of Modern Turkey, Syria, Israel, Iraq and Iran received adequate rainfall (over 20 inches a year) in winters. Both the forests and steppe that lay beyond them were rich in plant and animal species. Levant, for instance, could support two kinds of wild wheat (einkorn and emmer) and barley.

The wild ancestors of sheep and goat inhabited the hilly terrain. There are traces of herding of animals here during the Late Kebaran period about 11,000 BCE. Soon after this, the Mesolithic community of Natufians in the Jordan valley (especially in Wadi-en-Natuf) developed a fairly broad subsistence base here. They followed the migratory movement of wild gazelle, sheep and goat when these moved uphill in mid-summer in search of grass. They exploited the marine resources in the coastal waters and undertook fishing in the freshly formed lakes of the region. The advanced foragers also collected the wild cereals and plants found here.

The Kebaran period (13,000-11,000 BCE) is named after the site of Kebara cave in the Jordan Valley. This period is identified as an Epipalaeolithic period i.e. the archaeological period that immediately followed the Paleolithic and preceded the Mesolithic period.

The Natufians are associated with the Mesolithic Culture of West Asia. They are named after the site of Wadi-en-Natuf of the Jordan Valley region. They were the first of the more sedentary groups of the region who 'experimented' with scheduled gathering of wild cereal grasses, herding of animals as also newer implements like the stone sickle and grinding and pounding tools like the mortar and pestle.

The Natufians mastered food gathering skills to such an extent that it enabled them to prolong their stay in particular regions and reduced the extent of their foraging activities.The cultural record of 10,500 BCE has tools like smaller harpoons, microliths and fishhooks intermixed with axes and sickles which indicate strengthening of the trend towards a more sedentary pattern of life. The sheen on the sickles due to the silica deposits found in the cereal grasses confirms the fact that they had begun harvesting these plants. They would have also turned to other stable plant foods such as acorns (oak nuts) to support a more sedentary existence. Tools such as mortar and pestle found in the Natufian sites confirm greater dependence on plant foods. As the temperature rose further and it grew increasingly warm in the southern Levant from about 8000 BCE, there was a decrease in forest cover and in rainfall which may have forced the Natufians to follow the migration of animals towards Lebanon and Syria. Many Natufian sites were abandoned, and a few, like Jericho, were reoccupied subsequently and are archaeologically recognized as early agricultural settlements.

It is well-established now that climatic change alone did not induce agriculture. The need to support large population and the fact that early farming was labour intensive and could be undertaken when there were more hands available for work, also drove communities towards a more sedentary existence through farming. Thus, after about 8500 BCE as the Natufians moved to areas that offered more favorable environment, there was sufficient inducement for communities to explore terrains that were well-provided for in terms of nature, mainly with water and grazing land for the newly herded animals. The early villages were confined to the upper reaches of the Euphrates rather than the lower Euphrates where the move towards irrigation farming and subsequently urbanism gathered momentum a few millennia later. Neolithic villages like Tell Mureybit, a site located on the Middle Euphrates site in Syria (*c*.8000-7600 BCE), experienced the new settlement pattern mainly due to availability of greater rainfall and grazing land. The transition was also preceded by a continuous spiral of disequilibrium between the available resources and the people feeding on them which led to intensification of food procurement strategies. Animals were now brought under greater control and plants came to be grown in a more systematic manner.

5.3.1 Beidha and Jericho

As discussed earlier, the early Neolithic villages were founded in areas where there was water, arable land and also land for grazing. In the Natufian level at Beidha, in Jordan, *capra* (genus related to goat) comprised 76% of the total faunal assemblage. This shows that *capra* was the most hunted specie. In the succeeding Neolithic period, from 7500-6200 BCE, there are indications in the form of changes in the appearance, reproduction and physiology of animals that is confirmed by the study of genome (the complete set of genetic material present in an organism or cell) and fossil remains which display that a pastoral economy based on maintaining herds of animals had been succeeded by an economy based on the domestication of animals. Vegetable sources of high quality protein like field peas, lentils and other leguminous plants are also represented in the early Neolithic levels. The evidence of knowledge of rudimentary

irrigation techniques in Beidha and use of pestles and other stone vessels shows that it had made advances in cultivation.

Jericho (now in Palestine) in the Jordan Valley region was close to a perennial spring and therefore a very significant source of water for a growing agricultural settlement. Archaeological excavations of the mid-twentieth century carried out mainly by Kathleen Kenyon (1959) have shown that there was a continuity of settlement here from the Mesolithic period to the early farming stage that followed it after *c*.10000 BCE. The lower stratigraphic levels of Jericho are aceramic i.e. they do not have evidence of the use of clay pottery. In this Pre-Pottery Neolithic A (PPNA) phase (*c.* 8300-7300 BCE) the wheat and barley grown here were not native to the region. The seeds of these grasses may have been brought from the Jordan Valley. However, soon after the initial attempts at cultivating these grasses here, the early farmers exploited the environment in such a way that they became capable of producing a food surplus. Gazelle, pig and wild cattle are the animals represented in the early levels of PPNA. There is no evidence of domestication of animals in this phase. The evidence that comes from Jericho establishes a very significant point that while specialized hunting did encourage domestication of animals, not every hunting economy (in this case gazelle hunting economy) necessarily led to domestication of the animals hunted. In Jericho, sheep and goat were selected over gazelle. This could have been due to some desirable traits (like a hairy body) or feeding habits of these animals. Gazelle has a selective diet and restricted habitat, which makes it unsuitable for domestication.

With greater dependence on farming, the typical Mesolithic tools like microliths and bone harpoons were gradually discontinued to be replaced with cutting instruments, digging stick and a simple variety of grinding and pounding tools. Blades of all sorts, including sickle blades with fine denticulation and well-worked arrowheads were smaller in proportion and there was a qualitative shift in the nature of lithic equipment. In the succeeding Pre-Pottery Neolithic A stage, which occurs after a time-gap (*c*. 9250-8350 BCE) when there is denudation of the settlement, there is a qualitative shift in the nature of lithic equipment. The relatively new tool-kit comprising the grinding tools like mortar, pestle, querns, as also hammer stones and polishing stones is certainly an indicator of the greater dependence on an agricultural economy.

It is easy to discern the increase in population that farming induced from the changing pattern of the housing architecture. The houses are round or rather curvilinear in the PPNA stage and are subsequently built on a rectangular plan in the PPNB phase (*c*. 7300-6000 BCE). The changing architectural style indicates both a shift in the pattern of life as also an increase in population. The rounded houses of the earlier period were of light material and could be carried along. The rectangular houses were mud-plastered with brick platforms. Rooms could be added to rectangular structures and therefore, these houses indicate an increase in population as also greater sedentism. Interestingly, during her excavations here in the 1950s Kathleen Kenyon had also discovered a deposit, thirteen feet in depth, immediately below the round houses.

This deposit was made up of innumerable succession of floors associated not with solid wall but with humps which were estimated to be the floors of hut-like shelters. Therefore, for a length of time sufficient to build this depth of deposit, communities had lived more or less permanently by the perennial stream but in residences more suited for a nomadic existence and they had then moved to more permanent residences (Kenyon, 1959: 40).

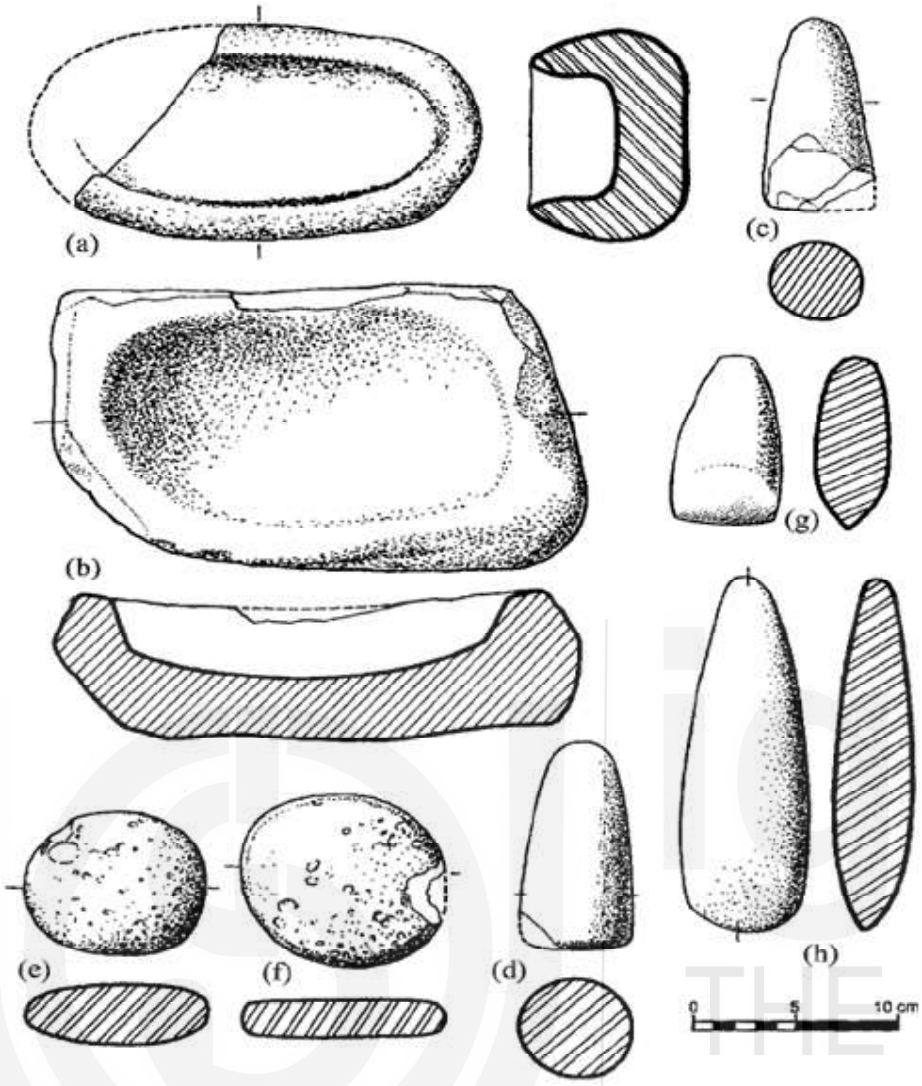


Figure 5.1 : Ground and Polished stone tools from Pre-Pottery Neolithic B of Southern Levant including Jericho. (a and b) grinding stone; (c and d) pestle; (e and f) hand stones; (g and h) ground and polished stone axes.

Credit: Kuijt, Ian and Morris, Adrian Nigel Goring. 2002. 'Foraging, Farming, and Social Complexity in the Pre-Pottery Neolithic of the Southern Levant: A Review and Synthesis'. *Journal of World Prehistory*. Vol. 16 (4). pp. 361-440.

Source:https://www.researchgate.net/figure/Ground-and-polish-stone-tools-from-the-Early-Middle-and-Late-Pre-Pottery-Neolithic-B_fig12_227138426

A rock-cut ditch more than 9 feet deep and 10 feet wide was bordered by a finely built stone wall with towers. While the exact reasons for the wall are not clear, the competition for scarce resources and the need to safeguard these resources suggest that these could have served the purpose of defence. Some recent geomorphological researches (Ofer Bar-Yosef, 1998) indicate that Jericho was flood-prone, hint that the walls may have been flood control works.

Except for settlements in the north of Palestine-Damascus Basin and the Mediterranean coastline, the Neolithic villages at Beidha and Jericho disappeared after 6000 BCE. There was a shift in settlements as the steppe was abandoned due to environmental degradation and an increase in aridity. The Neolithic communities did have a role to play here. The domestication of plants and animals required clearing up of small patches of land for cultivation as also for grazing purposes. This certainly had an impact on the process of deforestation. This, together with the practice of felling trees to get wood for

fuel, disturbed the ecology as is evident from the decreasing pollen core in the stratigraphical layers of the Neolithic period here.

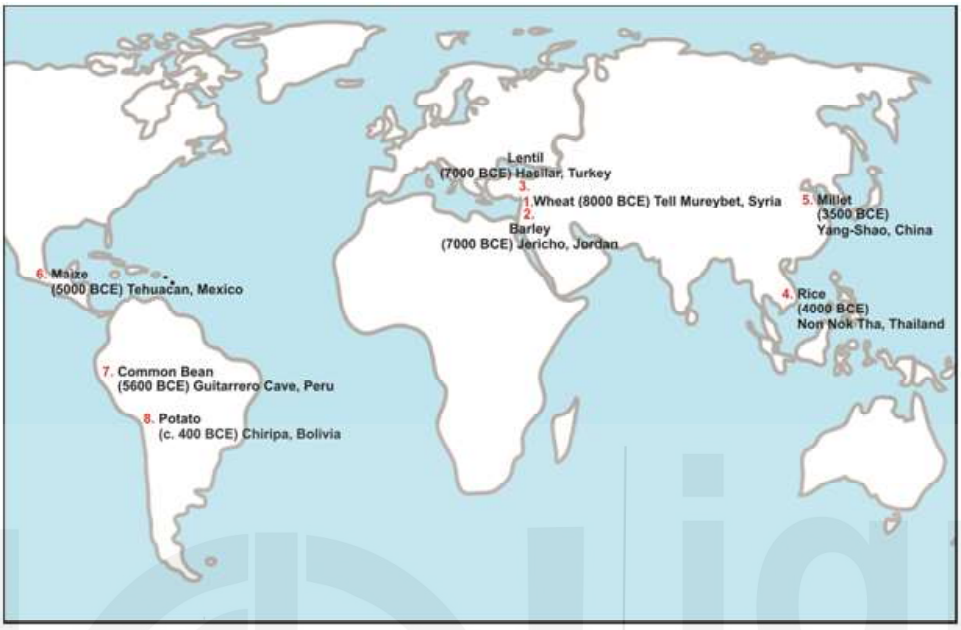
Figure 5.2 : Tower of Jericho, Tell es-Sultan archaeological site, ca. 7000 BCE
Credit: Reinhard Dietrich
Source: Wikimedia Commons (https://fr.m.wikipedia.org/wiki/Fichier:Tower_of_Jericho.jpg)

5.3.2 Zagros Mountains in Iraq and Iran

The woodlands of the Zagros mountains in Iran and Iraq were ancestral homes of some of the cereal grasses like wild wheat, barley, lentils, vetch (wild variety of plant belonging to the pea family), peas and linseed as also some of the tamable animal species. However, the brittleness of the rachis (stems) which caused the seeds to disperse as they ripened,would have slowed down the process of cereal-seed collection. Also, as Jack Harlan's study undertaken in the 1960s amply demonstrated, in the absence of necessary tools the collections had to take recourse to hand-stripping of cereal seeds. The dependence on these resources would have increased once the early farmers introduced new kind of cutting implements and storage facilities between 10000-7000 BCE.

Excavations at the sites in Kurdistan like Karim Shahr, Shanidar (both are in Iraqi Kurdistan) and Tepe Asiab (Iran) show that hunter-gatherers had grown and reaped wild cereals and other plants here since 9800 BCE. Some of the earliest agricultural sites in the Zagros Mountains experienced a continuity of settlements between the Mesolithic and the Neolithic. Ganj-dareh, situated at a height of 4,593 ft. on the Zagros Mountains, was occupied about 10500 years ago as a seasonal camp of hunter-gatherers. It has provided the earliest evidence for goat domestication in the world (Zeder & Brian, 2000: 2254). During the Neolithic period it had emerged as a village. Ali Kosh, on the arid steppe of Western Iran, was occupied in mid-tenth millennium BCE. This was the time when the hunter-gatherers hunted gazelle, wild ass, pig, fished in the Mehmeh

River, collected shellfish and snared wild fowl. The work undertaken by Frank Hole and Kent Flannery who excavated the settlement in the 1960s demonstrated that by 8000 BCE the inhabitants of the settlement lived through a combination of simple farming, hunting and gathering.



Map 5.1: Early domesticated plant species (After Wenke, Robert J. 1984. *Patterns in Prehistory: Humankind's First Three Million Years*. OUP. p.162)

Source: MHI-01: Ancient and Medieval Societies, IGNOU Study Material, 1990, Block 1, Unit 3, Map 4, p. 55.

Jarmo in the Kurdish foothills in Iraq, had a long history of growth from c.7000-4700 BCE, and it grew from a temporary settlement to a settled village. Excavations were first carried out here in 1949-50 by Robert J. Braidwood of the Oriental Institute of the University of Chicago. Braidwood strongly held the belief that the earliest centre of food production could be found in the hilly flanks of the Zagros mountains where the natural abundance of domesticable plants and animals due to ecological reasons encouraged him to use the term 'nuclear zone' for this location.The diggings which continued for the next five years till 1955 showed that the Neolithic village of Jarmo was well-established by 4700 BCE and measured approximately three to four acres ('Jarmo Expedition', 1955: 460).The settlers built mud houses which were not very durable. There is evidence for repeated construction at the same spot. Houses were repaired and rebuilt at the same spot perhaps to economize on land. A wall, about 5 feet thick, raised due to rebuilding from the disintegrated debris could have also guarded against floods. As a result of the very frequent reoccupation of the area, the elevated areas created about 12 distinct levels of occupancy. Jarmo came to represent a cluster of about 24 houses built of baked mud. Villages of mud-plastered walls, as in Jarmo, hint at a somewhat elaborate village network of about 150 people.

Jarmo was a community of herdsmen and farmers. The animal bone remains have yielded a large number of bones of domesticable animals particularly sheep, goat and pig. The milling stones, mortars, pestles and stone sickles found during excavations as also the carbonized grain kernels showed that the inhabitants of Jarmo were very active farmers. Hans Halbaek, the botanist who was part of the expedition that carried out excavations in Jarmo in the early 1950s, had also found impressions of grains in the clay of the house walls and particularly on the clay on the oven walls. Braidwood established

that the farmers here were at a very early stage of domestication of wheat and barley. Field peas and lentils were grown alongside the cereal grasses. The inhabitants used stone extensively for daily use. Their tools were chipped mainly from flint and **obsidian** (a natural glass formed by a volcanic rock) and their tool-kit consisted of microliths as well. The obsidian was imported mainly from the Lake Van region of Anatolia, about three hundred miles in the north. This means that there were regular exchange relations between the two regions.

Stone was also used for making grinding implements like pestles, mortars and querns. Many decorative objects like beads, pendants and bracelets were also made from stone. Bone was used for both making useful as well as decorative objects such as awls, needles, pins, spoons and beads. Clay was used extensively for making a variety of human and animal heads which were perhaps votive offerings or used in fertility practices. Interestingly, despite their understanding of plasticity of clay, the early inhabitants of Jarmo did not use it for making portable pottery and continued to use stone bowls and **bitumen** lined baskets. Linda Braidwood (1952) is of the view that pottery used later by the last of the inhabitants, however, was well-made suggesting local adaptation of an idea that was brought to Jarmo from outside.

Figure 5.3 : Personal adornments from Jarmo – 1 carnelian beads, 2 turquoise bead, 3 clay beads, 4 stone bracelets, 5 pendants of clay, stone, and shell

Credit: Daderot (Exhibit in the Oriental Institute Museum, University of Chicago, Chicago, USA)

Source: Creative Commons (https://commons.wikimedia.org/wiki/File:Jarmo_personal_adornments,_1_carnelian_beads,_2_turquoise_bead,_3_clay_beads,_4_stone_bracelets,_5_pendants_of_clay,_stone,_and_shell__Oriental_Institute_Museum,_University_of_Chicago_-_DSC06938.JPG)

Similar developments were at work in the neighbouring regions of southwestern central Iran. Explorations since the mid-twentieth century in Karmanshah and other sites on the eastern side of the Zagros have established the early process of settling down of communities on the basis of specialized hunting and gathering. Robert Braidwood continued to hold the view that the trinitarian concept forwarded by Kent Flannery in which he distinguished between the stage of specialized hunting-gathering and a stage of 'incipient cultivation' that led to a 'broad-spectrum revolution' was hard to establish on the basis of evidence from these sites.

Considerable advances could however be seen in the Neolithic cultures of Syria and Mesopotamia from *c.* 6000-5000 BCE as seen in the Halaf, Hassuna, Samara and

Ubaid cultures. The advance was marked mainly by the uniqueness of the hand-made pottery, in the architectural pattern of houses and the dependence on irrigation in some of the sites. By about 5,500 years BCE, there was considerable improvement in agriculture, cattle and sheep breeding, date palm cultivation and fishing in certain parts of southern Mesopotamia.

Check Your Progress Exercise-1

1) Name some of the early agricultural sites in West Asia.

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2) Discuss the interrelationship between environmental changes, population increase and social change in the beginning of agriculture in the regions discussed so far.

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3) Highlight the similarities and differences in the agricultural practices adopted in the West-Asian sites.

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5.4 EVIDENCE FROM ANATOLIA AND EUROPE

Rainfall continued to increase in the early Holocene in Anatolia. This helped in the spread of forest cover especially in the western and central parts of the region. The conditions for human habitation improved much later than in the Levant but the habitable conditions lasted for a longer time. Evidence for einkorn cultivation has been found in southeastern Anatolia in the regions inundated by the Euphrates and Tigris. One such region, Sanliurfa Yeni Mahalle, where the world's oldest known domesticated einkorn has been identified, dates back to about 9400 BCE. In some of the other neighbouring sites such as Cayonu Tepesi (8600-7000 BCE) we can clearly detect a progression from a fairly simple economy dependent on both hunting-gathering and some amount of farming as evident from processing equipment such as grinding stones as also domestication of caprines (related to goat), principally sheep and goat to one that was socially complex with some amount of ritualistic beliefs.

CatalHoyuk, a site first excavated by J. Mellaart in the 1960s and more recently by Ian Hodder was the largest and one of the most prominent of the late Neolithic sites in Anatolia. It existed as a village between 7400 BCE and 6200 BCE. It was situated on rich alluvial soil besides a stream and thus presented excellent opportunities for domestication of plants and cereal **hybridization** (breeding of one variety with another). Cattle were the most prominent animal domesticated here. Situated on the Anatolian plateau, the region was also close to an outcrop of obsidian, the volcanic glass that was bartered throughout West Asia for the sharp cutting edge that it provided to agricultural implements. So widespread was its use that scholars have often used the term 'trade' for a kind of 'down the line' bartering of obsidian in return for other substances.

Figure 5.4 : The earliest excavations of CatalHoyuk
Credit: Omar Hoftun
Source: Wikipedia (https://commons.wikimedia.org/wiki/File:%C3%87atalh%C3%B6y%C3%BCk_excavations_..jpg)

About 8000 years ago, the Neolithic settlement of CatalHoyuk covered about 32 acres. Numerous houses of sun-dried bricks of standard sizes were built. The foundation of houses also consisted of mud bricks. The houses were rectangular with a small storeroom attached to them. They were designed to back onto one another, occasionally separated by small courtyards. The insides of the houses show a remarkable consistency of plan with specific areas for resting, cooking and for worship. The entrance to the houses was through the roof, access to which could have been with the help of a moveable ladder. This could have provided protection against outsiders and floods. This system of defence must have been quite successful because the only form of destruction suffered by CatalHoyuk was fire. This village, which has often merited the description of a town, was rebuilt about 18 times in a span of 1200 years.

Interestingly, unlike in the neighbouring site of Gobekli Tepe where recent excavations have established the presence of megalith-like structures, there is no evidences of separate public buildings for worship or ceremonial centres from CatalHoyuk. Evidently, activities, both secular and ritualistic were conducted within the houses. Archaeological evidence revealed that many among the cluster of houses that are separated only by middens or narrow alleyways, were elaborately decorated and were marked by high degree of symbolism. During their excavations here, the team of Ian Hodder found elaborate paintings of humans and animals, burials in many houses, detached skulls of the dead

removed after death as well as ox horns and plastered bull horns on walls or arranged on benches. This reflects a complex world of meanings that was circulated and shared and recognized in a wide area. It also suggests that there was a complete blurring of the sacred and the secular and yet there remained a deep connect with the world of ancestors, as Hodder observes in his work (2010). Similar but perhaps lesser complex trends were at work in Anatolia and other parts of southwest Asia. The beginning of agriculture was not an isolated phenomenon. It preceded, followed and at times kept pace with a web of complex social and cultural changes that have intrigued scholars.

The trend towards agriculture was less dramatic in Europe. Following the gradual contraction of the ice-sheets and the resulting onset of post-glacial warm and humid conditions, the reindeer had moved to cooler regions and herbivorous like the red deer and elk (a specie of the deer family) now moved to northwestern Europe. Groups of hunter-gatherers had taken advantage of the newly formed lakes and streams during the Mesolithic Period. Elsewhere, as along the Baltic and the Caspian Sea region, fishing and fowling were providing additional means of subsistence. The archaeological record of the Mesolithic period in northwestern Europe (approximately 11,000-9000 BCE) shows that the climatic changes had resulted in the abundance of small animals like deer, water birds, fish, snails and mussels which made hunting difficult and compelled communities to take recourse to an intensified food gathering and selective hunting.

There is a debate among scholars regarding the beginning of agriculture in Europe. Several scholars uphold the view that agriculture originated in West Asia and got diffused to different parts of Europe after the arrival of farmers from Anatolia and other parts. This view is challenged by those who argue for indigenous growth of agriculture in Europe. In Europe the earliest evidence of cultivated emmer wheat, barley, domesticated cattle and pig comes from Argissa-Maghula in southeastern Greece (7000 BCE) followed by the Franchthi caves (6000 BCE) here. The West coast of Italy experienced similar developments by about 6000 BCE.

As far as temperate Europe is concerned, the beginning of agriculture was both a result of indigenous and intrusive developments. Environmental changes, such as the rising levels of the Black Sea due to the increase in the levels of the Mediterranean would have also played a role in bringing communities to settle around the sea shores and coasts upstream to the Danube Valley. This phenomenon may have occurred around 5500 BCE. Early agriculture in temperate Europe was mainly pursued in the rich in loess soil that could be easily tilled with digging sticks and simple hoe. A farming economy based on cattle herding and crops such as barley and einkorn had developed here by the end of the sixth millennium BCE.

Early experiments in farming were quite successful in the fertile floodplains of the Balkans (located in Southeast Europe). By 5500 BCE an agricultural economy based on wheat and barley and domesticated sheep and goats and single-room mud plastered houses was flourishing here. The Balkans is an area with as much environmental variability and ranges in temperature as West Asia and Anatolia. The fertile and the spring-fed permanently moist areas of the floodplains encouraged communities to live here uninterruptedly for a long period of time. The Karanovo (*c*. 5500 BCE) and the Bandkeramic culture (5,300 BCE) that followed it in quick succession, came to be based on the cultivation of barley, einkorn, emmer wheat and minor plants such as flax. They used a system of crop rotation and fallowing. In this process, the stubble of the crop that was harvested was burnt to allow the land to regain its fertility. In this process, called swidden cultivation or slash and burn farming, the farmers were enabled to remain in a place for a longer time. Sheep, goat and dog were kept but cattle was the main

animal domesticated here. As the density of population increased and agriculture supported the increase successfully, the Bandkeramik culture spread to other parts of Europe. This is evident from the presence of the liner line (band) decorated pottery in Holland and other places around 4000 BCE.

It was the biological diversity and a rich flora and fauna that enabled hunter-gatherers to thrive in Eastern Europe. Around 8000 BCE Eastern Europe was covered with pine and birch forest with a mixture of broad-leaved species of trees in the north and steppe vegetation in the south, which supported large animals. These could thus provide a substantial basis to the hunting-gathering economy. Some scholars even observe that subsequently there was a budding-off of surplus population from the Neolithic zones to such ecological niches where they adopted the Mesolithic way of life. So, a reversal in the way of acquiring subsistence was also possible!

The discussion, so far on the beginning of agriculture, was aimed to highlight and familiarize you that the early farmers did not adapt to specific environments but to specific plants and animals available in several environments. Their knowledge about the growth of certain cereal plants must have begun through the collection of the seeds of these plants. The Natufians, for instance, had scheduled their hunting and collecting activities according to the movement and/or availability of plants and animals in specific places during specific times of the year. Eventually, scheduled, i.e., time-bound ways of acquiring food, rather than erratic and unplanned food-procurement strategies, made them dependent on specific plants and animals. The reference to various sites in West Asia and Europe establishes the fact there could be year long and repeated settlements in the same region without the development of full-blown agriculture.

5.5 MESOAMERICA AND CHINA

Mesoamerica is the geographical area between the Pacific Ocean and the Gulf of Mexico. While agriculture was practiced at various sites in West Asia and Europe, a contrasting trend emerged of the practice of temporary settlement without agriculture in Mesoamerica and nomadism persisting even after the domestication of certain maize **(Map 5.2)**. The environment of this region was not favourable for the hunter-gatherers who found it difficult to locate game. In the Tehuacan Valley region, which is 125 miles south east of the Mexico City, the climate grew increasingly arid/dry after 11000 BCE. The hunter-gatherers resorted to season-bound hunting and gathering which did not cause exhaustion of resources. In winter people lived off the hunt and in summer they gathered fruits and seeds in the better-watered regions of the valley.

As people moved from one eco-zone to another, their knowledge of the available species also increased. They domesticated maize, squash and beans in both the highland and lowland of Mesoamerica and also continued to explore new terrains. By 5000 BCE small bands of hunter-gatherers were occasionally settling down near the coast. The initial impulse for agriculture and village life came from these coastal areas nearly 4000 years after the attempts at domesticating maize. By 3400 BCE people had begun living in villages and grew maize. Squash and bean grew alongside maize and comprised the bulk of the diet of the inhabitants of this region. The new evidence of domestication of maize from the Central and South American regions of Peru, Argentina and Chile, dating back to 3000 BCE amply demonstrates that a cereal which essentially belonged to the highland had now been domesticated in almost all the eco-zones. A mobile and nomadic life-style had not, however, been fully abandoned.

Map 5.2 : Mesoamerica and its cultural areas

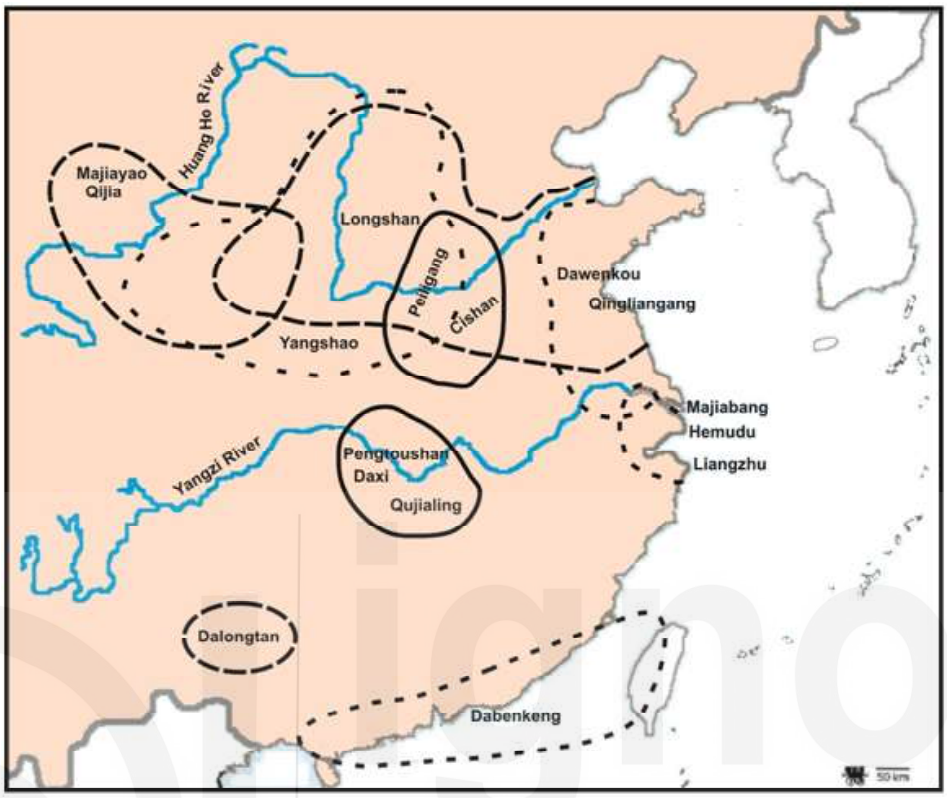
Credit: GringoInChile

Source: Wikipedia (https://en.wikipedia.org/wiki/Mesoamerica#/media/File:Mesoamerica_english.PNG) Adopted from Wikipedia

The beginning of agriculture in China in early Holocene is associated with the cultivation of rice and millet. Botanists are of the view that both the Asian variety of rice and millet radiated from the eastern Himalayan region in the post-Pleistocene epoch. Of the two, rice is more suitable for the warm and moist conditions that prevailed in the swampy and marshy areas of middle –Yangzi in southern China. The propagation of the wild progenitor of rice then gathered momentum in the alluvial and well-watered areas of the south. Wild rice was therefore gathered between 10,000-8000 BCE. The foraging communities subsisted on a broad spectrum economy of collection of seeds, as also aquatic plants and root species, fishing and hunting of smaller animals like deer and pig. Over a period of time the selection of the non-shattering variety of rice seed encouraged its domestication. Rice cultivation spread to many parts with some of the permanent settlements with definite evidence for rice cultivation coming up in Pengtoushan in the Middle-Yangzi Valley between 6500-5800 BCE. The Hemudu Culture south of Shanghai and dating back to 7000 BCE has yielded evidence for rice cultivation, bone shovels and handmade pottery.

The main domesticate in Northern China in the Hwang Ho valley region was millet although rice was cultivated here beginning around mid- 7th millennium BCE. The earliest farming villages here date back to 6300-5100 BCE and belong to the Peiligang Culture. Two of the best known regional cultures here are: the Yang-Shao (*c*.5100-3000 BCE) and the Long-Shan cultures (*c*.3000 BCE) **(Map 5.3)**. The economy of the Yang-Shao culture was based on cultivation of foxtail millet with the help of hoes and digging sticks as also hunting and fishing. Mulberry trees were utilized for silk worms here. The Long-Shan culture that expanded eastwards and southwards to Hunan, Shantung, Hupei, Kiangsu, Chekiang and Taiwan was based on cultivation of rice, millet, wheat, rice, soybean, poultry and domestication of sheep and cattle. The villages of both the cultures had defensive moats. The houses were either semi-subterranean or surface buildings of wooden construction. Many of the features associated with the Bronze Age Civilization

in China, for instance a highly skilled pottery making tradition, writing system and a complex stratified society, were already at work during the Neolithic.



Map 5.3 : Areas occupied by different Neolithic cultures of China

Credit: Lamassu Design Gurdjieff (Lopes, Rui Oliveira. 2014. 'Securing the Harmony between the High and the Low: Power Animals and Symbols of Political Authority in Ancient Chinese Jades and Bronze'. *Asian Perspectives*. Vol. 53 (2): 195-225.)

Source: Adopted from Creative Commons (https://en.wikipedia.org/wiki/List_of_Neolithic_cultures_of_China#/media/File:Neolithic_china.svg)

Check Your Progress Exercise-2

1) Briefly discuss the importance of CatalHoyuk as an early agricultural site.

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2) Do you think sedentary existence was possible without agriculture and that nomadism could coexist with early attempts at farming? State some examples.

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3) Explain the beginning of agriculture in China.

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4) Where was the region of Mesoamerica located? How did the geography of the region influence nomadism alongside experiment with plant domestication?

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5.6 SUMMARY

The discussion so far establishes the fact that the transition to agriculture was a harbinger of great significance and in some ways set an irreversible pace of cultural change. Two features associated with agriculture both as cause and effect – demographic increase and greater sedentism – encouraged people to explore newer strategies to cope with changing needs. It will be incorrect to observe that the beginning of agriculture immediately revolutionized the life of early farmers, yet there is no doubt about the fact that the potentialities inherent in irrigation farming (with possibility of a surplus, greater exchange etc.) encouraged formation of a more complex society.The Unit provides a framework for the study of myriad ways in which agriculture began in different parts of the world. Early attempts at agriculture had a definite impact on human communities in different parts of the world as the next Unit demonstrates.

5.7 KEY WORDS

Bitumen : sticky liquid or semi-solid form of petroleum found in natural deposits, commonly used nowadays for road binding.

Hybridization : the process of breeding an animal or plant with an animal or plant of another species or variety.

Obsidian : a naturally occurring hard glass formed by a volcanic rock. It produces a sharp cutting edge and was primarily used for making knives and scrapers.

5.8 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise-1

1) See Section 5.3, including its two Sub-sections.

2) Discuss the interconnections between of rise in temperature and rainfall, search for new places, increase in population and search for new strategies of subsistence. See Section 5.3 and its two Sub-sections.

3) Discuss the different forms of agricultural practices, whether sedentary or overlapping with nomadism and differences in pottery, tools etc. See Section 5.3. and its two Sub-sections.

Check Your Progress Exercise-2

1) See Section 5.4

2) Yes. See Section 5.5 for details.

3) See Section 5.5

4) See Section 5.5 for details.

5.9 SUGGESTED READINGS

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5.10 INSTRUCTIONAL VIDEO RECOMMENDATIONS

Origin of Agriculture
https://www.youtube.com/watch?v=MEv-rH0e03Q

UNIT 6 CONSEQUENCES OF AGRICULTURE*

Structure

6.1 OBJECTIVES

In Units 1 to 5 we discussed the changes from the origin of humans to the stage of settled agriculture and sedentary societies. In this Unit we will discuss the consequences of the coming of agriculture on humans and their habitats. After going through this Unit, you should be able to:

- Explain the shifts in the diet and physiology of humans;
- Identify the impact of agriculture on their social structure; and
- Outline the correlation between agriculture and new material culture.

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6.2 INTRODUCTION

The transition from a hunting-gathering lifestyle to agricultural production is one of the most important events of human history. The transition to agriculture, often referred to as the **Neolithic** Revolution, had far reaching consequences for human societies. It concerns us because almost all the food we eat is made up of domesticated plants and animals. It was also a prerequisite for the emergence of cities and civilizations. It spawned patterns of demographic change that led to the expansion of the culture and languages of the agriculturists at the cost of foraging groups. For example, about 88% of all humans speak a language belonging to one of the language families confined in the early **Holocene** to two small areas of Eurasia, **the Fertile Crescent** and parts of China. The inhabitants of these areas acquired this extraordinary power because they had a head start in agriculture. While foragers regarded themselves as part of an inherently productive nature, farmers saw environment as something that could be manipulated, tamed and controlled. But bending an environment to your needs requires a lot of hard work on land. Production of food is directly proportional to the amount of energy you invest. This required a more aggressive attitude towards nature and other human communities. Consequently, such investment resulted in significant consequences for the humans and their surrounding environment.

6.3 IMPACT OF AGRICULTURE ON HUMAN BIO-SYSTEMS

The coming of agriculture meant that our ancestors began to eat cereals and plants in larger quantities. This had significant impact on human physiology. Changes in the food regime also led to significant impact on population and human attitude towards nature.

6.3.1 Changes in the Human Diet

An immediate consequence of the advent in agriculture was the change in human diet. In the **Palaeolithic** age, meat was important and, in many regions, the primary component of human diet. With investment in agriculture, human diet became more diverse and cereals became an important component of their diet. Wheat, for instance, was a primary diet component in West Asia and Europe while South and East Asia relied largely on rice. Africa, on the other hand, had millet and America had maize. The replacement of meat diet by a largely vegetable one necessitated the use of salt which quickly became an item of local trade, and sometimes of long-distance trade as was the case in Neolithic Europe.

The introduction of ceramic pottery (detailed later in this Unit) which was durable in quality further allowed humans to easily boil and cook their food. Along with this, the domestication of animals added milk and its derivatives to the human diet. These radical changes in human diet certainly affected their metabolism, resistance, life-span and were the reasons for the onset of certain human diseases – areas of research which are still being explored.

6.3.2 Craniofacial Changes in Humans

With the coming of agriculture and the associated changes in diet, humans witnessed a significant change in their jawline. The hunter-gatherers are associated with larger skulls than Neolithic people due to their more mobile and active lifestyle. Moreover, foragers consumed tougher foods, requiring a larger chewing apparatus. With the advent of agriculture, new people preparation and processing methods were adopted and food became softer and easier to chew. This change in masticatory (chewing) function created

less mechanical demand on the bones of the face and jaws and gradually contributed to an overall reduction of bone mass in the human skull. These changes finally resulted in a smaller human face with reduced jaws and teeth.

Reduction of the face had a negative effect on the human oral health because smaller jaws compressed the size of teeth, led to crowding and consequently led to increase in tooth decay and many periodontal diseases (affecting the structures around the teeth) in humans.

6.3.3 Changes in Attitudes of the Humans

The coming of agriculture was connected with major changes in attitudes and orientations of humans. That hard work is a virtue and possession of stores of grains is a reflection of merit, is an idea completely foreign to foraging communities. The ability to grow food and control its distribution became a path to power and influence. Agriculture also transformed the way humans think about time. Seeds are planted in one season and harvested in another. Thus, agricultural societies created economies of hope and aspiration, in which we focus on the future.

6.3.4 Growth in Human Observation and Questioning Faculties

The domestication of plants and animals is an indicator of the power of human observation in the pre-Neolithic communities. This grew further once humans began farming, for they were led to observe, raise and resolve questions such as: Why seeds germinate? Which season would lead to better crops? What type of soil was suited to which crop? Such and similar questions would have promoted cultivation of a variety of crops in different seasons.

6.3.5 New Epidemics and Diseases

In addition to the negative impact on human dental health, the coming of agriculture had many other important consequences for the health and hygiene of people. While a regular supply of food seems to have increased their longevity (Australopithecus lived for 25 years only), sedentary life created ideal environments for mosquitoes especially when they started storing water, irrigating crops, or settling near swampy or marshy land. These mosquitoes were the carriers of diseases like malaria. The trash that accumulated around villages attracted pests, some of which were hosts for diseases. A famous example from a later period is that of the medieval spread of bubonic plague through the infestation of rats whose fleas carried the disease.

Many pathogens jumped from domesticated animals to humans. Diseases like small pox and measles are a result of this. In the old world, agriculturalists developed immunity to these diseases. In the period when Europeans discovered America, the Red Indian population did not have immunity to these diseases. Infectious diseases like smallpox and measles wiped out an estimated 95% of the New World's native population.

6.3.6 Increase in Population and Expansion of Settlements

Settled agricultural populations tend to expand both numerically and territorially. Population growth is higher among sedentary communities. Crops provided farmers with more dependable supplies of grain based weaning foods such as gruel and porridge, as well as milk, once goats and sheep began to be milked. Average interval between births was reduced, leading to increase in population. It has been estimated that in the Fertile Crescent the size of settlements increased tenfold in the transition to food

production. Hunter-gatherers lived in groups of twenty or thirty because large numbers could create food shortages. Farmers could grow more food than hunter-gatherers could collect. They could support more people on small plots of land. Unlike the hunter-gatherers, farmers could grow food which they could store for a long time. Thus, villages with population of hundreds of people came into existence. The coming of agriculture meant that crops were sown in areas where they did not grow naturally. Since 99% of natural vegetation cannot be consumed by humans, creation of artificial niche meant that edible plants covered most of the space around villages. Thus, there was an artificial extension of the production niche. Excavations in Cayonu, Jericho and Jarmo have revealed successive levels of occupation at the same site. A cluster of about 24 houses made of baked mud were found in the Neolithic village of Jarmo. The elevated areas created about 12 distinct levels of occupancy.

While hunter-gatherers depended on nature to provide them food, agriculturists actively created new landscapes of cultivated crops. But farmers also discovered that soil got exhausted after supporting few crops. So they needed to cultivate another clearing. Thus, cultivators colonized many new areas inhabited earlier by foraging population. Agriculture also led to an increase in the carrying capacity of land. Various calculations suggest that a hunter-gather would need roughly four-square kilometers of land to feed him in an year's time. A very small chunk of land could support large number of agriculturists.

Predictable availability of food enabled a much greater degree of role differentiation within farming societies. Craftsmen to make tools, priests to pray for rains, fighters to protect farmers from rivals, chiefs to transform economic power into social capital, characterize agricultural societies. In the **Upper Palaeolithic** there was one specialist, the sorcerer-shaman. Whereas in the Neolithic villages, a variety of activities such as farming, stock-breeding and pottery-making demanded a greater role differentiation. The coming of agriculture also meant slavery for many people. Social conflicts resulting from sedentary life required individuals with centralized powers who would act as arbiters in disputes. These people could have emerged as chiefs. Chiefs hungry for power and wealth forced other members of the community to take up cultivation and give them a part of the produce.

Domestication of plants is continuing in modern times too. Many of the colourful flowers growing in our gardens were brought from the Himalayas in the twentieth century. Similarly, many plants with medicinal properties have been discovered and domesticated in the present century. Everyday some botanist discovers some useful property in a plant and in many cases such discoveries are followed by growing those plants artificially. Unfortunately, because of the large-scale destruction of forests many plants are destroyed even before their medicinal properties are discovered.

Check Your Progress Exercise-1

1) In what ways did settled agriculture affect the food habits of humans during the Neolithic period?

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2) What was the negative impact of agriculture on the physiology and health of humans?

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3) Discuss the impact of agriculture on the demographic patterns in Neolithic period.

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6.4 IMPACT OF AGRICULTURE ON THE SOCIAL STRUCTURE OF EARLY FARMING COMMUNITIES

The coming of agriculture brought about radical changes in the social world of human communities. Larger number of humans living together over a long period of time presented new problems of order and dispute, kinship, sharing of work and produce. It was these challenges that led to the emergence of new social structures having greater centralization. Such restructuring is visible in the field of religion too.

6.4.1 Emergence of a Village Culture

Sedentarism was one of the important consequences of agriculture which led to the growth of village settlements. In the Upper Palaeolithic and **Mesolithic** period, hunter-gatherers moved their homes according to the seasonal migration of animals and availability of fruits and roots. Some Mesolithic groups did possess permanent dwellings where marine resources were available in plenty, but these were rare. The pattern of settlement transformed over a period of time. The remains of the Yang-shao culture reveal the fact that the competence in house building had reached a high level.

Unlike hunting-gathering, agriculture requires that the farmer stays in one place for a long period. They had to sow seeds, water the plants and protect the saplings from birds and animals. Only after four to six months are the plants ready for harvesting. This means that unlike hunting-gathering, agriculture encourages settling down in one place. Farmers began to build houses, barns and stables of wattle and daub, sometimes with dry-stone, that were more durable than the simple huts of earlier period. Multiple settlements at one area gradually led to the emergence of villages. These village settlements were relatively small. For instance, in CatalHoyuk – a village in Turkey – was home to a small population.

That is why the beginning of agriculture is connected with the emergence of villages. Although, foraging communities found villages and towns in some places where plentiful supply of food was available all the year round, such places were rare. In domesticating

animals and plants, humans necessarily domesticated themselves. The present world covered with roads and paths, huts and houses, hamlets, villages and towns are a creation of our agricultural ancestors. These are the places archaeologists dig up.

6.4.2 Emergence of Tribal Communities

Coming of agriculture is also related to the emergence of long term patterns of cooperation. Hunting-gathering groups needed cooperation for organizing hunt. Once the hunt was over and game had been shared, the group ceased to exist. Agriculturists needed cooperation from sowing to harvesting. Unlike a typical hunting expedition which might last a day or a week, agriculturists had to cooperate in the production process lasting at least four months. While agriculturists waited for the crops to grow, they survived on the food produced by farmers in the previous season. So, there was a need for cooperation among food producing groups across the year. No wonder agricultural societies are characterized by large kinship networks which are the institutional frame for cooperation among the farmers.

6.4.3 Complexity in Social Structure

Permanent settlement in a village led to social and occupational divisions. In the Upper Palaeolithic period, there was only one specialist, the sorcerer-shaman, while all the other members of the community shared similar activities of hunting, fishing and manufacturing of artefacts. With the emergence of a village settlement in the Neolithic period, the occupation of people got diversified as farmers, breeders, herdsmen, potters, weavers, stoneworkers, and carpenters. In the following centuries, further specialization emerged with people practicing as wheelwrights, traders and as early metallurgists. Sedentism thus paved the way for craft specialization. Regional centres of pottery manufacturing emerged in Merimde and Fayum in North Africa.

There probably also existed a division of labour between sexes and activities such as pot making and basket making being reserved for women. In the initial stages, even farming and stock-raising was exclusively done by women. With the development of agricultural techniques such as the invention of plough, drainage and irrigation, which required greater physical strength, these activities came to be dominated by men. According to Clark Larsen (1984), men carried on hunting and fishing after the adoption of agriculture, whereas women took on the taxing field and household chores.

Social stratification, which was hardly evident in the hunting-gathering societies, took a complex form. The position of chief became hereditary in this period and it became synonymous with the power of a ruler combining military control and religious sanction for his authority. There also emerged the position of a 'priest', whose religious authority was combined with secular, economic and political power.

Ethnographic evidence from Africa has revealed that hunting-gathering communities shared the products of their hunts equally among themselves. Such solidarity however faded away with the transition to food production wherein ownership of resources became a point of competition. While the concept of property was present even in earlier period in the form of marking the hunting territories,with agriculture it became more pronounced with the farmers competing to possess their own fields, tools and cattle. The need for private resources promoted crimes such as theft and pillaging, especially in situations when the fields of a neighbouring village were prospering. Sometimes this resulted in inter-village conflicts which explains the presence of fortifications as security in many Neolithic villages. Besides Jericho, where a stone wall surrounding the closely clustered houses is found, defensive walls were found in early Mesoamerica.

6.4.4 New Forms of Order and Dispute

Permanent houses meant substantial investments in labour. Similarly, agricultural fields too required considerable investment of labour. Agricultural communities would defend their fields and homes much more than the foraging groups. Anthropological literature suggests that in case there is a conflict among foragers the losing side simply leaves the place. Agriculturists tend to stay in their villages even if the victors take away part of their produce or give them a subordinate status. Thus, coming of agriculture changed the significance of war. It also paved the way for the creation of societies based on inequality. The presence of certain precious goods in the graves of a few in Abu Hureyra and CatalHoyuk is an indication of inequality in society.

6.4.5 Structuring of Rituals and Religious System

Agriculture and its associated social changes also brought changes in the religious system. The changes were not so much in the human belief system, rather they took the form of new forms of rituals and religious structure. Such organization is evident in the demarcation of specific spaces for religious purposes. For example, megalithic monuments and stone tools found at the site of Gobelki Tepe in Modern Turkey have been interpreted to symbolize ceremonial structures. The absence of a water resource near this site and the missing artefacts necessary for habitation indicate that it was a ritual space. Similarly, CatalHoyuk in Turkey has revealed buildings that are believed to have been used for religious or ceremonial purposes.

Figure 6.1 : The site of Gobelki Tepe in Modern Turkey

Credit: Zhengan, 2012

Source:https://upload.wikimedia.org/wikipedia/commons/c/c4/Göbekli_Tepe_site_%281%29.JPG

As for the belief system, early farmers were increasingly concerned with fertility and procreation. In tandem with the agricultural practices and associated environment, there emerged a renewed reliance on the reproductive abilities of plants, animals and human beings. The religious belief in fertility cult was based on a dual (male and female) principle, both of which were worshipped as supernatural powers. The large sized plaster reliefs, projections of bull heads from the walls and the elaborate frescoes in the buildings of

CatalHoyuk are indicators of an elaborate religious system and symbolism during this period.

The dead were buried with grave goods with the belief that these goods would accompany the dead in their afterlife. These goods were simple in the early stages of farming, but as social complexity grew, grave goods as also the size of the graves became a symbol for the display of power and social rank. There coexisted the practice of individual and collective burials. At sites such as Jericho and Ain Ghazal in Jordon, plaster figurines modelled after the deceased have been recovered which indicate the presence of some form of ancestor worship amongst the early village communities.

Check Your Progress Exercise-2

1) How did agriculture lead to the emergence of a village culture?

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2) How did the beginning of agriculture influence the social structure?

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3) Explain the influence of agriculture on the belief system.

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6.5 NEW FORMS OF MATERIAL CULTURE

The coming of agriculture brought significant introductions and changes in the material culture. The major ones include pottery, weaving and metallurgy. Introduction of these materials also brought to fore an economy of exchange.

6.5.1 Pottery

Evidence of terracotta figurines from the Upper Palaeolithic period in Moravia (Czech Republic) indicates that groups of foragers were already familiar with the phenomenon that clay hardens on contact with fire. However, pots and vessels of terracotta came to be made only with storage needs posed by the process of producing durable food

grains. Given the largely raw food diet in the previous period, hunter-gathers used materials such as hide and wood to make containers which had limited utility and could not be used for cooking.

The Neolithic pottery was also superior in quality compared to the simple, cruder and non-diverse earthenware of the Mesolithic period. The strength of the Neolithic pottery resulted from the mixing of materials such as sand and wood to clay which was done by early farmers to prevent the shrinkage and breakage of clay during the process of its drying and firing. Since there is no evidence of a furnace or a kiln from this phase, early pottery was supposedly sun dried or fired in a bonfire or in hearths at homes. Although clay pottery had gained prominence with farming, it did not spread uniformly across cultures and many farming communities, especially in places like West Asia, Greece and South America, were **aceramic** (did not produce pottery). Those producing pottery, over time introduced diverse designs, shapes and styles. For example, the early ceramic ware from CatalHoyuk in Anatolia (Modern Turkey) consists of oval bowls, jars with handles and vessels with flat bases. Some farmers also decorated their pots with symbols and artistic patterns which are believed to have held a ritual, magical or ethnic significance. The undecorated pots seemingly served the everyday needs of cooking and storage in the households.

Figure 6.2 : Neolithic Painted Earthenware Basin from Yangshao Culture (*c.* 5000 – *c.* 3000 BC) China. The basin was excavated from Miaodigou culture site in Shaanxian county, Henan province in 1956

Credit: Prof. Gary Lee Todd, 2011

Source:https://upload.wikimedia.org/wikipedia/commons/e/e7/Neolithic_painted_pottery_basin%2C_Yangshao_Culture%2C_Miaodigou_type%2C_Henan%2C_1956.jpg

While the early farmers made pots with hand, with the introduction of wheel in the sixth millennium BCE, wheel pottery became prominent in places like West Asia. It is for such developments and diversity offered by pottery that it stands as a crucial archaeological artefact for identifying a culture and its facets.

6.5.2 Weaving

Weaving is also connected with sedentary life. Once farmers put the fleece (woolly covering) of the early domesticated animals, such as the goat and sheep in West Asia

and llama, guanaco and vicuña in the region of the Andes (South America), through a round of mutations, the wools became suitable for spinning and led to the beginning of weaving. However, as pointed out in Unit 4, the woolliness of sheep was not the reason for their domestication in the first place. Gradually, farmers of West Asia, Egypt and Europe also learned the techniques of using plants like flax for weaving while India and Mesoamerica had begun to grow cotton in the Neolithic period. Bone needles, awls and fishhooks are some of the tools associated with early weaving.

6.5.3 Metallurgy

One of the initial consequences for the emergence of metallurgy was the desire of early agricultural and pastoral communities to adorn themselves. Around the eleventh-ninth millennium BCE, people in Southwest Asia began to use colourful ores and naturally occurring metals to decorate human body in life and death. In the beginning, only native copper which was abundant in West Asia was used to make simple tools and decorative and adorning jewels such as pendants and rings. The first evidence of trinkets (small jewellery) made from copper comes in the form of a perforated pendant was found from the Shanidar caves in the Zagros mountains. Copper trinkets dating to seven thousand BP have also been found in Ali Kosh (Zagros mountains), Yarim Tepe (north-eastern Iran) and Hacilar in Turkey. Copper was however not indigenous to all sites where these artifacts were made which affirms the presence of an exchange economy along with the transition to agriculture.

6.5.4 Material Exchanges

As the foragers, the early farmers also depended on an economy of exchange. Items exchanged included seeds and other food products, textiles, salt, rare stones, ceramic vessels and raw materials such as flint. Food was often exchanged for stones, tools or other raw materials, or to meet the needs of a local or neighbouring settlement. Obsidian, which was traded in an earlier period as well, was one of the prominent items of Neolithic exchanges. Similarly, grains, fruits and pottery were bartered and exchanged. People exchanged by walking to neighbouring areas on foot or boating across water channels. Tools made from obsidian have been found in the Natufian sites like Jarmo in the Levant. In the Neolithic site of CatalHoyuk both obsidian and flint were used for making daggers and knives.

> Obsidian is a hard-volcanic glass which produces a sharp cutting edge. It was primarily used for making knives and scrapers and was found near regions of volcanic activity such as Italy, some islands in the Aegean Sea, Taurus (the mountainous region around Modern Turkey) and Armenia. The abundance of tools of obsidian, far away from areas of occurrence, is a clear indication that the Neolithic economy was connected in networks of exchange .

While promoting economic contacts between people in different areas, such exchanges also encouraged interactions, social ties and exchange of ideas among Neolithic communities. It is believed that such exchanges promoted the early diffusion of the invention of pottery and eventually that of copper and bronze metallurgy across the major sites of Neolithic period.

Check Your Progress Exercise-3

1) Explain the relationship between the advent of agriculture and pottery.

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2) Were the early farming communities self-sufficient?

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6.6 SUMMARY

The advent of agriculture is an important phase in human history. Some of its effects such as greater sedentism were immediate and long drawn, while others such as increase in population, effects on human health came about gradually. Advent of agriculture also led people to think about newer ways and strategies to cope with the surroundings. Certainly, beginnings in agriculture did not immediately revolutionize the life and lifestyle of early farmers, but it was definitely a harbinger of several significant social and economic changes that paved the way for more complex social formations.

Transition to agriculture was not universal as many communities chose to retain a hunting gathering lifestyle. Moreover, as the ongoing excavations at CatalHoyuk in Turkey seem to indicate, production of food was not the reason for the transition to agriculture in all the regions. At CatalHoyuk, for instance, evidence suggests that people numbering in tens of thousands settled down there not for cultivation but for some still mysterious cultural reason (See www.catal.arch.cam.ac.uk/catal/catal.html for details). Thus, in this Unit you learnt about the impacts of early agriculture in different regions across the world.

6.7 KEY WORDS

Aceramic communities : communities or societies that did not produce pottery

Fertile Crescent : it is the arc of the fertile land that is covered by the mountains and foothills of Israel, Jordan and Syria to the west, Turkey to the north and Iran to the east.

Holocene : the present geological epoch that set in with the end of the Pleistocene epoch (beginning about 1.6 million years ago and ending about 10,000 years ago)

Lower Palaeolithic : the earliest phase of the Old Stone Age (palaios+lithos=Palaeolithic). It lasted from around 3.3 million years ago to 300,000 years ago

Mesolithic : relating to the period in prehistory immediately following the Ice Age when people still lived by

hunting and food gathering but, in some places, had begun very basic farming practices.

Neolithic : relating to the New Stone Age or period of prehistoric farming before the introduction of metal-working.

Upper Palaeolithic : relating to that part of the Old Stone Age that lasted from approximately 40,000 to 12,000 years ago.

6.8 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise-1

1) See Sub-section 6.3.1

2) See Sub-sections 6.3.1, 6.3.2 and 6.3.5

3) See Sub-section 6.3.6

Check Your Progress Exercise-2

1) See Sub-section 6.4.1

2) See Section 6.4 (including all its Sub-sections, especially 6.4.3)

3) See Sub-section 6.4.5

Check Your Progress Exercise-3

1) See Sub-section 6.5.1

2) No, See Sub-section 6.5.4

6.9 SUGGESTED READINGS

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6.10 INSTRUCTIONAL VIDEO RECOMMENDATIONS

Mankind: The Story of All of Us: Birth of Farming
https://www.youtube.com/watch?v=bhzQFIZuNFY

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