

HISTORICAL ORIGINS OF AGRICULTURE

Marek Zvelebil

Department of Archaeology, University of Sheffield, UK

Mark Pluciennik

Department of Archaeology, University of Wales, UK

Keywords: Agriculture, taming, farming, domestication, famine, productivity, reliable food supply, elimination of species, cultural selection, biological domestication, agricultural revolution

Contents

1. Introduction: Domestication and the Origins of Agriculture
2. Historical Conditions for the Origins of Agriculture
 - 2.1. Symbolic, Social, and Economic Domestication
 - 2.2. Emergence of Agriculture as a Special Case of Economic Domestication
 - 2.2.1. Generalized Hunting and Gathering
 - 2.2.2. Specialized Hunting and Gathering
 - 2.2.3. Husbandry of Tamed Food Resources
 - 2.2.4. Cultivation of Domesticated Plants and/or Animal Husbandry of Domesticated Animals
3. Why Take up Farming? Explanations of the Origins of Agriculture
 - 3.1. Cultural Ecological Approach
 - 3.2. Demographic Approach
 - 3.3. Evolutionary Approaches
 - 3.4. Social Competition Approach
 - 3.5. Ideological and Cosmological Explanations
4. The Development and Spread of Early Farming
 - 4.1. The Development of Agriculture in the Centers of Origin
 - 4.1.1. Southwest Asia
 - 4.1.2. Mesoamerica
 - 4.1.3. Andean South America
 - 4.1.4. China
 - 4.1.5. Sub-Saharan Africa
 - 4.1.6. Eastern North America
 - 4.2. The Development of Other Systems of Management—The “Non-centers”
 - 4.3. Other “Indigenous” Areas
5. The Consequences of Early Farming
 - 5.1. Ecology and Environment
 - 5.2. Population and Politics
6. The Conclusion
- Glossary
- Bibliography
- Biographical Sketches

Summary

The origin of agriculture is seen as a long-term process of fundamental social and economic significance. The consequences of the origins and early development of agriculture cannot be overestimated. They profoundly changed the operation of human communities within the last 10 000 years. These changes included an increase in population density, the greater survivorship of infants in the early stages of farming, but also greater spread of density-dependant disease, and of other pathological conditions related to poor diet. In summary, although agriculture allowed a greater number of people to survive, it did not make them healthier (this was achieved only with the Industrial Revolution).

This article focuses on general themes, shared by the transition to farming in different parts of the world, rather than going into the detail of regional sequences. It examines the cultural and historical background to the process of domestication among the prehistoric hunter-gatherer communities of the Upper Paleolithic and the Mesolithic periods. It makes a case for management of biologically undomesticated resources and management of the landscape to increase productivity or predictability of resources among the hunter-gatherer communities extending back into the Upper Paleolithic.

The consequences of agriculture have also been linked to the increase in socioeconomic complexity, publicly administered redistribution of foodstuffs, and the shift from “the ideology of sharing” to the “ideology of hoarding.” The development of the notion of private property and of territoriality, the consequent increase in social competition and warfare, increase in social hierarchy, a shift from individual or shamanistic cults to communal or ecclesiastical religions are other outcomes. The origins of early states, and, finally, the degradation of the landscape, simplification of the food web with catastrophic consequences when it failed (famine), and the extermination of many wild species as agriculturally managed landscapes were established throughout the world

Contrary to conventional wisdom, more recent evidence shows that from at least 20 000 years ago hunter-gatherer societies all over the world made efforts to domesticate their landscape and its resources. These efforts occurred along the continuum of symbolic, social, and economic (or practical) domestication. The economic or practical domestication took several forms. These included interventions in the landscape by various firing regimes, weeding, and other forms of protection of useful plants, coppicing, pollarding, burning of grassland and wetland vegetation, selective cull of wild animals, and taming and tethering of biologically undomesticated animals.

The principal motivations of such activities were to ensure greater predictability or reliability of the game, increase in the productivity of the resources, and ideologically rationalized procurement of game for ritual purposes or competitive feasting. Within a relatively short span of time, between 10 000 and 5000 years ago, most agricultural systems became established in certain key regions (nuclear areas). The reasons for the origin and the development of agriculture can be usefully divided into practical and motivational.

From a practical-ecological point of view, the key regions had to possess resources amenable to biological domestication, as well as being subjected to selective practices that would implement such domestication. For further development of agriculture, the

resources had to be complementary, so they could form an adaptable package, or an agricultural system that could then develop further. The most successful systems of agriculture are the agro-pastoral farming originating in the Near East, and now practiced in Europe, North America, and much of the rest of the world, and the rice-based cultivation of East and Southeast Asia.

From a motivational point of view, several causes for the origins of agriculture have been proposed, but no single cause has gained general acceptance. Suggestions include:

- a gradual rise in population beyond the capacity of hunter-gatherer economies
- a rapid rise in population density caused by the post-glacial rise in sea-level and flooding of large coastal areas
- sudden population increase contingent on increased sedentism among hunter-gatherers at the end of the last glaciation
- climatic changes marked by desiccation
- social competition between hunter-gatherer communities driven by desire to gain status and social power
- ideological reasons

The development and spread of agriculture occurred principally through contact or emigration from the key “nuclear” areas to other regions, such as Europe. The role of contact between Neolithic farmers and Mesolithic hunter-gatherers in Europe is presented as an example of the ways by which agriculture can expand.

So the origins and the development of agriculture can be regarded as a mixed blessing at best. Some argue that it is an evolutionary dead-end in the long term for the human species. Profound social, economic, and ideological changes are required across nations to stabilize what, from a long-term human evolutionary view (the last 10 000 years is barely 1% of human existence), seems like an uncontrolled population explosion.

If the rapid rise in population outstrips the agricultural capacity of most environments and/or service capacity of complex industrial systems based on the exploitation of other resources, humans will face an uncertain future.

1. Introduction: Domestication and the Origins of Agriculture

“Who are you?” asked the little prince, and added, “You are very pretty to look at.”

“I am a fox,” the fox said.

“Come and play with me,” proposed the little prince. “I am so unhappy.”

“I cannot play with you,” the fox said. “I am not tamed.”

“Ah! Please excuse me,” said the little Prince.

But, after some thought, he added:

“What does it mean—‘tame’?”

“It is an act too often neglected,” said the fox. “It means to establish ties.”

“To establish ties?”

“Just that,” said the fox. “To me, you are still nothing more than a little boy who is just like a hundred thousand other little boys. And I have no need of you. And you, on your part have no need of me. To you, I am nothing more than a fox like a hundred thousand other foxes. But if you tame me, then we shall need each other.” Antoine de Saint-Exupéry, *The Little Prince*, pp. 65–66.

The act of taming—and the broader process of domestication—has been a subject often neglected in explanations for the origins of agriculture. The emergence of farming is embedded in broader cultural developments occurring among hunter-gatherer communities some ten thousand years ago to fourteen thousand years ago at the end of the last Ice Age, (8000 BC to 12 000 BC), when the entire earth belonged to hunter-gatherers. Since then, within the last 10 000 years, hunter-gatherer societies have all but disappeared, to form only 1.0% of the population in AD 1500, while in 2000 they accounted for only 0.001%. And yet the societies based on farming, never older than the last 10 000 years, account merely for a fraction of our entire existence as humans. *Homo sapiens* as a species is about 100 000 years old, the genus *Homo* evolved 2.5 million years ago. Nothing else can emphasize more dramatically the scale and the speed of changes that have occurred following the emergence of agriculture, changes so recent on the total scale of human history that their consequences have not been fully comprehended yet by humanity.

This article will review the origins of agriculture as a long-term process of fundamental social and economic significance. It will focus on general themes, shared by the transition to farming in different parts of the world, rather than going into the detail of regional sequences. It will outline the historical conditions of the process of domestication among the prehistoric hunter-gatherer communities of the Upper Paleolithic and the Mesolithic periods. And it will show that the manipulation of undomesticated resources and the management of the landscape to increase the productivity and reliability of resources formed a common cultural background from which farming practices arose.

The origins of agriculture occurred from about 10 000 years ago in certain suitable regions, known as “core areas” or “nuclear zones.” The key factor in this process was the biological domestication of targeted plants and animals through selective breeding and other forms of selection (see *Domestication and Development of Plant Cultivars*). But the process of domestication, the process of taming and husbandry of plants and animals, began much earlier, in the Paleolithic period of the last Ice Age.

2. Historical Conditions for the Origins of Agriculture

2.3. Symbolic, Social, and Economic Domestication

Agriculture is based on the cultivation of domesticated plants and the keeping of domestic animals. Domestication, then, is a key social practice that defines agriculture, but agriculture is more than domestication. In the same way, domestication is more than an economic process of managing the reproduction of plants and animals and changing their characteristics through selective breeding. It denotes more generally the bringing closer to home of plants and animals useful to humans, thereby increasing control over

them; it is an act of socialization, of conceptual enculturation of natural resources. Many scholars researching the subject have recognized domestication as an act of taming.

Domestication began as a process of emerging separation between two key symbolic concepts, one having to do with a domestic, enclosed, enculturated sphere of life, the other with the natural, wild, and outside. Other, more tentative binary opposition can be attached to these two basic notions, sometimes referred to as *domus* (inside) and *agrius* (outside). It well may be the case that this basic distinction provided an organizing principle around which social and symbolic life revolved already in the Paleolithic Age.

The duality between the cultural and the natural can be traced back to the symmetrical tools such as hand-axes in the Lower Paleolithic, symbolizing the beginnings of an abstracted cultural code which provided a symbolic language based on the prestige and security of the cultural as opposed to the dangers of the wild, the natural. Prestige was gained and maintained through the ordering and embellishment of the wild: at first through the controlled use of fire and the elaboration of hunting equipment in the Lower and Middle Paleolithic Ages.

This process continued in the Upper Paleolithic (40 000 years ago to 10 000 years ago) through architectural developments of the living space, either within caves and rock-shelters, or within free-standing dwellings, through the elaboration of ritual and burial, through cave art and other forms of symbolic expression, and through technological advances. Taken together, these conceptual and practical advances of the Upper Paleolithic are represented by many scholars as the first human revolution.

At the end of the last Ice Age, environmental changes and restructuring in the distribution of resources permitted more sedentary existence, an opportunity taken up by some hunter-gatherer societies for a variety of reasons. Greater sedentism led to an increase in population numbers, increase in social competition within and between communities, and to the development of the dwelling place as the focus for the social and symbolic strategies of domestication.

What until then was a part of a broader symbolic effort for the enculturation of nature emerged as a deliberate social strategy for gaining personal or collective prestige and for exercising more practical control over a community, a region, and the surrounding natural environment and its resources. The shift in emphasis from symbolic to social domestication also represents the point when symbolic domestication begins to have practical, economic implications. This shift began toward the end of the Upper Paleolithic, about 14 000 years ago.

Within this cultural code, the domestication of food resources and the origins of agriculture can be regarded as entirely predictable. The economic domestication is merely an extension of the concept from the symbolic and social sphere to selected food resources. The historical trajectory moves from symbolic to social to economic domestication. In the last 10 000 years, many hunter-gatherers adopted farming, and agricultural societies began replacing those based on hunting and gathering. The Neolithic, originally defined as a farming society with stone tool technology, began in the Near East some 10 000 years ago, later elsewhere; and lasted until the introduction

of metals 6000 years ago in the Near East, 4000 years ago in Europe, and much later in other parts of the world (Figure 1). In this sense, then, the Neolithic period was about people learning to live as a farming society.

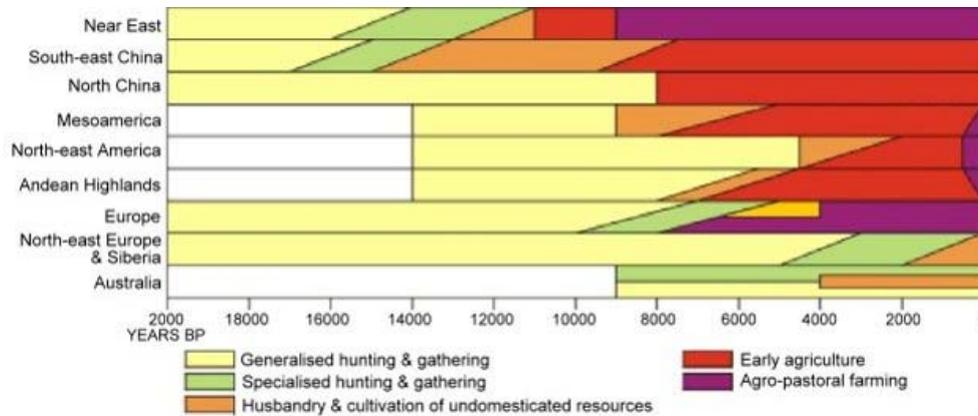


Figure 1. Chronology of husbandry practices

2.4. Emergence of Agriculture as a Special Case of Economic Domestication

Economic domestication follows its own trajectory. This trajectory follows regionally distinctive pathways, but, like a braiding river, all pathways toward domestication cross the same significant thresholds. The thresholds, in essence, are defined by the *degree of control* by humans over plants and animals. The duration of each step toward domestication also varies, and scientists argue whether major biological changes along the pathway to domestication were gradual or sudden.

As a number of researchers have noted, the domestication of plants and animals was a long-term process, reaching, perhaps, as far back as the Upper Paleolithic and marked by symbiotic relationships between people and plants and people and animals. Within this social practice of attending to food resources, highly sophisticated systems of wild plant use, not necessarily leading to domestication, existed both in the archaeological and the ethno-historical past in hunter-gatherer communities (see *Ethnographic Aspects of Human Nutrition*). Similar forms of management were practiced in relation to wild animals (see *Animal Husbandry, Nomadic Breeding, and Domestication of Animals*).

In the twenty-first century, biologically domesticated plants and animals come into being as a result of cultural selection brought about by prior cultivation and tending of undomesticated species. It follows then that such management must have occurred for some time before biological domestication took place, and before biologically domesticated species can be recognized on morphological grounds in the archaeological record. This is a very important point to understand.

Different researchers subdivide this crucial process of cultural selection processes into different steps. But, bearing the significant thresholds of human control in mind, the following social practices are common to most if not all pathways to domestication.

2.4.1. Generalized Hunting and Gathering

This is the basic hunter-gatherer food procurement strategy, characterized by the generalized and opportunistic use of wild food resources. It is accomplished by either people moving from one resource patch to another as a group in a seasonal cycle of mobility (residential mobility), or by sending out task groups to collect resources at specific locations in the landscape and bring the food back to the main settlement (logistic procurement, logistic mobility). In practice, most hunter-gatherers in the past as in the present employ a combination of both strategies.

The San (or Kung) hunter-gatherers in southern Africa are a good example of people practicing this strategy. Their movements around the landscape are determined by the distribution of resources in the dry and wet seasons. During the dry season, when resources are concentrated around permanent sources of water, the San foragers practice a logistic procurement strategy. The community remains mostly stationary around a permanent source of water, sending out hunting parties farther afield on hunting expeditions. During the wet season, the whole community relocates from one camp to another, taking advantage of seasonally available resources in otherwise arid locations. The San utilize a wide range of food resources without specializing in any one of these; plant foods play a major role in their diet.

2.4.2. Specialized Hunting and Gathering

With more regular targeting of specific resources, people develop systems of specialized resource exploitation. Hunter-gatherer communities engaged in such practices tend to be more sedentary, more territorial, more technologically advanced, and procure food more often in a logistic pattern. Food resources used in this systematic, specialized manner respond biologically to such intensive cropping in various ways, often by increasing their reproduction. People, on the other hand, often engage in the conservation of their food resources, or in promoting—through clearance, soil disturbance, feeding, or removal of competitors—selected species to increase their productivity or reliability. In aggregate, such practices can be characterized as tending or management of selected wild food resources.

For example, Australian Aboriginal communities manage their landscapes by woodland clearance, weeding, soil alteration through digging, coppicing, pollarding, and firing of wetlands, woodlands, and grasslands. In so doing, they encourage the growth of plants useful to them as food, for example nut-bearing and fruit-bearing plants (*Casuarina*), root crops, such as *Ipomoea* or *Microseris*, and small-seeded grasses such as *Panicum*. In tropical and subtropical Australia some root crops, for example the *Dioscorea* yam, were also planted, bringing these practices even closer to agriculture. Even though none of these resources is biologically domesticated, it is at this stage that “enculturation of nature” and the “domestication of the environment” takes place.

The Ainu people of Hokkaido in northern Japan practice several specialized strategies, focused on the efficient management of a number of targeted resources. In tending their plants, they use the same range of practices as the native Australians. To manage the exploitation of migratory fish, such as salmon, they build dams, set nets and fish traps,

and modify their streams to create ponds, owned and managed by separate households. To hunt for deer and bear, they send out task groups for a logistic procurement of resources. The Ainu also tame bear cubs for ritual and religious reasons, to sacrifice them two or three years later in a religious ceremony symbolizing respect for animals killed, replenishment, and the circulation of resources between people and nature.

Such practices can be identified for the distant past. For example, manipulation of drylands through clearance and firing, and of wetlands through the making of channels and ponds, have been recorded from 9000 years ago in New Guinea and Australia. In North Africa and the Near East, a wide range of techniques was used to encourage the growth of small-seeded grasses 17 000 years ago. In temperate Europe, Mesolithic hunter-gatherers engaged in a similar range of practices 10 000 years ago to 4000 years ago.

2.4.3. Husbandry of Tamed Food Resources

The next threshold is crossed when the symbiotic relationship, implicit in the tradition of specialized hunting and gathering, reaches the point of taming, or behavioral domestication. Culturally, this is marked by deliberate and effective promotional strategies, designed to increase the control over food resources and to improve the conditions of habitat favorable to the propagation of selected species. For plant foods, such practices would include protective plant tending, selective burning of woodland, weeding, and soil modification. It may include sowing or planting.

For animals, this may include selective cull, feeding, corralling, herding, and removal of predators (see *Animal Husbandry, Nomadic Breeding, and Domestication of Animals*). It is through these practices that animals become tamed and plants semidomesticated in the sense that they become accustomed to human presence, attached to human habitations, and dependent on anthropogenic environments (those created by humans) within a web of mutually beneficial, symbiotic relationships. It is the mutual benefit that makes this process of great adaptive value for both humans and their resources. It is with these promotional practices that the change in social relations toward investment, delayed returns, and the appropriation of resources takes place: actions that take place well in advance of actual cultivation.

We know from the ethnohistorical record that hunter-gatherer communities cultivated undomesticated plants. The Kumeyaay in southern California, for example, harvested seeds of wild grasses, then burned the fields, broadcasting seed over it. The practice of burning and broadcasting was widespread in the American West, as were other plant-husbandry practices involving the planting, propagation, and tending of fruit and nut-bearing trees, such as oaks, pine, palms, and wild plum trees, prickly pear, and fruit-bearing shrubs, such as manzanita, yucca, and wild grapes. Such practices, based on traditional knowledge and the use of indigenous plants, were widespread in other regions of North and South America, Africa, and Asia in the more recent past.

Reindeer herding of biologically undomesticated, but culturally tamed reindeer in northern Europe and Siberia illustrates a corresponding form of animal management. For at least 2000 years, hunter-gatherers of this vast area kept reindeer for traction,

transport, as a decoy to hunt wild reindeer, and as a source of milk, meat, and hides. Reindeer are tamed and their movements are controlled, but they are often allowed a free run of their pastures and they are allowed to interbreed with wild reindeer. As a result, there is no biological difference between the tamed and the wild reindeer, and the tamed ones easily revert to a wild state.

Prehistoric examples of this kind of husbandry of tamed animals included, probably, the use of red deer and pig in Mesolithic Europe by communities who, among other practices, transported these animals onto islands off the continent, such as Ireland, Corsica and Sardinia in the Mediterranean, and Gotland and Bronholm and Saaremaa in the Baltic. A recent find of tamed and tethered bear at a Mesolithic site in France, 8000 years old, suggests that the practice of bear taming, described for the Ainu above, extended deep into prehistory. Other examples include the cultivation of wild cereals in the Near East possibly as early as 13 000 years ago, of root crops in New Guinea from 9000 years ago, and of rice in southeast China from as early as 15 000 years ago.

2.4.4. Cultivation of Domesticated Plants and/or Animal Husbandry of Domesticated Animals

In some cases, husbandry of tamed resources leads to domestication. It can be accomplished through selective breeding of targeted resources, or by practicing other forms of selection that will result in biological change in the species over the course of several generations. Just how many generations it takes depends on the species in question, of course, on the intensity of selection, on isolation from other populations, and on other factors. The biological change in the genetic makeup of the organism, resulting from cultural selection, defines the threshold from behavioral to biological domestication. By crossing this threshold, species that are culturally domesticated but biologically identical to their wild counterparts become a new species with a separate genome and new appearance, incorporating phenotypic characteristics for which they were bred by humans. Such species often end up dependent on humans for survival and reproduction: an ultimate form of human control.

The shift in dependence from tamed to biologically domesticated plants and animals marks the beginnings of farming. Biological domestication was a social practice: it was contingent on practical conditions (technology, subsistence practices, investments, and returns) and on symbolic considerations (ideological significance of animals and plants, social prestige, and social competition). Conceptually, the people involved had to make a transition from ensuring the deaths of living animals as hunter-gatherers, to ensuring their survival as farmers: essentially the predator-prey relationship had to change toward constraining the movement of target populations, regulating their breeding, and controlling their feeding both to ensure and to shape successive generations. Ideologically, they had to make a shift from regarding plants and animals as a natural resource given to the community to a cultural resource dominated by individual human ownership—an act of appropriation leading from “trust to domination.” Taken together, these conceptual, ideological, and practical changes amounted to a gradual, but far-reaching revolution. What motivated hunter-gatherer communities to embark on a journey that resulted in the creation of new, agricultural worlds?

-
-
-

TO ACCESS ALL THE 38 PAGES OF THIS CHAPTER,
Visit: <http://www.eolss.net/Eolss-sampleAllChapter.aspx>

Bibliography

Cohen M.N. (1977). *The Food Crisis in Prehistory*. New Haven and London: Yale University Press. [A review of demographic arguments for the origins of agriculture.]

Cowan C.W. and Watson P.J., eds. (1992). *The Origins of Agriculture. An International Perspective*. Washington and London: Smithsonian Institution Press. [An update on Reed's seminal volume, reviewing in ten papers the origins of agriculture in different regions of the world.]

Gebauer A.-B. and Price T., eds. (1992). *Transitions to Agriculture in Prehistory*. Madison, WI, US: Prehistory Press. [Patchy in geographic coverage, but another useful review volume.]

Harlan J. (1995). *The Living Fields: Our Agricultural Heritage*. Cambridge: Cambridge University Press. [Often anecdotal and idiosyncratic, but a useful introduction to plant domestication and use on a global scale.]

Harris D., ed. (1996). *The Origins and Spread of Agriculture and Pastoralism in Eurasia*. London: UCL Press. [A wide range of specialist articles from diverse perspectives, including potential evidence from genetics and comparative linguistics, with extensive bibliographies.]

Harris D. and Hillman G., eds. (1989). *Foraging and Farming: The Evolution of Plant Exploitation*. London: Unwin Hyman. [Geographically widespread collection of theoretical, archaeological, and ethnographic papers on cultivation.]

Higgs E.S., ed. (1975). *Palaeoeconomy*. Cambridge University Press. [An evolutionary perspective on animal domestication and patterns of landuse during agricultural transition.]

Higgs E.S., ed. (1972). *Papers in Economic Prehistory*. Cambridge University Press. [An Evolutionary perspective on plant and animal domestication.]

Hodder I. (1990). *The Domestication of Europe*. Oxford: Blackwell. [A cognitive and ideological perspective on the agricultural transition in the Near East and Europe.]

Price T. and Gebauer A.-B. (1995). *Last Hunters, First Farmers*. Santa Fe, New Mexico: School of American Research Press. [Patchy in coverage and overlapping with other volumes, but another review volume.]

Reed C.A., ed. (1977). *Origins of Agriculture*. The Hague: Mouton. [A classic volume of 29 papers tracing the history of agricultural origins in different regions of the Old and New Worlds.]

Rindos D. (1984). *The Origins of Agriculture: An Evolutionary Perspective*. New York: Academic Press. [An evolutionary perspective on the origins of agriculture with specific reference to plants.]

Sherratt A. (1997). Climatic Cycles and Behavioral Revolutions: The Emergence of Modern Humans and the Beginnings of Farming. *Antiquity* **71**:271–288. [An excellent review of the environmental explanations for agricultural origins.]

Smith B. (1995). *The Emergence of Agriculture*. New York: Scientific American Library. [A good global review of agricultural origins for the lay reader.]

Zvelebil M., ed. (1986). *Hunters in Transition*. Cambridge University Press. [An important specialist book examining the transition to farming in Eurasia with particular regard to the role of hunter-gatherers in the process.]

Biographical Sketches

Professor Marek Zvelebil, Ph.D., is a member of the Department of Archaeology and Prehistory at the University of Sheffield. He is a specialist in the mesolithic-neolithic transition in Europe, especially in the north and east, and in Eurasia, on which he has published many major articles. Among other publications, he was editor of the highly influential *Hunters in Transition*.

Dr. Mark Pluciennik, Ph.D., is a lecturer in the Department of Archaeology, at the University of Wales, Lampeter. His research interests include the mesolithic-neolithic transition in Europe, especially the Mediterranean regions, archaeological ethics, and the theory and philosophy of archaeology, on all of which subjects he has authored major articles.

UNESCO – EOLSS
SAMPLE CHAPTERS