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Archaeology

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DEVELOPMENT, Economic. The earth's landscapes have along history of intensive use by indigenous peoples and small farmers. These peoples have utilized agricultural technologies that permit them to make a living from what is often considered to be marginal farmland, despite pressures from the world economy, urbanism, civil unrest, and top heavy national development. Indigenous knowledge systems can provide models for sustainable uses of landscapes and a viable alternative to the economic development commonly promoted by national and international institutions.

What is often forgotten is that these indigenous knowledge systems have long histories. The deep trajectories result from dynamic, long-term interaction between humans and local environments. Indigenous knowledge systems are often fragmentary or transformed. Often they have been abandoned, as in the case of raised field agriculture in the upper Amazon of Bolivia, in the highland Andes, and the Maya lowlands of Guatemala, Belize, and Mexico. The same is true of irrigation and terrace agriculture throughout much of Latin America. Archaeology can provide a "window" into the history of indigenous knowledge systems. Ancient agricultural systems often were based on the massive transformation of local and regional landscapes. Embedded in these landscapes are the physical structure, patterning, and designs of agricultural engineering and expertise, resulting in a palimpsest of land-use strategies and knowledge systems. Many of these long-used landscapes in Latin America are presently underproductive or abandoned. Archaeological techniques, combined with a multidisciplinary approach, can provide information on the crops grown, tools utilized, field morphology, and patterning, functions, prehistoric demography, and the technical knowledge used. This long-term perspective also provides the political, demographic, social, and economic context of the ancient farming system and its evolution over time.

A small group of prehistorians are practicing what has been referred to as an "applied archaeology." Through the study of ancient indigenous knowledge systems and landscapes, archaeology can provide a practical contribution to rural economic development in the contemporary situation. Despite drastic changes in the social, economic, political, and natural environment, many ancient technologies have been demonstrated to be appropriate in contemporary rural society.

Raised Fields in Peru and Bolivia. Traces of an impressive agricultural system referred to as raised fields (*waru waru*, *suka kollus*) are found throughout the Lake Titicaca region at 12,500 feet (3,810 m) in the Andes. Raised fields are large, elevated planting platforms constructed of earth taken from adjacent canals; which improve planting conditions by doubling topsoil, aerating the soil, and providing local drainage. In addition to irrigation, the deep canals capture, produce, and recycle nutrients in the form of organic matter, algae and green manure and act as a heat sink to protect fields from frosts. Although once a highly productive landscape, the ancient fields now lie abandoned and little agriculture is practiced here because of poor soils, seasonal inundation, and harsh frosts. A number of indigenous communities in the region have worked with two archaeological projects in the rehabilitation of raised fields. In 1981, raised fields were rebuilt for experimental purposes in Huatta using information recovered from excavations of ancient fields. The results were so impressive that a number of projects have begun to promote raised fields as a

sustainable alternative to capital-based western models of agriculture being introduced into the region. An estimated 741 acres (300 ha) of fields have been put back into production and over fifty communities are participating in the rehabilitation projects. A similar raised-field rehabilitation project based on the study of ancient fields has begun with native communities in the Amazon region of Bolivia.

Prehispanic Terracing in Peru. An estimated 12 million acres (5 million ha) of mountain slope were once farmed using stone-faced terrace platforms. Many of these now abandoned fields were part of elaborate irrigation canal networks which distributed water over long distances. Traditionally attributed to the Incas, archaeologists now know that these agricultural works have a long history in the Andean region. In the recent years, various multidisciplinary projects have begun to promote the rehabilitation of pre-Hispanic terraces to put these lands back into production for the benefit of local communities.

Desert Agriculture in the Negev. Archaeological investigations of the Negev Desert region of Israel located numerous large settlements in areas that today are deserted arid wastelands. A long multidisciplinary study by Michael Evenari and colleagues of the landscapes around these sites discovered engineering works which show us how these areas were farmed in the past. A sophisticated network of stone lines, ditches, and barriers above the sites were used to capture the limited rainfall in this area and the runoff was funneled into artificially leveled fields where it provided the moisture necessary to farm these marginal regions. Experiments based on the ancient design proved successful and a development project has put some of these lands back into use.

[See also ARCHAEOLOGY IN THE CONTEMPORARY WORLD; FUTURE OF THE PAST.]

■ Michael Everai, et al., *The Negev: The Challenge of a Desert* (1971). John Browder, ed., *Andenes y camellones en el Perz Andino: historia presente y futuro* (1986). John Browder, ed., *Fragile Lands in Latin America: Strategies for Sustainable Development* (1989). Clark L. Erickson, "Applied Archaeology and Rural Development: Archaeology's Potential Contribution to the Future," *Journal for the Steward Anthropological Society* 20: 1-2 (1992): 1-16. Clark L. Erickson, "Prehistoric Landscape Management in the Andean Highlands: Raised Field Agriculture and Its Environmental Impact," *Population and Environment* 13: 4 (1992): 285-300. Alan L. Kolata, *The Tiwanaku* (1993). Kathryn Gleason and Naomi Miller, eds., *The Archaeology of Garden and Field* (1994). Clark L. Erickson, "Archaeological Perspectives on Ancient Landscapes of the Llanos de Mojos in the Bolivian Amazon," in *Archaeology in the American Tropics: Current Analytical Methods and Applications*, ed. Peter Stahl (1994).

Clark L. Erickson

DIET, Reconstruction of. The acquisition of food is the first concern of all human societies. Not surprisingly, food-getting activities have played a central role in shaping the course of human history. The reconstruction of prehistoric diets is therefore an important part of modern archaeological research.

Prehistoric subsistence first became a major subject of archaeological inquiry in the 1940s and 1950s, when archaeologists began to conduct detailed studies of the origins of agriculture in the Near East, Europe, and the Americas. It was also during these years that Grahame Clark conducted his landmark study of hunter-gatherer subsistence at the Mesolithic site of Star Carr in East Yorkshire, England. In the 1960s and 1970s, paleodietary research broadened to encompass a wide range of questions and economies. Dur-

ing these years archaeology began to shift from a historical discipline concerned with sequences and unique events to one of holistic inquiry into the causal relationships between culture and environment. The shift to problem-oriented research was accompanied by technological and methodological developments in data collection and analysis. Biological specimens were included in archaeological research teams to aid in the analysis of plant and animal remains. More rigorous excavation and extraction techniques were developed to insure the proper collection of food refuse.

From the late 1960s onward, archaeologists have increasingly turned to studies of modern human and nonhuman primate groups to achieve a better understanding of the benefits and limitations of different subsistence strategies. Studies of nonhuman primates have provided valuable insights into the relationship between subsistence practices and variables such as body size, group size, and mating patterns. Modern hunter-gatherer and horticultural groups have provided models for understanding the relationship between cultural attributes, environmental conditions, and economic strategies, and for interpreting the distribution of patterns of food refuse in archaeological sites.

Modern paleodietary research depends on a variety of different analytic specialties, the practitioners of which are generally trained within the discipline of archaeology. These specialties include artifact analysis, the analysis of animal and plant remains, coprolite studies, site catchment analysis, and the study of human skeletal remains. Each line of inquiry contributes its own dimension to the study of prehistoric foodways.

The artifacts found in archaeological deposits are important sources of information about food procurement and processing techniques. Subsistence-related artifacts include such implements as manos and metates, digging sticks, hoes, fishhooks, knives, projectiles, and cooking and storage vessels. Since resource availability is a function of technological capability, the resource potential of a region must be evaluated in the context of a particular group's ability to exploit it.

Animal remains also provide a wealth of information about subsistence activities. Faunal remains that tend to be preserved in archaeological sites include the bones and teeth of vertebrates, and the shells of marine and terrestrial invertebrates. Through the analysis of these remains, it is possible to look attemporal and spatial variations in the relative importance of different animal food resources. Cut marks on bone can be used to determine when early hominids began to eat meat and provide clues on how this meat was acquired. Other research questions that have been addressed using faunal remains include differential access to protein resources and processes of animal domestication.

Plant remains are equally important in the reconstruction of prehistoric diets. Depending on conditions of preservation, these may include seeds, nut shells, rinds, pollen grains, and phytoliths. Botanical remains document the selection and use of different plant species by ancient peoples, and have been particularly valuable in documenting the origins and processes of Old and New World plant domestication.

In the rare cases where they are preserved, human coprolites (fossil/ancient feces) are the best single source of information regarding what people actually ate. Coprolites are primarily comprised of residues and undigested plant and animal food components, in roughly the same combi-