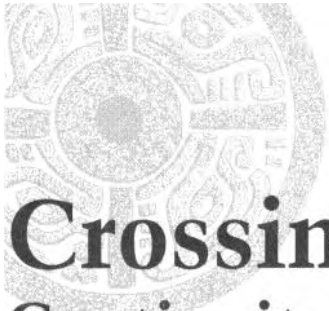

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Applied Archaeology and Rural Development

Archaeology's Potential Contribution to the Future

Clark Erickson

ABSTRACT/SUMMARY

Archaeology can play a significant role in development projects, especially those focusing on improving agricultural production. Local agricultural systems, both prehistoric and traditional, are commonly neglected by development groups seeking to introduce Western capital-intensive technologies. Although research on these systems has received only a minuscule percentage of funds compared to research on Western systems, it has been demonstrated that many of these traditional systems can be both efficient and productive. Throughout the Americas, traces of relict agricultural field systems can be found (for example, terraces, raised fields, and irrigation canals) that were part of once highly productive landscapes. Archaeology is unique in that it provides the methodology to examine such systems in a diachronic perspective. Because many systems, such as raised fields, have been completely abandoned, archaeology may be the only way to understand these technologies. Archaeological excavation of prehistoric agricultural features can provide the model for the rehabilitation of these abandoned field systems. A recent case of applied archaeology which combines raised field agricultural studies and rural development in the South central Andes of Peru is presented.

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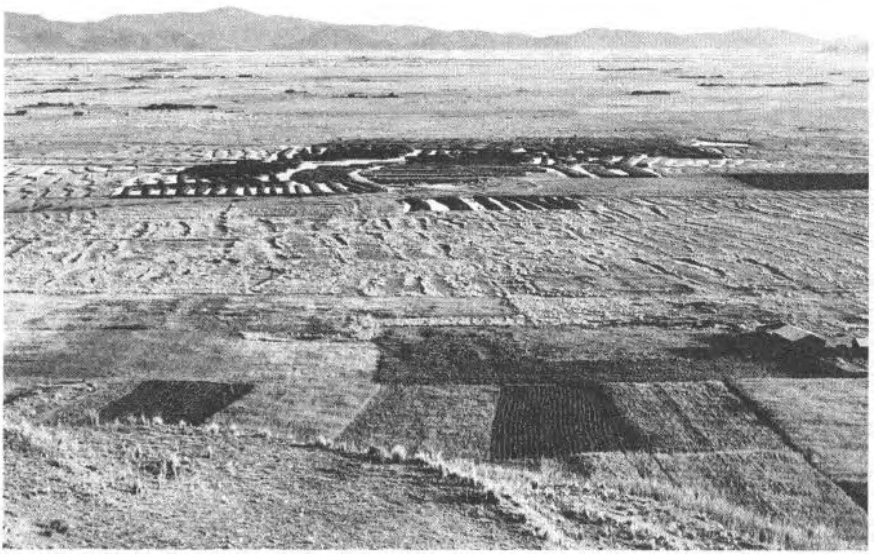
INTRODUCTION

The most direct contribution that the field of archaeology can make to the contemporary world and the future is in the area of rural agricultural development. Recent research interest in prehistoric human-made landscapes (e.g., Farrington 1985; Darch 1983; Denevan et al. 1987; Miller and Gleason 1995; Fedick 1996; Turner and Harrison 1983, Harrison and Turner 1978; Killion 1992) provides the basis for what I refer to as an "applied archaeology." Applied archaeology is the anthropologically informed study of the human past, primarily through material remains, with a goal of employing the knowledge gained from this research to improve



Raised fields covering the seasonally inundated plain near Huatta, Peru. The rehabilitated fields in the center (the dark areas flanked by water-filled canals) are surrounded by traces of ancient raised fields.

the human condition in the contemporary world. Quite often, past human activities and culture are embedded in and layered on the landscape in the form of field patterning and boundaries, pathways and roads, agricultural infrastructure such as canals, terraces, and farming settlements. Archaeological investigations of the landscape can provide important insights into issues such as long-term land-use, agricultural sustainability, indigenous knowledge systems, human- vs. natural-induced environmental change, and the human effect on biodiversity. I argue that this approach is particularly useful for rural development, especially in areas where the archaeological record indicates that humans successfully managed landscapes over considerable periods of time.

Groups promoting rural development in developing countries have slowly begun to realize the critical need to incorporate anthropology into their programs if they are to succeed. Much of the failure of the "Green Revolution" can be blamed on lack of understanding of local technological, social, economic, and political systems. To attempt to address this, agronomists, developers, and social scientists involved in agricultural rural development have developed their own version of cultural ecology and systems analysis known as "farming systems research" (Shaner et al. 1982).

Despite evidence that most contemporary landscapes are the product of thousands of years of changing land use practices and human transformation of regional environments, farming systems research and related approaches result in what are basically synchronic studies. Most include short-term evaluations based on questionnaires, sometimes with follow-up, but these studies rarely include data collected over a period of several years. The refusal to consider the long history of the traditional systems being studied or modeled severely hampers any attempts to understand present situations and plan effective development strategies. The integration of archaeological approaches in development studies and applied projects could help resolve this critical deficiency.

Farming systems research and the "agroecological approach" has emphasized the importance of systemic interrelationships within the agricultural context (Altieri 1983) but it is often assumed

Farmers of Huatta re-constructing raised fields during the dry season. The soil is cut and moved using chakitaqllas (Andean footplows), hoes, shovels, and carrying cloths.

that the ideal state of agriculture is equilibrium and stability (now commonly glossed under "sustainability"). It is doubtful that any agricultural system, past or present, has been static, and most, if not all, systems are probably inherently unstable and dynamic (Rindos 1984; Crumley 1995; Stahl 1996). Archaeology should play a key role in development because farming systems are dynamic, historically contingent, and the product of hundreds of years of intentional and unintentional human agency.

Traditionally, development workers have assumed that indigenous and past land management systems in developing countries are inefficient, backwards, and "primitive" (for critiques of this perspective, see Netting 1993; Wilken 1987). Many evaluation studies focus on how poorly the land is used today, neglecting the archaeological evidence that these same lands may have been used productively in the past. Development agencies commonly fail to recognize that no environment is "pristine"; all landscapes have been used and transformed by humans in the past, some continuously (Denevan 1992). Farming over many centuries accounts for most of the disturbances. Landscapes throughout the Americas that appear pristine or abandoned usually show evidence of human modification at some time in the past, commonly in the form of agricultural remains. Human modification of such environments appears subtle to the uninformed observer, but is often quite profound, especially when measured in terms of increased biodiversity (Stahl 1996). So far, archaeology plays no part in the planning and implementation of modem development schemes; although in many, if not all cases, it can be demonstrated that prehistoric peoples fully utilized the same landscapes, sometimes very successfully.

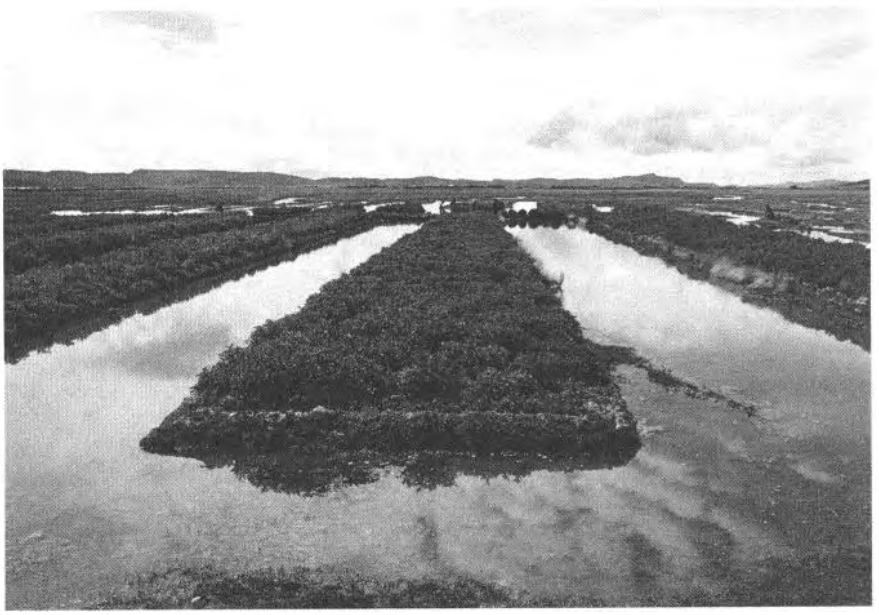
Extensive archaeological remains of farming such as the massive terraces lining the steep slopes of the Andes mountains are often considered to be quaint "testimony" to the accomplishments of past civilizations. These features and the sophisticated technological knowledge they represent are not considered to have any practical modern use. Indigenous agricultural practices, often based on long traditions, are rarely considered worthy of study; more often, they are more something to wipe out so "progress" can occur. The "Green Revolution" of the 1960s and 1970s resulted in the displacement of many local land races of crops by genetically "improved" varieties, the destruction

A communal farming group in Huatta, Peru, posing in front of a newly constructed raised field.

of prehistoric and traditional agricultural infrastructure through the introduction of energy- and capital-intensive mechanized farming, and an increased dependence on Western technology and markets by previously self-sufficient farming communities (Netting 1993). Unfortunately, this situation continues to the present in Latin America driven by poorly planned development programs. The post-Green Revolution strategy has been to focus on "appropriate," "alternative," or "adequate" technologies. Although not as capital intensive as the previous approaches, most emphasize Western technology (e.g., biogas production, windmill power, small water pumps, greenhouses, and small tractors) and rarely consider the potential indigenous models.

PREHISTORIC AGRICULTURAL LANDSCAPES IN THE AMERICAS

Before the arrival of Europeans in 1492, vast areas of the Americas were farmed intensively. The steep mountain slopes in the Andean region of Ecuador, Peru, Bolivia and Chile include remains of possibly tens of thousands of square kilometers of irrigated and nonirrigated terraces (Donkin 1979). In Peru alone, there are between 500,000 and 1 million hectares of terraces, of which 50 to 75 percent now lie abandoned (Treacy and Denevan 1994; Masson 1986). Raised fields (discussed below) cover large areas of the Llanos of Venezuela, Rio San Jorge Basin in Colombia, the Rio Guayas basin in Ecuador, the Llanos de Moxos in Bolivia, highland Ecuador and Colombia, and the Lake Titicaca Basin of Peru (Parsons and Denevan 1967; Denevan 1970, 1983). There is now evidence that the Maya Civilization, once believed to have been supported by slash and bum agriculture, was based on sophisticated combinations of construction of terraces, artificial reservoirs, raised fields and elaborate agroforestry practices (Harrison and Turner 1978; Killion 1992; Fedick 1996). A conservative estimate for the area in Latin America covered by ancient raised fields is 1,000 square kilometers (Denevan 1982). On the north coast of Peru, vast networks of prehistoric irrigation canals channeled water over an area 20 to 40 percent larger than that cultivated today (Moseley 1983). Archaeological studies of many of these agricultural remains have provided a basis for understanding the origins, evolution, and abandonment of once productive farm-



Raised field platforms (10 meters wide) planted in potatoes and water-filled canals during the rainy season in Huatta, Peru. The water can be used for irrigation, for the production and capture of nutrients, for aquaculture, and/or for improved crop microclimate through the capture of solar radiation.

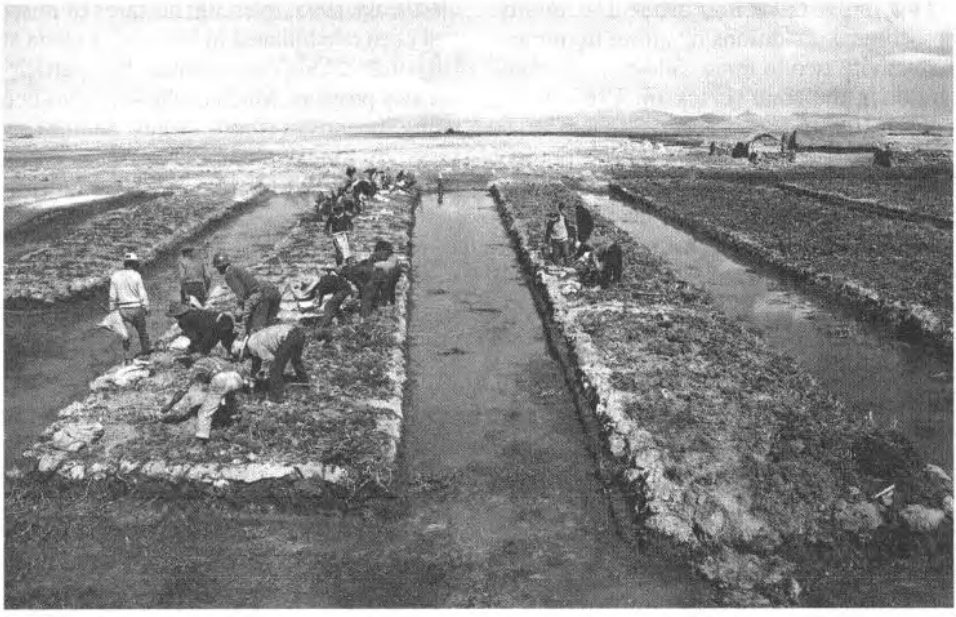
ing strategies (e.g., Erickson 1996; Mosely 1983; Turner and Harrison 1983).

Unfortunately, much of the research on past agricultural systems remains at a descriptive and analytical level, with little emphasis given to potential application of this knowledge to contemporary situations. Ironically, Peru and Bolivia, the countries with the most impressive abandoned remains of prehistoric intensive land use and modification, now have some of the worst problems of poverty and underdevelopment in the Americas. Applied archaeological investigation of these once productive landscapes could provide viable alternatives for contemporary rural development.

APPLIED ARCHAEOLOGY: A CASE STUDY FROM PERU

Located at 12,500 feet in the Andean Highlands, the Lake Titicaca Basin of southern Peru and northern Bolivia is a difficult environment for farming. Frequent frosts and hailstorms, irregular rainfall resulting in serious droughts and flooding, high altitude, and generally poor soils characterize this zone. Despite these environmental limitations to agriculture, the area supported dense and well-organized populations before the Spanish conquest.

The Lake Titicaca Basin is one of the most massively human-modified landscapes in the Americas where hundreds of square kilometers of terraces and raised fields were constructed. Raised fields are large elevated planting platforms designed to improve soil fertility, to provide drainage, and to improve microclimates. The adjoining canals excavated during construction conserve water for irrigation, produce "green manure" that can be placed on the fields as an organic muck for soil fertility, store heat against radiation frosts, and may have been used for raising fish and economically useful aquatic plants (Denevan and Turner 1974; Erickson 1985, 1992). As a system, the raised fields demonstrate hydraulic sophistication in the management of water resources (Lennon 1983; Kolata 1993). Some 82,000 ha. of surface remains have been documented for the basin (Smith et al. 1968).



Farmers of Huatta harvesting potatoes on community raised fields. Potato yields here were two to three times that of traditional potato fields in the community.

Soil up to two meters in depth was disturbed by prehistoric farmers to construct the raised field platforms and canals.

Our raised field research was conducted between 1981 and 1986 in the Quechua-speaking community of Huatta (Brinkmeier 1986; Erickson 1995, 1996; Erickson and Candler 1989; Garaycochea 1987, 1987). Huatta is located in southern Peru on the flat seasonally inundated plains surrounding Lake Titicaca at 3,800 meters above sea level. The Raised Field Agricultural Project combined archaeological reconnaissance, excavation of raised fields and associated occupation sites, agronomic studies, and agricultural experiments using reconstructed raised fields (Erickson 1994). The research design was directed towards investigating (1) the social organization necessary for the construction and maintenance of prehistoric raised field agriculture, (2) the overall efficiency (labor input and production output) of the fields, (3) the functions of raised fields, (4) the origins, evolution, and abandonment of the raised fields, and (5) the potential role that raised field technology could have in contemporary rural development.

The importance of archaeological techniques in understanding prehistoric agriculture technology is demonstrated in the reconstruction of raised fields for experimental purposes. Reconstructions had to be based on the prehistoric models because the system has been completely abandoned. Soil profile data on the original morphology and construction stages were used to guide the reconstruction.

Labor for the reconstruction of raised fields for experimental purposes was provided by Quechua farmers using the local traditional tools (Andean footplow, hoe, clod breaker, and carrying cloths). In exchange for potato seed and the harvest, several communities in Huatta offered unused communal land and their labor to construct large blocks of fields to expand the experiments. With the initial success of the small-scale experimental fields, the program was expanded to include other Quechua communities in the area.

The results were encouraging and demonstrated the feasibility of the reintroduction of raised field farming in indigenous communities of the Lake Titicaca Basin. Archaeological investigation showed that raised field farming has an extremely long and complex history extending back some 3,000 years (Erickson 1987, 1996). Our experiments docu-

mented how raised fields improve soil, humidity, and microclimate conditions resulting in impressive productivity two to three times that of traditional fields in the zone (Erickson 1985, 1996; Garaycochea 1987).

One major criticism leveled by development agencies at the proposed reuse of many prehistoric agricultural systems in the Americas is that the labor costs are too high and that complex social organization including centralization and administrative hierarchies are necessary. Unfortunately, archaeologists and geographers have done much to reinforce this idea by wholeheartedly adopting the model of Ester Boserup on agricultural intensification and a revival of certain aspects of Karl Wittfogel's ideas on the need for centralization in complex irrigation systems and other intensive forms of agriculture such as raised fields and terraces (e.g. Kolata 1993; Harrison and Turner 197X; Farrington 1985; Darch 1983) This may be a major misunderstanding of past agricultural systems.

In our raised field experiments we demonstrated that over the long run, raised field farming is actually very efficient (Erickson 1985, 1996; Garaycochea 1986, 1987; Erickson and Candler 1989). The long-term benefits of high continuous productivity and low maintenance easily offset labor input. Another surprising find was that raised fields do not necessarily require centralization or administration. Local communal landholding groups of farmers such as the traditional Andean ayllu and even individual farm families can effectively mobilize the necessary labor and organization and appear to have also done so in the past (Erickson 1993, 1996).

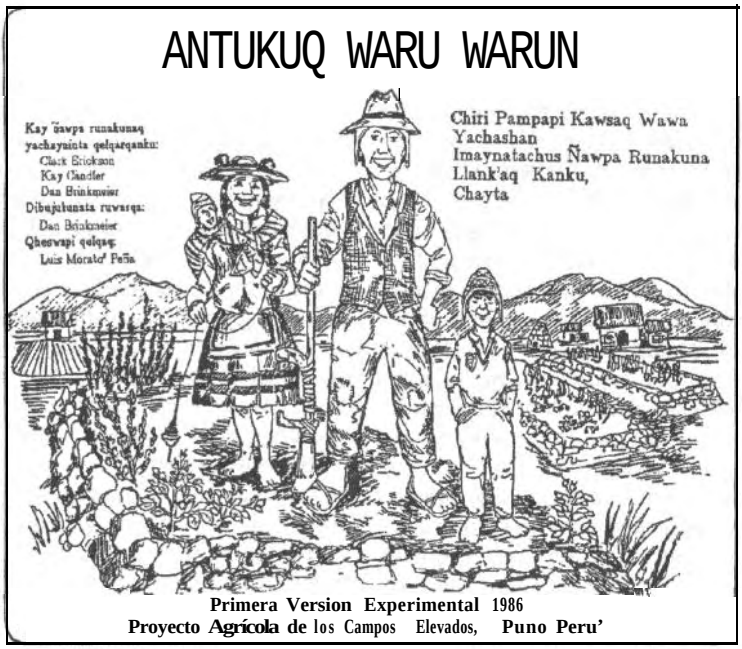
The present situation in Huatta and nearby communities is very favorable to the rapid adoption of raised field technology. The plains have remained little used except for limited grazing since the fields were abandoned. These marginal lands with little potential, once part of haciendas and later a failed government cooperative, were recently turned over to indigenous communities which have begun successfully to exploit them using raised field technology. This is the only means to use this land intensively without major capital investment. The positive response to raised field technology is not only at the community level. Many individual farmers who learned the technology by participating in the communal groups have transferred this knowledge to their private fields (Erickson and Candler 1989). By 1995, over 300 hectares of raised fields had been rehabilitated in Peru and Bolivia and over fifty indigenous communities had participated in various projects. Much of the work has been done using incentives (food, wages, and/or seed) provided by the development agencies and it is not certain what will happen if these incentives are withdrawn.

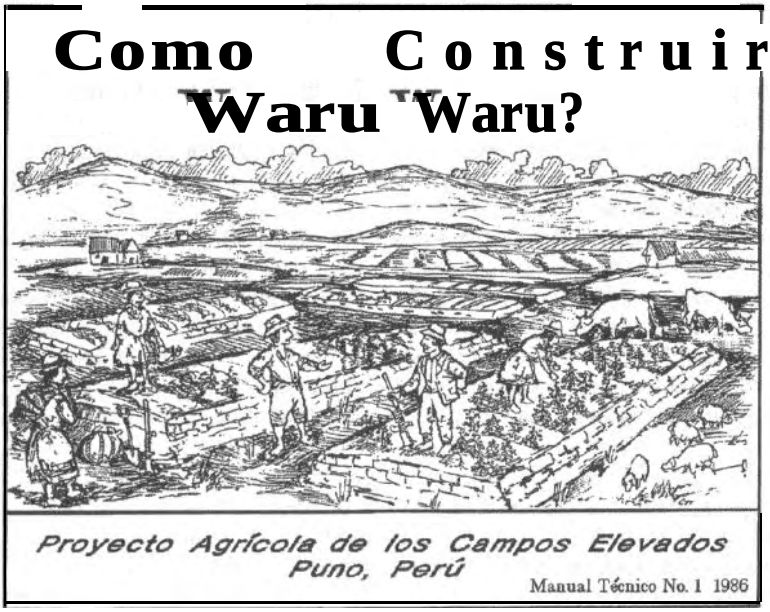
POTENTIAL APPLICATION OF RAISED FIELD TECHNOLOGY

How generally applicable is raised field technology to rural development? Raised fields are only effective in areas of permanent wetlands or seasonal inundation. Socioeconomic and political factors will vary in areas of potential application and must be considered in their context. In addition, there is no one single model of raised field that will work in all cases. The remains of raised fields (and some still functioning such as in New Guinea, China, and Africa) have been found throughout the world (Farrington 1985; Denevan and Turner 1974; Denevan 1970, 1982), indicating that the use of raised fields was a common response by small farmers to many wetland and seasonally inundated savanna environments. Are raised fields and other indigenous forms of past and present agriculture the panacea for all development problems? Certainly not, and I am not suggesting that raised field technology can be applied to every wetland situation in the world, or even the Andean region. We have noted above and elsewhere (Erickson and Candler 1989) that the social, political, and economic situation has (inevitably) changed considerably since the Spanish conquest and in many cases the local indigenous infrastructure (traditional land tenure, original crops, tools, social organization, and sectorial fallow systems) necessary for raised field agriculture is gone.

APPLIED ARCHAEOLOGY: ADDITIONAL CASE STUDIES

The rehabilitation of raised fields in Huatta is a case study of applied archaeology and the potential that archaeological methodology can contribute to rural development. Archaeological approaches to other





Covers of two agricultural extension booklets used by the Raised Field Agricultural Project to train local farmers in raised field agricultural technology (drawings are by Dan Brinkmeier). These manuals were used with a video program in the Quechua language.

abandoned agricultural landscapes have also shown potential. Three cases are summarized below.

Andean Terracing: The remains of ancient terracing ***(andenes)*** can be found throughout the Andean region, especially in Central and Southern Peru and Bolivia. In many places, these terraces extend continuously from valley bottom to the high peaks of mountains. Recent archaeological and geographical research in highland Peru (Treacy and Denevan 1994, Treacy 1989) has suggested that terrace rehabilitation may be possible where abandoned remains are found. Between 1981-1987, strong interest in terrace rehabilitation was demonstrated by the Peruvian government and various nongovernment organizations. Impressive reconstruction projects were plannedwith hopes of eventually putting all abandoned terraces back into use and also applying this technology to nonterraced slopes. Government ministries even competed with each other for community participation. Unfortunately little, if any, of the construction of terraces was based on archaeological or agronomic information. At first, the model for terrace construction and reconstruction was that developed by United States Soil Conservation Service and applied to Central America by the USAID more than two decades ago. The projects, although apparently suecessful in some situations, were fraught with social, economic, and political problems (Gelles 1988; Treacy 1989). The use of detailed archaeological and agronomic studies of the terraces such as those conducted by Denevan and colleagues for the Colca Valley, combined with long-term agronomic experimental studies could have prevented some of the problems facing terrace reconstruction projects (Treacy and Denevan 1994). Terracing probably has much potential in the Andes, it will just need more archaeological investigation to develop adequate models for reconstruction.

Chinampa Agriculture: Chinampas, a form of raised field agriculture, provided a major portion of the food production for sustaining the large Aztec urban center and capital of Tenochtitlan. Similar raised fields are now believed to have provided much of the support for the densely populated urban centers in the Maya lowlands (Harrison and Turner 1978; Turner and Harrison 1983). The state govemment of Tabasco, Mexico, attempted to implement a chinampa program in the late 1970s in the wetlands near Villahermosa (Gomez Pompa et al. 1982; Denevan 1982). This program, the Camellones Chontales Project, was declared a failure, despite high praise and positive publicity, and near mythical status. Continuous crop failures, high costs, lack of markets for the crops produced, and discontent with communal labor organization has been pointed to as the causes of this failure (Chapin 1988). Many of the technical problems were due to the short-sighted approach the government used (e.g., heavy machinery, which dug canals too deeply into the lake sediments, placing sterile subsoil on the raised field platforms). Many of these problems could have been avoided if archaeologists had been consulted on the project. Little of the knowledge of the contemporary chinampa farmers of Mexico was used in the construction and planning, nor was any of the archaeological information collected during years of excavations in prehistoric raised fields used. As an afternote, the local Chontales Maya made the ***chinampas*** highly productive after the government abandoned the project and they are requesting that more be constructed. Other ***chinampa*** projects throughout Mexico have been successful as agronomic experiments, but few have had positive impact for rural development (Gomez-Pompa 1988; Chapin 1988).

Desert Farming in the Negev: The classic example of archaeology's successful contribution to rural development is the Negev project in Israel in the 1960s directed by Michael Evenari (Evenari et al. 1971). Here, archeologists, working closely with agronomists, ecologists, botanists, and hydrologists, were successful in applying information gained from the detailed study of the prehistoric remains of structures that were used to collect runoff after infrequent rains. The discovery of ruins of farmsteads and larger settlements with associated agricultural features in the inhospitable desert had long been an enigma for Israelis. Archaeological investigation of these remains, combined with the experimental reconstruction of several farms based on the archaeological information, provided the foundation for the development program. The success of this applied archaeology project demonstrated that development of the desert is possible using the knowledge available to the prehistoric inhabitants of the area.

APPLIED ARCHAEOLOGY: WHAT CAN BE DONE?

The failure of development projects to consider past land use is common for Ecuador, Peru, and Bolivia. Prehistoric terraces, irrigation canals, and raised fields are ignored as if they do not exist. Although the modest raised field rehabilitation project has been successful in relatively small areas around Lake Titicaca, each year thousands of raised fields are plowed under by tractors for monocropping, or bulldozed away for roads, bridges, causeways, and housing. What is remarkable about this destruction of potentially useful archaeological resources is that the policies of the Peruvian and Bolivian governments and international development agencies are responsible for much of this destruction. Examples include the USAID-sponsored irrigation project and the projects of the National Agrarian University and the Ministry of Agriculture to introduce capital intensive agriculture to Illpa, near Huatta. These projects have resulted in the destruction of large areas of prehistoric raised fields (Erickson and Candler 1989).

Capital-intensive agricultural systems, especially the crops used in such systems, have received a disproportionate amount of the research funds, whereas thousands of potentially important food crops go unstudied. We know very little about non-Western systems (precise figures of yields, efficiency, input-output, production, and sustainability) which makes it nearly impossible to compare them to modern Western systems. Agronomists often declare that traditional systems are not as efficient as modem systems, but we have so little data (especially in the long term) for comparison. Experimentation based on archaeological models derived from ancient field forms may provide viable alternatives to introduced, nonlocal systems.

What can be done to remedy the situation? Archaeologists should be included in development planning as regular consultants. The training of archaeology students in developing countries for archaeological investigation of prehistoric agricultural systems is critical. What is drastically needed is increased funding for archaeology student training and projects investigating non-Westem traditional and prehistoric agricultural systems. Many of the projects, such as mapping, documentation, and basic description of past land-use systerns, could be done without huge funding. Archaeology could play a part, just as cultural anthropologists play a critical role in the planning and evaluation of today's development projects.

CONCLUSIONS: THE FUTURE OF ARCHAEOLOGY IN DEVELOPMENT

Archaeology has traditionally had the problem of not being considered very relevant, with at best an indirect application (Ford 1973). Throughout the 1960s and 1970s the "lawlike generalizations of human behavior" were regarded by many as our most important contribution to the larger world (Watson et al. 1984 and others). Now, such claims are rarely heard and statements are much more modest. Recent articles speculating on the future of archaeology have stressed the importance of conservation of archaeological resources, use of Darwinian and sociobiological evolutionary models, and the adoption of new rigorous methods and technologies for more precise data collection, especially using the recent advances in remote sensing and computer hardware and software (Fagan 1989; Nash and Whitlam 1985). If archaeology is to continue to be funded at an adequate level in the future, I suggest that we may have to demonstrate a more direct, practical application. One important contribution of archaeology is that our methods can be applied to understanding long-term landscape use, which may have implications for rural development and understanding the history of local environments. I also suggest that development agencies and planners use archaeological insight on past land use. Most areas of the underdeveloped world show evidence of previous, long-term, successful use of the land by humans, often taking the form of massive transformations of the earth through terracing, irrigation, and raised fields. Before imposing capital-intensive systems or "appropriate technology" developed in and for the Western agricultural context, development organizations should seriously consider indigenous alternatives. Archaeological techniques can provide critical information on the stmcture and functioning of these ancient farming systems.

Time is running out for archaeologists, agronomists, geographers, and developers as many agri-

cultural technologies with potential for rural development are being lost. Many functioning traditional systems are marginalized or have been eradicated by the introduction of capital-based systems. Ancient and traditional landscapes are rapidly disappearing under the plow or are being replaced with monocropping and mechanized agriculture. As a result, once-productive rural populations are being displaced, causing massive migrations to urban areas. Genetic erosion of local races of important crops is severe in such areas. Many of the traditional social institutions that organized labor exchange, controlled crop fallowing cycles, and provided access to community land are disappearing.

What is being argued here is not a naive romantic "return to the past," but a plea for the need to investigate and experiment with past agricultural systems as potentially viable alternative models for rural development.

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