# Pre-Columbian Agriculture

**Maya Subsistence.** Studies in Memory of Dennis E. Puleston. Papers from a conference, Minneapolis, Oct. 1979. KENT V. FLANNERY, Ed. Academic Press, New York, 1982. xxii, 372 pp., illus. $34.50. Studies in Archaeology.

The contributions of this volume are papers delivered at a memorial conference held in honor of the late Dennis E. Puleston, a charismatic and inventive student of Maya prehistory. Also included are an obituary by G. R. Willey, and, as appendixes, a tribute by F. C. Miller and Puleston's final thoughts on the ramón thesis (discussed below).

The volume may be viewed as representing a stage in the development and maturation of the study of ancient Maya subsistence. The 1970's witnessed a major shift in perspective as the Maya came to be regarded as a densely settled populace supported by multiple types of agriculture and other means of food procurement, many of which were intensive. The initial data on which this perspective is founded have been enlarged by various means: application of new kinds of research; recombing of the ethnohistoric literature; recovery of remains of cultivars; expanded field studies of agricultural relics; examination of erosion and nutrient sequestering in lowland basins; and so forth. On the evidence of this volume the 1980's promise to be a time in which the new perspective is expanded, refined, and challenged.

Aspects of Maya use of wetlands for agriculture by channelization and field raising are discussed by a number of the contributors. D. A. Friedel and V. Scarborough document the existence of a Preclassic canal and a set of associated fields at Cerros, Belize. P. D. Harrison notes the location of Maya sites in southern Quintana Roo, Mexico, in relation to wetlands and introduces his study of Maya sites adjacent to the wetland fields at Pulltrouser Swamp, Belize. R. T. Matheny, W. M. Denevan, and A. Gómez-Pompa and colleagues contribute, respectively, a recapitulation of lowland and highland Maya water works, a comparison of pre-Hispanic wetland cultivation in the New World, and an evaluation of experimental raised-field agriculture in Mexico. Each study provides a measure of support for the view that traditional wetland agriculture involving channelization and field-raising typically involves high levels of labor input. A. H. Siemens's reflections on ancient Maya wetland cultivation in northern Belize do not discount the high-input theme, but he is reluctant to issue generalizations about functions and input-output attributes given the variety of field types that exist and the number of habitats in which they occur. P. P. Antoine and associates provide chemical and textural analysis of soils from two wetland fields at Albion Island, Belize, one of which had been interpreted originally as having been raised by the addition of a marl base. Their evidence demonstrates no such base, and they infer that the fields are probably channelized.

Subsequent work in Belize and elsewhere suggests that Maya wetland fields were raised and channelized, depending on the specifics of the locale in which they were used. Moreover, modern analogies indicate that traditional farmers do not haul excavated canal material away but typically incorporate it into the field. This mode of construction does not appear to conflict with the results of the soil tests for the Albion Island fields. The key issue seems to be the degree to which the fields were raised by this procedure, which is most likely related to the depth of the canals and the composition of the material into which they were cut. The issues of function and labor input may be clarified by various ongoing studies in the Maya area.

P. D. Sheets discusses his remarkable find of prehistoric Maya farmsteads, complete with intact field ridges and carbonized maize, preserved by volcanic ash at Cerén, El Salvador. He notes that the so-called "highland" Maya ruins in the southeast area are situated in a transitional zone between the lowlands and highlands and that this zone may have greater ecological affinities with the lowlands than have been proposed. The implications are that the field type found at Cerén may have been (indeed it was) suitable for the lowland Maya core zone and may have been used there (most likely). The larger issue of the ecological zonation of Maya sites in the southeast area deserves close scrutiny.

G. D. Jones offers assessments of colonial trading in the southern (more correctly central) lowlands. He calls attention to the documented presence of short-fallow cultivation and arboriculture in the area in the 16th century. The evidence is mounting that orchard-garden type foods contributed handsomely to Maya subsistence. Jones also directs us to early Hispanic references to possible raised-field cultivation along the southwestern edge of Lake Petén and to double cropping in the savannas south of the lake. These systems were most likely pale reflections of those present during the 9th century A.D.

M. Pohl and L. H. Feldman marshal a variety of evidence to demonstrate the role of women in food and other production from Late Classic times to the colonial era. This work is followed by a modern assessment of Maya women and livestock production in northern Belize by M. M. Nimis. Such studies are extremely limited with regard to the Maya and reveal that women have played an important, direct role in livestock production.

W. T. Sanders and C. N. Murdy provide two interesting propositions in their examination of the settlement sequence and cultural evolution in the Valley of Guatemala. Disregarded is the "romantic" view of the traditional (and hence the Maya) farmer as a conservationist interested in long-term ecological stability. Rather, farmers are viewed as operating within short-term economic frameworks. In addition, soil erosion is considered to be a long-term process of the kind that farmers may not recognize. Terracing (presumably everywhere) is thus seen as a response not to soil erosion but to short-term factors, such as runoff. The apparent lack of Maya terraces in the Valley is offered as evidence supporting the argument.

The rationale for implementing terracing is complex, as indicated by comparative works on traditional terracing in the Old and New Worlds, and probably not reducible to a single environmental constraint. Studies suggest that, given sufficient time, farmers can and do recognize soil erosion and have responded by use of terraces. The early detection of soil erosion is related to the rate of soil loss and its impact on cultivation, and whether terracing is used to impede this loss is largely related to the economics of the circumstance. The conclusion that the absence of terraces in the Valley supports the non-association of terracing and soil erosion thus must be viewed with caution.

B. Voorhies integrates ecological and trading themes on Maya cultural evolution into a model of cultural evolution. She lists over 225 tropical flora and fauna

that occur in the lowlands, that may have been in demand by highlanders, and that were transportable. J. Marcus documents numerous aspects of Maya agriculture and cultivation practices that can be found in the literature of the colonial period. She concludes that the oldest and most ecologically stable types of cultivation have persisted in the lowlands while the intensive types collapsed, apparently with the Classic civilization (around A.D. 900 to 1000). The implications here are complex. We do not know if the cultural collapse was a product of a subsistence system pushed to its technological limits. Few modern analogies, if any, can be found. Moreover, strong support exists for the thesis that agriculture is largely responsive to demands on production (interacting with other variables); the absence in colonial times of the highly intensive systems may simply reflect the tremendous decline in demand created by the collapse and population reduction some 600 to 700 years before the Spanish conquest. Finally, some intensive systems did persist into colonial times where population concentrations existed, as is demonstrated in the contribution by Friedel and Scarborough.

A comment on Puleston's evaluation of his provocative ramón thesis is a fitting end to this review. Puleston proposed that the concentration of population at the great site of Tikal, Guatemala, could be explained by a major reliance on the harvest of ramón (the fruit of *Brosimum alicastrum*) and its storage in special underground chambers (*chultuns*). Though few researchers doubt that the ancient Maya used ramón, numerous arguments have been raised against the proposition that it was a major staple, including ethnohistoric evidence that it was considered a famine food by the Maya. Most of the direct evidence pertinent to the thesis has been unveiled since Puleston's death. Ecological studies suggest that ramón concentrations around ruins are an edaphic response and that the species shows no signs of genetic manipulation by people. Archival studies have uncovered references to cured maize stored in *chultun*-like features. And recovery of carbonized plant remains from *chultuns* has revealed several foods, but not ramón. However, the legacy of the thesis is not its validity but its inventiveness and the research it stimulated.

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"Splash irrigation (using gourds) of a garlic crop on *tablones* at Aguacatán in highland Guatemala. The *tablones* are raised planting beds separated by ditches, which serve for both drainage and irrigation. Note the pile of crop residue in the foreground, which will be used for fertilizer. October 1974." [Photograph by Kent Mathewson. From W. M. Denevan's paper in *Maya Subsistence*]

## A Problem in Unification

**Quantum Gravity 2.** A Second Oxford Symposium. April 1980. C. J. ISHAM, R. PENROSE, and D. W. SCIAMA, Eds. Clarendon (Oxford University Press), New York, 1981. xiv, 670 pp. $39.95.

Of the fundamental forces (strong, electromagnetic, weak, and gravitational), the one that most steadfastly resists attempts to join it with the others in a unified description is gravity. The failure to include gravity is all the more tantalizing because it means that deep and as yet unexpected connections will be uncovered when unification is achieved. A major impediment to unification is the lack of a completely satisfactory quantum theory of gravity. Recent years have seen a flurry of activity as physicists working in relativity and in particle theory have converged on this key problem. A sampling of the progress made is provided by this Oxford symposium.

The book opens with a clear and remarkably comprehensive survey by Isham of the entire subject of quantum gravity. The other papers are grouped by topic: semiclassical theory, thermodynamics and quantum gravity, cosmology