Typological Schemes and Agricultural Change: Beyond Boserup in Precolonial South India [and Comments and Reply]
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Typological Schemes and Agricultural Change

Beyond Boserup in Precolonial South India[1]

by Kathleen D. Morrison

Anthropological conceptions of the nature and course of agricultural change have been strongly influenced by the seminal work of Ester Boserup. In this paper I suggest that the Boserup model is best viewed as one example of a unilineal and universalizing cultural-evolutionary stage typology. As such it evinces many of the same weaknesses as other neoevolutionary schemes that purport to describe change in sets of linked cultural, technological, and organizational attributes. At the heart of the Boserup model is a set of propositions about the nature of economic organization and of change, propositions that find expression in a series of quasi-historical stages that falsely sequentialize modal agricultural strategies. I argue, however, that diversity and variability are critical aspects of both the structure of agricultural production and the process of agricultural intensification. The utility of this model and its constructed sequence of change is considered in light of a case study from late precolonial southern India. In this analysis, archaeological, historical, and palaeobotanical data from the area surrounding the city of Vijayanagara suggest that multiple strategies of agricultural production were pursued simultaneously and, further, that the course of change was itself complex, incorporating diverse scales and forms of production differentially employed by producers at all levels of society.

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Agricultural landscapes are human creations, apprehended through culturally constructed perceptions and practices and, in part, physically constructed through intentional and unintentional human modifications of the natural environment. The physical and cultural landscape of agriculture is a transformed environment that, moreover, is constantly remade as strategies of agricultural production change through time. It is also an environment in which context matters. Notwithstanding the powers of human perception or human effort, success in agriculture depends on the maturation or reproduction of taxa supremely indifferent to human concerns, and the practice of agriculture illustrates well that humans cannot construct this landscape any way they choose. It may follow, then, that analyses of change in agricultural production must encompass both what I refer to here as the contextual aspects of this production, which include considerations of climate, vegetation, soils, and hydrology, and its organizational or strategic aspects.

This paper focuses on processual aspects of change in agricultural organization in the context of one particular trajectory of agricultural intensification in southern India. I suggest that an understanding of process requires both specification of variables and more contextual considerations of the specific paths or courses of change. Discussion of the course or courses rather than causes of change in agriculture may seem an unlikely topic. One reason for this may be that, in the case of agricultural intensification, it might be assumed that the shape of change is already known; it is cause that remains hotly contested. Considerable disagreement persists regarding the factors underlying intensification—whether they are primarily related to demography (Boserup 1965, 1981; Brown and Podolefsky 1976; Cohen 1977; Johnson and Earle 1987; Netting 1993; Turner, Hanham, and Portararo 1977), socially generated demands for produce (Bender 1981, 1985; Gilman 1981, 1991; Kirch 1992), market forces (Grigg 1982; Bronson 1975; and see Netting 1933:288–94), risk aversion (Nichols 1987, Halstead 1989), or some other single cause or constellation of causes (cf. Morrison 1994*a*). While such issues still generate debate, concern with process may appear more pedestrian. As I suggest here, however, understanding of process may be the most fruitful way to understand "cause" in a realistic way. We are still very far from an understanding of the long-term history of agriculture.

In this paper I argue that anthropological and, specifically, archaeological analyses of the long-term history of agriculture have been hampered by their adherence to rigid typological contructions of stepwise cultural

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evolution that define away diversity and variability at all analytical levels. These constructions include not only neoevolutionary models such as those of Service (1971, 1975), which have already come under heavy criticism (e.g., Yoffee 1993, Dunnell 1980, Feinman and Neitzel 1984), but also models such as that of Boserup (1965, 1970, 1981, 1990) that, at first sight, appear to make more modest claims. Far from simply describing the conditions of agricultural growth, however, Boserup offers a totalizing neoevolutionary program that differs in content but not in form from similar constructions. Archaeological adoption of this view has had the effect of drawing research away from the analysis of process, focusing concern instead on the application of definitions.

In considering Boserup's formulation of agricultural intensification, it is not my intention to minimize the historical importance of her work. However, it is indeed my argument that the view of economies and how they change that is presented in her work is fundamentally flawed and misleads rather than inspires anthropological investigation. The degree to which the Boserup perspective is internalized in current research, especially in archaeology, may not be immediately apparent. This is particularly the case because what is sometimes seen as the "essence" of that perspective—population driving intensification—is not a view popular among anthropologists generally. I suggest in this paper however, that there is a great deal more to Boserup than simply this famous causal pair, and, indeed, I am not concerned to address this proposed relationship here (cf. Morrison 1994*a*). Instead, I draw attention to the structural similarities between Boserup's work on intensification and other typological schemes of progressive cultural evolution, arguing that her work is no simple argument to developers and planners but one more example of a progressive, stepwise classification of cultural types based on the substitution of space for time. Our contemporary ancestors are now swidden farmers. To put it even more bluntly, I would suggest that Boserup has created a pseudo-historical sequence by (I argue, falsely) generalizing modal economies and placing them into stages of her own devising. The structure of this worldview compares closely with other such attempts—savagery to civilization, primitive modes of production to socialist, bands to states. The construction of this sequence, from long fallow to annual cropping, is essential to Boserup's model and flows logically from its premises. Without the sequence there is no model. Given that Boserup's worldview mirrors in structure other cultural-evolutionary schemes, it becomes a little clearer why it has clung to life, especially among archaeologists who have a fondness for such progressions. If, then, the constructed progression of change in the Boserup model is based not on analyses of change through time (and not even on generalizations from actual historical progressions) but on the arrangement of contemporary peoples into an evolutionary scheme, it seems worthwhile to consider evaluating this proposal against what we know about the past. After all, it matters little how Boserup's scheme was devised if it proves to be correct and useful.

Measuring Intensity and Monitoring Intensification

If we are to avoid a definitional view of agricultural change that merely stipulates a priori how the shape or trajectory of change will appear, it then becomes necessary to consider more closely how intensification proceeds. This concern requires further that we consider how intensification is to be measured. The lack of common measurement criteria relates in part to the different data sets of scholars involved in the project. The possibilities open to the ethnographer or agronomist are different from those of the archaeologist or historian. Differences are deeper than this, however, and follow from more fundamental disagreement about what exactly intensification is (see Morrison 1994*a* for an extended discussion of this point).

The most influential specification of degrees of intensification has been that of Boserup (1965, 1981, 1990), who characterized agricultural intensity in terms of fallow length.[2] This measure had the admirable effect of bringing diverse production strategies, from the then putatively "primitive" ones such as tropical swidden to "modern" Western industrial agriculture, into a single analytical scheme. Unfortunately, the use of cropping frequency as a measure of intensity, however compelling in terms of great sweeps of time and space, seriously misrepresents the organization of actual agricultural strategies and of their change through time. Agriculturalists incorporate a significant measure of diversity into strategies of production (cf. Colson 1979, Netting 1993), diversity that is not strictly temporal and is not captured in this single variable (Morrison 1995).

In fact, anthropologists have good reason to believe that the internal diversity of economies is a fundamental part of how they work and that, contrary to what Boserup suggests, this diversity is normal and not the artificial product of seeing a course of change only partly realized. This state of affairs may have implications for other typological schemes as well. If internal diversity of economic strategies is typical, then what are we to make of the quasi-historical sequence Boserup proposes? If presumably "early" (could one even say less developed?) strategies such as long fallow are routinely a part

2. Measures of intensity other than fallow length have also been employed. For example, Kates, Hyden, and Turner (1993*a*:10) write: "The measure of agricultural intensification has taken on a rather precise meaning as the total production per unit of area and time (typically per hectare and year). Its obvious measure, therefore, should be that of total output. Owing to several complications and to the paucity of data at the local level, surrogate measures are commonly employed. The most common two are the frequency of cultivation and the type and number of agrotechnologies." Measuring intensity as total output has the practical effect of characterizing all efforts at intensification as "successful"; only higher output is defined as being intensification, and "failed" attempts to intensify are simply defined out of existence. Output turns out to be difficult to measure, however; Kates, Hyden, and Turner (1993*a*:12) note "the multiplicity of products, times, and conversion measures." The frequency of cultivation and technology ratios (assumed to be correlated) are then substituted as measures of intensity (or "intensification" in their terms).

of, for example, very intensive systems, then how can the sequence be considered credible? Boserup (1965:56–59) has suggested that when we observe a single economy in which there occur multiple forms of cropping, this diversity is really false and what is actually at work is a process of change from one kind of cropping to another that is simply not yet complete. If this diversity is consistently observed, however, and if farming "types" are consistently "mixed," it is equally plausible that the proposed progression is incorrect. This could, of course, be evaluated by considering actual trajectories of change.

Decision making by individual and apparently autonomous production units lies at the dynamic core of the Boserup model (and see Netting 1993:10–11). The scale of analysis, however, seems to vary from "ethnic" or linguistic groups to entire nation-states (Boserup 1965, 1981). This looseness of analytical scale constitutes a serious problem. On the one hand, decision making, particularly decision making that impinges on agricultural organization, takes places at a number of levels or scales simultaneously (Barlett 1980), and these decisions are not always in accord or even always conscious. The conflation of large clusters of classes, castes, and/or concerns into ethnic, linguistic, or political categories of intensity seems patently absurd in light of the internal diversity and flexibility of agricultural strategies documented by anthropologists. In the following analysis, I suggest that the opportunities open to different producers and their strategies, even in one small region over a relatively short time, varied widely. The "cases" in Boserup's analysis (e.g., 1981:214) include such entities as nation-states and language-groups—entities with either no corporate existence at all or none at the level of agricultural decision making. Is this simply a necessary generalization? Two factors are important here. First of all, the Boserup model *itself* is predicated on the supposition of rational economic actors or decision makers. The power of her account is that it brings the apparently "irrational" behavior of Third World agriculturalists into the fold of neoclassical economics; it "rationalizes" their farming strategies in ways that economists have found appropriate. If, however, the units of analysis have no decision-making potential, then this seems to constitute a serious analytical problem.

Further, Boserup's unilineal scheme of gradually decreasing fallow length is not empirically valid in many cases, and this slippage between model and application is itself significantly linked to the ecological conditions of specific cultigens and to sociopolitical contexts of crop production. Context does matter. Although Boserup appears to insulate herself against criticism by noting that counterexamples would not weaken the model (1965:17), in fact the lack of fit between her measure of intensity and our understandings of agricultural production constitutes a serious failing of the model, not least because the measure of fallow length is closely tied to the logic of cause.[3] Fallow reduction in the Boserup scheme constitutes a unilineal (if reversible) sequence that is part of an integrated package implicating a suite of other changes in technology, land tenure, gendered divisions of labor, and labor organization and productivity (Boserup 1965, 1970, 1981). In studies of long-term change, the influential Boserupian "measure" of intensity has also been employed to retrodict past agriculture, with "early" agriculture seen as *necessarily* long-fallow. Such retrodiction, again, has met with empirical resistance that not only embarrasses the model but also seriously calls into question its utility.

Why, then, the continued currency, particularly in archaeological circles, of the Boserup model of agricultural change and of the search for one or a few "prime movers" behind such change? Why have processual archaeologists devoted so little attention to process? I suggest that the answer is partly rooted in continued archaeological adherence to typological constructs and to the desire, if no longer to formulate general laws of human behavior (or "law-like generalizations") that transcend time and space, then to construct general "proclivities" of human behavior (e.g., based either on neoclassical economics or on biology) that are similarly decontextualized. Much of processual archaeology, it seems, is not fundamentally about process at all. Concern for process takes us into consideration of specific trajectories, into history. The challenge, then, is to construct historically informed analyses of change that do not deny regularities in human action and perhaps even in the construction of that action and yet recognize the contingent and transformative nature of change.

As I have suggested, the Boserup model is not simply a proposal about conditions of agricultural change but a totalizing perspective on social and economic transformation.[4] In common with other cultural-evolutionary schemes, it proposes sets of matched attributes that march together in virtual lockstep. As fallow periods decrease, technology, tenure, gendered labor relations, the productivity of labor, and the length of the working day all change in response. The archaeological appeal of such models is obvious, since painstakingly constructed inferences about one aspect of economic organization can then blossom into a full-blown picture of the past.

Like similar typological schemes, Boserup's model

3. That is, population growth (leads to pressure) leads to increased demand for produce in the dual context (given in the model) of the "law" of least effort (Boserup 1965, Zipf 1949) and the "law" of diminishing returns (see, e.g., Nakana 1980, Padoch 1985, Wadell 1972 for instances in which this "law" seems not to apply), and this forces agriculturalists to reduce fallow length. Fallow length, then, directly measures effort, given this chain of specification and the monolithic, single-strategy depiction of agricultural organization.

4. The conceptions of "growth" and "development" offered by Boserup highlight the apparent symmetry of this position with those of 19th-century evolutionists such as Morgan and Tyler. The declining productivity of agriculture does not in itself represent growth but can lead to "a genuine process of economic growth" (1965:118) through changes in work habits ("the intensification of agriculture may compel cultivators and agricultural laborers to work harder and more regularly" [1965:118]) and the spread of communication and education. Hence the "vicious circle of sparse population and primitive techniques" (1965:70) that keeps "primitives" from such "development."

was constructed through a substitution of space for time, creating "our contemporary ancestors" (Service 1971:6; cf. Sollas 1924, Yoffee 1993). Contemporary variation was inferred to represent stages of temporal progression. If, as I have suggested, the spatial analytical scale employed by Boserup (whole "societies") falsely homogenizes agricultural strategies in space, then their transposition to time also falsely homogenizes this view of change. The Boserup model, then, is simply one example of an entire class of evolutionary typological constructs. A closer examination bears out the structural similarity of other such schemes to the Boserup model. Proponents of bands, tribes, chiefdoms, and states eschew the notion of progress embedded in Morgan's savagery, barbarism, and civilization, replacing it with a more neutral conception of complexity (Dunnell 1980). The extent to which the consequences of change involve transformation rather than simple addition of new scales of integration or levels of complexity is, however, an open question. Are states, for example, just chiefdoms plus, or does social change imply fundamental structural reorganization at all levels? This concern is mirrored in the debate about the status of contemporary hunter-gatherers (e.g., Bird-David 1992, Lee and Guenther 1995, Wilmsen and Denbow 1990) living in or at the margins of nation-states. Can they be seen as representative of a normative hunting-and-gathering way of life, or are they in some sense products of contemporary socioeconomic structures as much as, for example, the urban poor? It may be fair to say that many archaeological conceptions of long-term history have stressed the additive rather than the transformative nature of change and have viewed human groups as pyramidal arrangements of varying numbers of building blocks in which subsistence strategies constitute the essence of each block and the complexity of the group can be easily measured in terms of the number of blocks in the pile. Hence the great interest in origins, or temporally defined points at which new blocks are introduced.

Notwithstanding this interest, and to draw out this metaphor even more, the "basic" elements of each block are seen as somehow enduring. This view is perhaps nowhere as evident as in the archaeology of South Asia, where, for example, the presence of contemporary people who hunt and gather has sometimes been seen as a continuation of deep tradition (e.g., Allchin and Allchin 1982, but see Fox 1969). Another South Asian example relates to the decline of the Harappan cities and the long hiatus between Harappan urbanism and the later "second urbanization" of the Gangetic plain (Erdosy 1988, Ghosh 1973). In this case, the abandonment of the Indus cities relates to a loss of complexity, the removal of the uppermost block from the pile. The lower blocks, however, endure unchanged, and what are seen as the more fundamental aspects of peasant agriculture continue more or less without modification.[5] Although the context of this view relates both to a continued adherence to typological conceptions of bands, tribes, chiefdoms, and states (caricatured as bigger and bigger piles of essentialist building blocks) and to colonial constructions of South Asian prehistory[6] (Morrison 1995), that is not my intention in raising these issues here.

Instead, I want to suggest that given our (albeit imperfect) perspective on long-term human history, archaeologists should be in an excellent position to evaluate such propositions about the nature of change. Further, I suggest that what we see in the specific record of specific times and places challenges this received view and instead reveals a past in which change has been historically contingent and in which such transitions as the appearance of cities and the intensification of agricultural production are actually transformative rather than merely additive in their consequences. That is, changing political, economic, and social relations in complex urban landscapes alter the opportunities of and constraints on producers in powerful ways. This transformation is not limited to humans; landscapes—soils, slopes, vegetation—are also transformed by human action, and this transformation creates new contexts for those who follow (cf. Lansing 1991). In some sense, those latter, physical transformations are the most accessible in the material record, although certainly they constitute only one aspect of any particular trajectory of change.[7] Concern for process and close understanding of specific instances of change need not, however, imply narrow particularism. Quite the contrary, it will be in the analysis of actual paths of change rather than in the abstracted isomorphic plains of our formal models that archaeologists will generate more realistic and powerful views of both how and why change occurs.

The Process of Intensification

The process of intensification is an integral aspect of the adoption of agriculture, the growth of cities, and changes from rural to industrial-based production. A general understanding of the process of intensification is critical, then, for developing and evaluating arguments about the human past, and, as suggested above, such a processual understanding must take into account actual courses or paths of change. The increasing demands on agricultural production prompted by growing populations, rising de-

5. The construction of South Asian villages as timeless, stable, isolated, and self-governing communities, "village republics," is certainly implicated here (see discussion by Krader 1975, Inden 1990, and Breckenridge and van der Veer 1993, among others).

6. The Boserup model, too, has some tendency to naturalize colonial experiences and to employ observations made in colonial contexts without explicit consideration of the effects of those contexts on the organization of production. For example, Boserup (1965:45–46; 1970) cites observations made by Richards about Bemba work schedules and gender roles in agriculture that fail to note the potential effect of demands for cash income and consequent male absenteeism (Moore and Vaughan 1994).

7. This sequence of transformation and contingency is of great importance for understanding trajectories of agricultural change. As Jane Guyer has put it (personal communication, 1995), steps taken at one point tend to "frame" the next set of possibilities—a phrasing that neatly conveys contingency without determination.

mands for surplus production, however generated, and particularly population aggregations such as cities have historically resulted in transformations in productive strategies designed to extract a greater amount of produce from a given quantity of land and/or labor. It is useful to draw a distinction between intensification and expansion, the difference being analogous to the difference between *concentration* and *amount*. In fact, agricultural change may involve both. Further, the process of intensification is itself quite diverse and can be broken down in a number of ways.

Archaeologists and others interested in long-term change have tended to view intensification, particularly of agriculture, as a unitary process, one which can be accounted for by one or a few simple causal factors. However, when we examine actual cases of productive intensification, we see that this apparently single process is actually composed of multiple strategies of production differentially employed by individuals and groups. In complex societies, in particular, it is incumbent upon archaeologists to recognize the differences in opportunity and the constraints acting on different individuals and groups and thus to admit the potential at least for a diversity of responses. What is represented, then, in the archaeological record is an aggregation of the results of those diverse responses, compressed in both time and space.

Diversity in the course of intensification can also be expected to follow from the historically contingent nature of agricultural land use; human transformations of the environment work to create new environments which confront later peoples. Given, then, that the apparently unitary process of intensification actually incorporates considerable diversity of strategies, it may be possible to organize these strategies,[8] in the terms of Kaiser and Voytek (1983), into *intensification proper*, *specialization*, and *diversification*. In agricultural production, intensification proper, the process by which the yield per unit of land and/or labor of an existing resource base is increased (Tringham and Krstić 1990), may take the form of increased investments in practices such as plowing, seed bed preparation, weeding, transplanting, manuring, or the construction of soil and water control facilities—certainly such facilities are the most archaeologically visible product of this strategy. Increased frequency of cropping may also be one strategy of intensification proper.

Specialization, the channeling of resources and/or labor into more restricted avenues, is a strategy commonly employed in complex societies and one which can be difficult to isolate from intensification proper, especially given the difficulty of archaeologically distinguishing the activities of specific households or other small-scale productive units. Certainly in the case of Vijayanagara, wet-rice agriculture can be viewed as a specialized strategy—it entails very specific and labor-intensive techniques of field preparation, irrigation, and drainage and promotes major modification of soil structure and of the landscape. Many aspects of specialization, however, may be more evident at the scale of landscapes than at that of producers.

Diversification is probably the least obvious aspect of productive intensification in that it may involve the addition or elaboration of productive strategies which seem to be *extensive* rather than *intensive* of land or labor. Strategies of diversification may, for example, include the coexistence of multiple fallowing regimes, the use of spatially fragmented field locations, extensive arrays of cultigens and wild taxa, maintenance of a range of crop varieties, staggered planting times, and integration of agricultural and nonagricultural activities. Strategies of diversification might not involve agricultural facilities at all, among them the forging of social or other ties and the creation of entitlements across regions (see Halstead 1989).

8. These categories should be considered heuristic devices only. They neither constitute mutually exclusive categories nor exhaust the possibilities for forms of organization.

Agricultural Intensification and Vijayanagara

The following sections sketch out some results of a program of research designed to investigate agricultural land use and settlement in the region surrounding the large, precolonial city of Vijayanagara, in southern India. Data are derived from the regional archaeological record, fossil pollen and charcoal, and historical documents. The results of this research suggest that the course of agricultural change during the Vijayanagara period was complex, involving both expansion and intensification. Further, the path of intensification was not uniform, moving from longer to shorter fallow periods or from simpler to more complex systems, but was internally diverse, involving intensification proper, specialization, and diversification. The process of agricultural change, then, involved the transformation—or creation—of an entire agricultural landscape, structured and defined by the changing configurations of settlements, agricultural facilities, temples, and roadways as well as by productive potential.

THE VIJAYANAGARA REGION

The city of Vijayanagara was the capital of an extensive empire of the same name which claimed hegemony over most of southern India between about A.D. 1300 and 1600 (fig. 1). The city itself may have contained several hundred thousand people at its height in the early 16th century (Stein 1980, 1989) and was heavily fortified, containing monumental temples, palaces, platforms, and other forms of elite architecture as well as extensive areas of settlement, markets, and systems of roads, paths, and bridges (Fritz, Michell, and Nagaraja Rao 1985, Filliozat and Filliozat 1988, Michell 1990).

Vijayanagara was situated in an area which had never before been politically central or densely populated. Lying at the northern political frontier of the empire, the city was also located at an agricultural frontier of sorts.

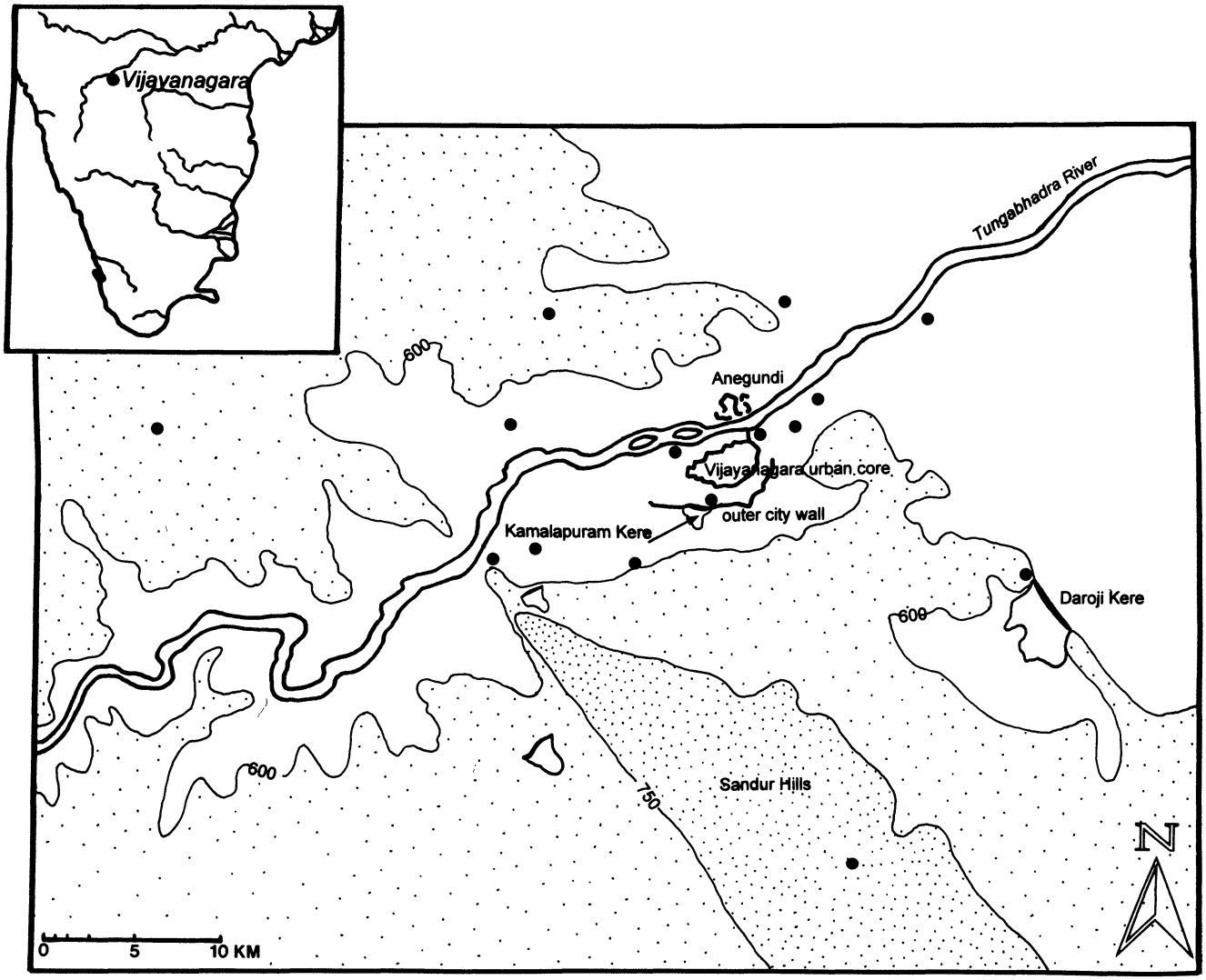

FIG. 1. *Vijayanagara and selected outlying fortified settlements or fortifications, along with selected reservoirs* (kere).

In contrast to rich alluvial deltas that supported many earlier South Indian capitals, the semiarid Karnatak plateau lies well within the rainshadow of the western Ghats, the mountain chain which runs down the west coast of India, and receives a low and temporally variable rainfall of less than 500 mm per year (Spate 1954). For this reason, and because almost all of the rain falls within the summer monsoon season, productive agriculture requires constant efforts to control and store water (see Kanitkar 1960).

The empire expanded rapidly, and large areas of southern India were claimed by Vijayanagara as early as the mid-14th century (Nilakanta Sastri 1975). It was at the beginning of the 16th century, however, that there was a dramatic increase in the tempo of political, demographic, and agricultural change in the Vijayanagara region and the empire. During the 16th century, documents and oral histories mention large-scale population movements throughout southern India (Stein 1980). It is not quite clear what the more local implications of these population movements were, but there was a major increase in construction activity in the city at this time, and through archaeological survey outside the city (Morrison 1995, Sinopoli and Morrison 1995) we have established that many new settlements were founded and several large temple complexes built in the surrounding area (and see Filliozat and Filliozat 1988). The early 16th century also saw a period of increased militarization, attempts at centralization of control over the empire, and possibly an increase in the size of the standing army. Finally, the historical record of the 16th century contains many references to the clearing of forests and reclamation of land and to the construction of agricultural facilities (Morrison 1995).

POLLEN AND CHARCOAL ANALYSIS

Palaeobotanical data are also helpful in tracing agricultural change. In appropriate depositional environments, pollen and spores resist decay and may provide information on vegetation modifications resulting from human land use. Bodies of water such as lakes or reservoirs act as traps for pollen, and the continuous accumulation of pollen in the bottom of the reservoir creates a temporally stratified record of past vegetation (Faegri, Kaland, and Krzywinski 1989). In this record it should be possible to see the consequences of intensification in the form of increases in the pollen of crops and field weeds and decreases in that of trees and shrubs as agricultural land encroaches on forests (and as the pressures of firewood collection and grazing increase). Certainly the relationships between land use and vegetation and between pollen and vegetation are neither simple nor direct (Birks and Gordon 1985, Webb et al. 1981). However, the massive restructurings of land use during the Vijayanagara period ought to have had significant effects on vegetation which can be monitored in the pollen record.

Sediment cores from the Kamalapuram *kere*, or reservoir, located just south of the city were collected and analyzed in order to study the vegetation history of the Vijayanagara region (Morrison n.d., 1994*b*), and analysis of a larger series of cores from reservoirs throughout the study area is under way. The Kamalapuram reservoir is fed by a canal from the Tungabhadra River as well as by seasonal runoff. It contains water year-round, thus providing a favorable environment for pollen preservation. The base of the core dates to the later 14th or early 15th century, the construction date of this facility. The Kamalapuram reservoir is still in use, watering a large area under paddy rice and sugarcane. Thus, given the lack of apparent gaps in the sequence, the pollen record should extend from the late 14th or early 15th century up to the present. Unfortunately, chronological control is, at present, limited, and the basal date, the upper limit of the sequence (1990), and temporal indicators in the vegetation itself in the form of New World species introduced to India constitute the sole chronological referents.

Figure 2 (*top*) depicts the pollen percentages of several general groupings of plants. The earliest taxon introduced from the New World (*far right*) is a weedy herb, *Alternanthera*, accidentally introduced sometime after A.D. 1500. The following one is *Casuarina*, brought to India in the 1780s. The upper portion of the sequence, then, dates to no earlier than A.D. 1500. Grasses dominate the pollen assemblage, followed by herbs and trees. The most important agricultural crops of the Vijayanagara period, rice, sorghum, millets, and possibly sugarcane, are all grasses, and many noncultivated grasses also thrive in open or disturbed habitats such as fields. Although research into methods for distinguishing between pollen of different tropical grasses, especially rice, is in progress, no such distinction can yet be reliably made (see Chanda 1972).

What is evident from this generalized grass curve, however, is a very high percentage of grasses in the pollen record early on, up to 90% of all nonaquatic pollen. This proportion undergoes a long and sustained decline until it reaches a minimum at about 40 cm. Following this low point, grasses rebound somewhat (between 40 and 28 cm) and then undergo a slow and sustained decline. Because of the composite nature of the grass curve, it is difficult to give an unambiguous interpretation of this pattern. The concentration diagram of the same vegetation groups (fig. 2, *bottom*) indicates clearly, however, that grasses were dominant in the pollen record from the very beginning of the sequence.

The preponderance of grass pollen at the base of the core is significant. At no other level does the relative or absolute abundance of grass pollen reach the levels it attains near the base. It is not possible to assess proportions of vegetation types directly from proportions of pollen types, but it is very striking that the contemporary landscape—deforested, overgrazed, virtually denuded of natural vegetation, and containing many agricultural fields—does not create as strong a grass signal. Certainly the pollen data in no way present a picture of "natural" vegetation but instead show a long history of significant human impact on the environment.

Pollen concentrations also decline in the middle of the sequence, between about 28 and 14 cm. In fact, at 24 cm there was virtually no pollen at all in the core, and this level was left out of the calculation of the diagram. No stratigraphic break was apparent, and this level did contain charcoal. One potential explanation is that the reservoir actually dried out during this period and the consequent wetting and drying destroyed pollen in sediments near the surface. This possibility and, indeed, the history of the reservoir itself can be explored by looking at the record of aquatic plants (fig. 3).

Figure 3 depicts concentrations of pollen from the three major taxa of aquatic plants. South Indian *Typha* and Cyperaceae species generally grow around the edges of standing water (Singh 1988), but *Potamogeton* grows both in the ground around the edges of reservoirs and as a floating weed on the surface. This pernicious weed can seriously affect the operation of a reservoir if it is not controlled. Thus, it is possible to identify a period during which the reservoir became choked with aquatic plants, a period that just postdates the early grass peak and begins somewhat before trees and shrubs began to regenerate. This period appears to represent the collapse, or disintensification, of the Vijayanagara agrarian system. The aquatic plants fall away again in the upper levels, at about the time the first introduced taxa appear and while grasses are staging a minor comeback.

Because this reservoir is supplied by a canal, one explanation for such a drying-out could be that the flow from the canal was blocked, even temporarily. This blockage, if indeed that is the case, occurred during the post-Vijayanagara era, marking the beginning of a new pattern of agricultural production in the area. It may be that this brief dry period represents the beginning of renewed maintenance of the reservoir, since today ca-

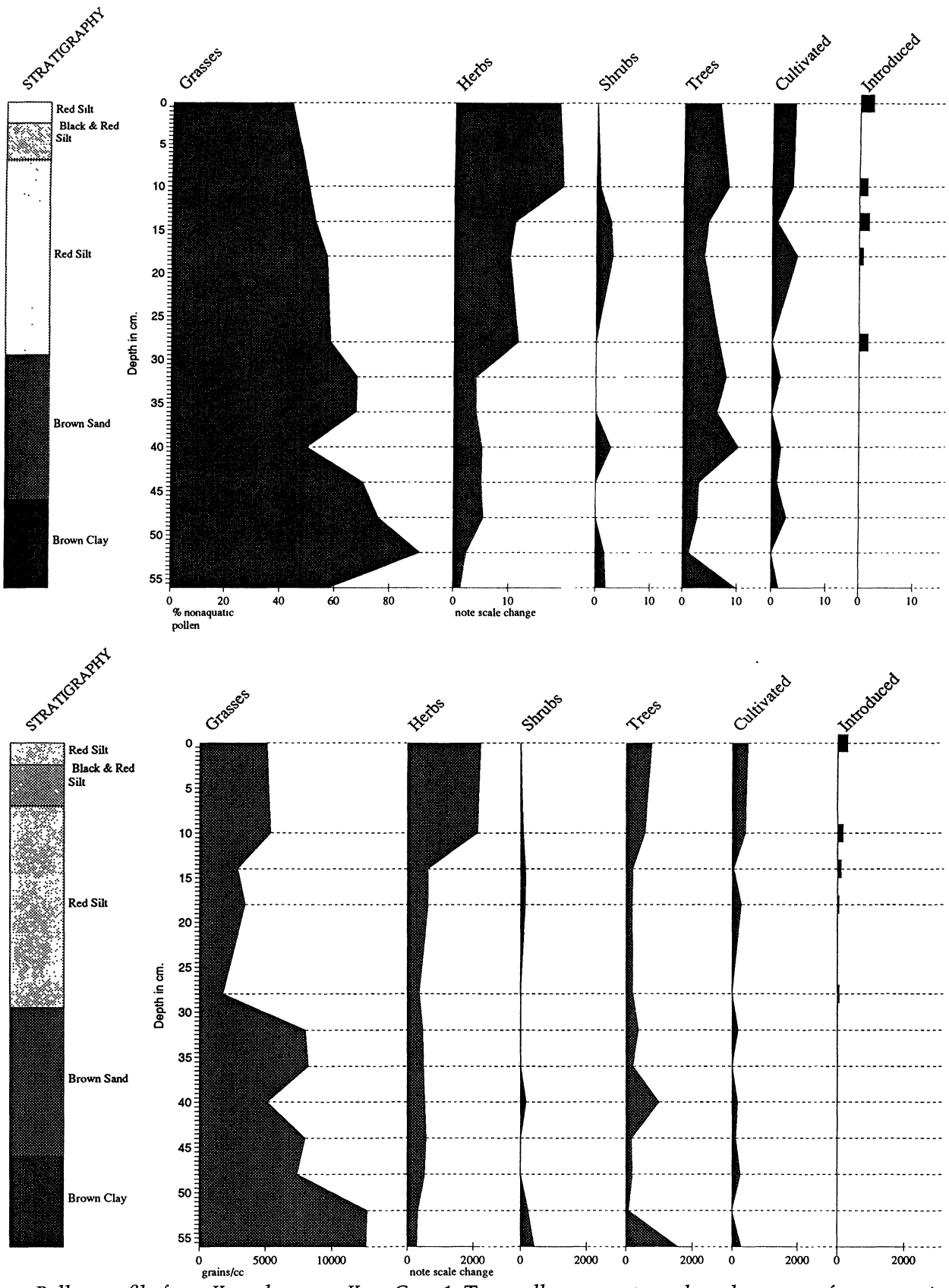

FIG. 2. *Pollen profile from Kamalapuram Kere Core 1.* Top, *pollen percentages based on sum of nonaquatic pollen;* bottom, *pollen concentrations. (In both diagrams, note changes in scale.)*

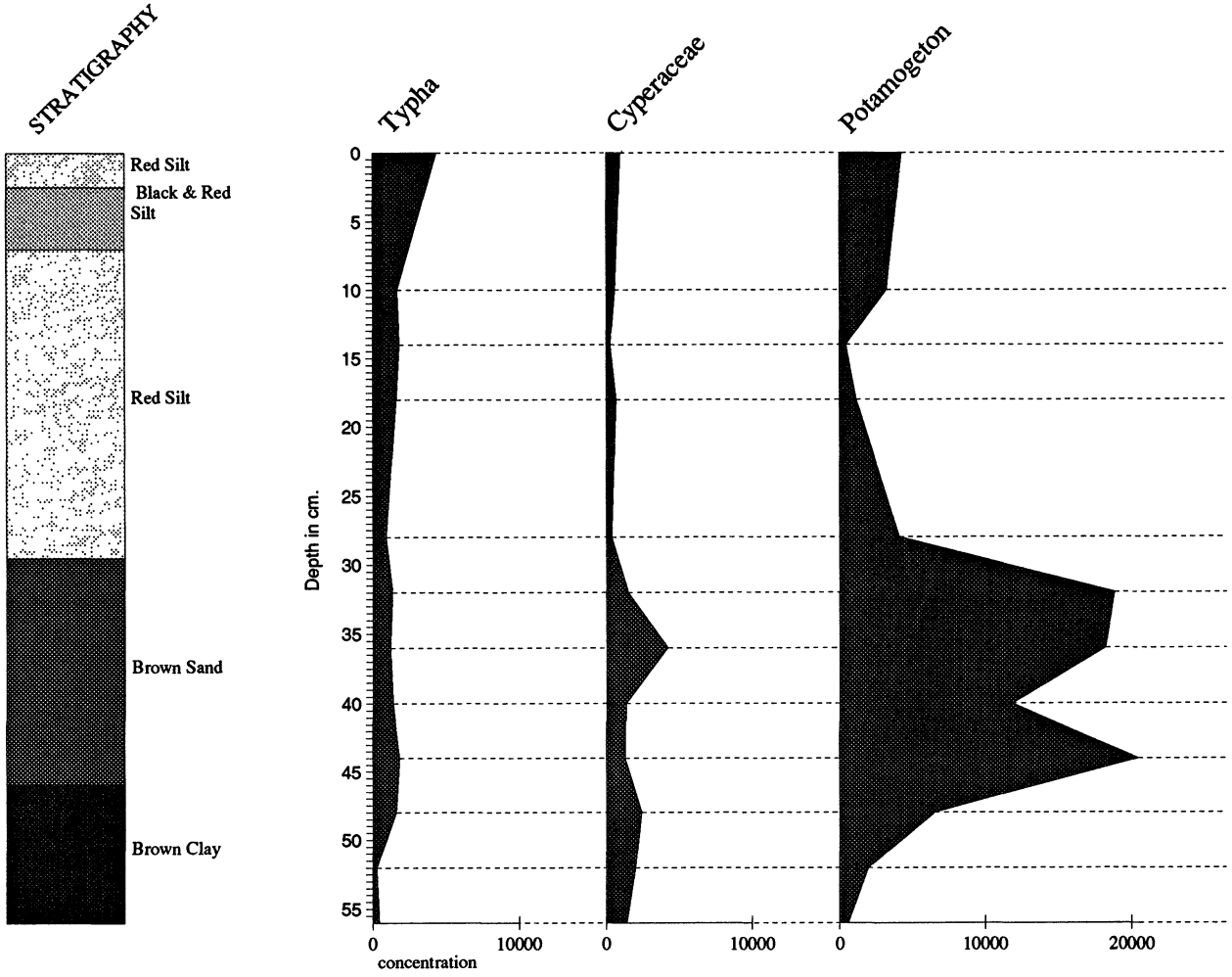

FIG. 3. *Concentration values of principal aquatic plant taxa, Kamalapuram Kere Core 1.*

nals are periodically blocked up in order to clean out silt and vegetation.

I have suggested (Morrison 1995, n.d.) that the Kamalapuram sequence shows at least two major periods of cultivation, the earlier in the Vijayanagara period and the later in the colonial and postcolonial periods. The tree curve shows a regeneration of trees in the middle period, when agriculture was in decline and the reservoir was choked with aquatic vegetation. It may be significant that the later periods show relatively more trees than the very early period; this again suggests a landscape virtually denuded of natural vegetation. Indeed, European visitors to the city remarked on the lack of trees in the area and the great extent of cultivated fields (cf. Sewell 1900).

Finally, the general diagrams of figure 2 also indicate the pattern of pollen from cultivated plants, a category that does not include cultivated grasses and, in fact, consists largely of coconuts (*Cocos nucifera*), especially in the upper levels. Although coconuts were grown in the Vijayanagara period, they clearly did not assume the importance they have in the contemporary landscape. What this seems to indicate overall is that colonial and postcolonial agriculture was (and is) much more focused on the production of cash crops and Vijayanagara agriculture on food grains.

What is not evident in this particular pollen diagram is a clear record of early Vijayanagara intensification. Already by the beginning of the record there was a highly intensive agricultural landscape, one with few trees and few shrubs. What is evident, however, is the record of agricultural decline. Grasses fall slowly away, trees recolonize the area, and maintenance of the reservoir virtually ceases. Then there seems to be renewed maintenance of the reservoir, and a series of new agricultural cycles begins during which the weed flora changes (Morrison 1995)—partly as a result of introduced vegetation and perhaps also as a result of a shift within wet agriculture from rice to sugarcane, tree crops, and other cash crops, essentially the contemporary agricultural pattern. These data must be considered preliminary, given their relatively coarse chronological control; additional analyses may revise and perhaps refine the picture of vegetation change.

The pollen data are complemented by the evidence of microscopic charcoal. This material has been described in some detail (Morrison 1994*b*) elsewhere. However, the connection between the charcoal and pollen records is worth noting. At the base of the core is a charcoal peak (52 cm) which corresponds with the peak in grass pollen and the decline in trees and shrubs. Although some of this charcoal is probably attributable to domestic burning, it is likely that it also relates to land-use practices which led to the creation of a more open, less wooded landscape. Large charcoal peaks also occur in the upper portions of the core, and these probably relate both to the recent surge in population in the area and to the practice of burning off the stubble of harvested sugarcane fields. Thus, charcoal patterns correspond in a general way with the patterns of open, transformed vegetation. Both burning and open vegetation are indicated in the Vijayanagara period and again in the colonial and postcolonial periods, when agricultural production was the most intensive.

ARCHAEOLOGICAL EVIDENCE: AGRICULTURAL PRODUCTION AND FACILITIES

Previous archaeological work at Vijayanagara has focused almost exclusively on the city itself (Fritz, Michell, and Nagaraja Rao 1985; Nagaraja Rao 1983, 1985; Narasimaiah 1992; Devaraj and Patil 1991*a*, *b*) or on monumental structures near it (cf. Michell 1985). The Vijayanagara Metropolitan Survey, initiated and codirected by me and C. M. Sinopoli, was the first systematically to examine the region surrounding the city, including nonurban and nonelite contexts. In addition to less intensive study of a ca. 350 km^2 area surrounding the city, we have nearly completed an intensive, systematic surface survey of eight "blocks" of land, each slightly more than 20 km^2, adjacent to the walled city (fig. 4). At this point, we have surveyed the five blocks south of the river and have recorded over 500 sites that provide data on patterns of land use, settlement, fortification, and transportation (Morrison and Sinopoli n.d. *a*, *b*; Sinopoli and Morrison 1991, n.d.). Although the majority of the area's population lived within the city walls, several nucleated settlements lie close to the city, most situated along major roadways leading to Vijayanagara. The survey area has also yielded traces of numerous routes of transport and movement, ranging from narrow footpaths to major paved roadways. Road networks zigzagged between irrigation features and led to gates and informal openings in the city walls. The region surrounding the city, even that outside the formal rings of well-constructed masonry walls, constitutes a large fortified zone marked by massive walls, forts, walled villages, and bastions (Sinopoli and Morrison 1995). What direct evidence there is on nonagricultural production, mostly stoneworking, sculpting, and iron production, indicates relatively small-scale, dispersed production, much of which appears to have been situationally mobile (Lycett 1994). The survey area also contains numerous temples and shrines, ranging from isolated sculptures to large walled complexes. Temples were important components of the agricultural economy. Finally, there exists a great range of features related to agriculture, from small walls designed to check erosion to huge complexes of interconnected reservoirs and terraces.

It is customary in discussions of South Indian agriculture to draw a distinction between "wet" and "dry" cultivation, differentiated on the basis of water availability. Thus, "wet" agriculture is based on perennial supplies of water, while "dry" agriculture consists primarily of rainfall-dependent production. A third form of production is termed "wet-cum-dry" cultivation, in which the water supply is seasonal but which does involve some form of water collection and storage facility. The nature of the water supply has important implications not only for the type of crop grown but also for the number of crops per year, yields, and the relative security of obtaining an adequate harvest. There also exist relationships between these categories and the scale of production, the degree of investment and control exercised by noncultivators, and the labor organization of the cultivators. Although these categories are not mutually exclusive (Morrison 1993), it is worth reviewing them and describing some of the types of agricultural facilities associated with each that have been encountered archaeologically in the survey area in order to highlight some of the diversity in productive scales and strategies in the region.

Wet crops include rice, vegetables, sugarcane, and tree crops such as coconuts and mangos. These crops require a secure and abundant source of water, but with such a supply it is possible to obtain, and obtain reliably, two and even three crops per year. There is a price to pay for this high level of production, however. Wet agriculture in the Vijayanagara region is possible only with the aid of labor- and capital-intensive facilities such as canals, canal-fed reservoirs, and wells. The operation of these irrigation networks is complex, requiring coordination and careful scheduling. Wet crops themselves also often require considerable labor inputs and pose significant scheduling constraints.

The Vijayanagara canal network has evoked admiration from outside observers since the 16th century. Canals watered an area of over 11,000 acres, and most are still in operation (Kelsall 1872). Water is diverted from the Tungabhadra River by means of stone dams, or *anicuts* (Kotraiah 1959), into a complex and interconnected system of channels. One of these, known as the *hiriya kaluve*, or "big canal," ran through the city walls, watering an area of gardens and orchards (Filliozat and Filliozat 1988). A few other wet-agricultural facilities were also served by the canal network, including the Kamalapuram and two unnamed reservoirs and a massive aqueduct (VMS-3 [Morrison 1991]) that carried water from a canal across the river to irrigate a large island.

Several of the most "intensive" features of the agricultural landscape date to the Early Vijayanagara period. The Kamalapuram reservoir was constructed in the mid-14th century, and the "big canal" also dates to near the

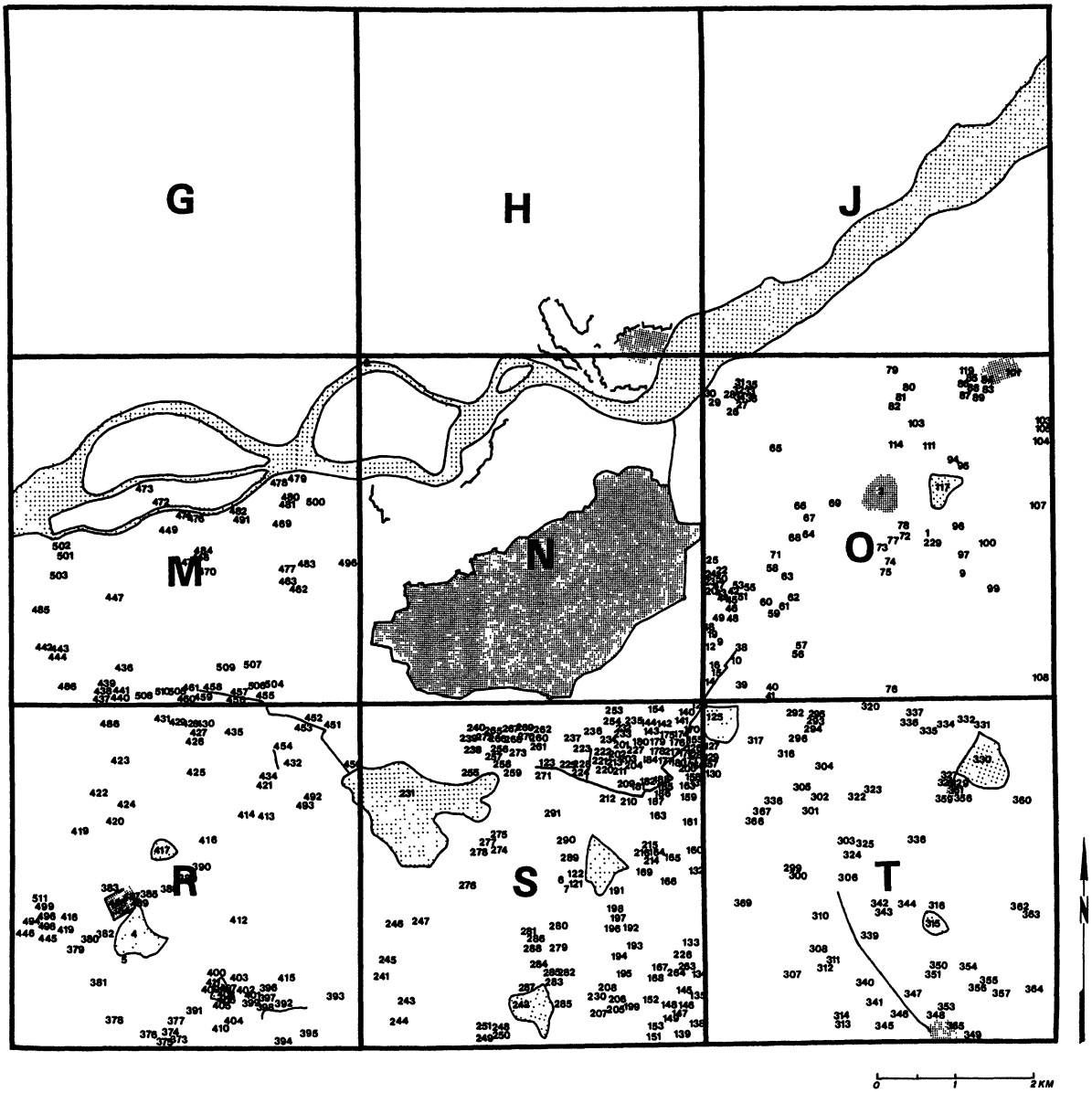

FIG. 4. *The eight sample blocks of the intensive phase of the Vijayanagara Metropolitan Survey, showing locations of archaeological sites recorded. Block N contains the large walled city of Vijayanagara* (shaded) *and is not included in the sample.*

beginning of the period, as do several others. Indeed, the chronological distribution of inscriptions[9] referring to canal construction and maintenance (Morrison 1995) indicates many early canals and only a slight tendency for dates to cluster in the early and late Vijayanagara periods. Another way of looking at the temporal distribution of wet agriculture is to consider all inscriptional references to wet lands (Morrison 1995). References to wet lands in the district containing the city of Vijayanagara form a distinct unimodal peak in the 16th century. Thus, wet features are associated with both early and late periods of intensification.

Dry agriculture was widely practiced in the survey area. The dry crops of sorghum (*Jowar* or *Cholum*) and various millets have traditionally been the most important food grains in the region. Other dry crops include oilseeds, legumes, and cotton. Although most dry fields appear to have been relatively small, cotton was grown on a large scale during the Vijayanagara period (see Sewell 1900). It is possible to raise dry crops using only rainfall (and in fact cotton was almost certainly raised this

9. Graphs of inscriptions are based on coded information from 1,538 published and unpublished inscriptions from 13 districts in northern Karnataka that date to the Vijayanagara period. For details of the analysis, see Morrison (1992, 1995) and Morrison and Lycett (1994).

way), but the high degree of annual variability in precipitation makes this form of production very risky. The survey area contains a wide range of agricultural facilities which are associated with dry farming, including check-dams, gravel-mulched fields, bordered fields, and terraces. These facilities certainly required labor investment for construction and maintenance but not on the scale of wet facilities. Although the archaeological record of the Vijayanagara region contains the remains of a great many dry agricultural features, they do not appear in the historical record even though dry agriculture covered a much larger area than wet agriculture. The existence of dry land is noted historically (see Gopal 1985, 1986, 1990), but neither construction, maintenance, nor use of dry facilities is generally considered in texts. The relatively small scale of dry facilities, their lack of inscriptional notice, and the scheduling demands of dry farming suggest that the organization of production of dry-farmed crops was quite different from that of irrigated crops.

It is difficult to trace the temporal development of dry farming, although we are now beginning to address this more directly through excavation. There are, however, some chronological indications such as the location of small settlements vis-à-vis the dry-farmed areas, and these indications do not suggest that dry agriculture was restricted to any portion of the Vijayanagara sequence. Dry facilities are sometimes also physically linked to other kinds of features. For example, the rocky hillsides that formed the watersheds for runoff-fed reservoirs were often extensively terraced. Small reservoirs or wells were also integrated into systems of facilities that included terraces and gravel-mulched fields. Overall, there is extensive landscape modification and interconnection of features across the entire survey area. Thus, even small-scale, arguably marginal strategies such as dry farming were not divorced from the operation of other facilities, nor were its practitioners isolated from the consequences of changes in other forms of agricultural production.

The third category of agricultural production, wet-cum-dry cultivation, derives from a term meaning "dry crops on wet lands" (Ludden 1985). This type of cultivation is dependent upon seasonal sources of water, of which the most important are runoff-fed reservoirs or tanks. Wet-cum-dry cultivation, supported by reservoirs, allowed agriculture to expand into areas beyond the reach of canals without the resort to dry cultivation.

Reservoirs were an extremely important component of the Vijayanagara agricultural landscape, particularly during the intensification of agriculture in the 16th century. They were typically placed across valleys or natural drainages to capture monsoon runoff behind an earthen embankment faced with masonry (Morrison 1993); water flowed into the fields below through slab-lined tunnels constructed underneath the embankment. The flow of water through the tunnels was controlled by sluices, which in the Vijayanagara period were often quite large and stylistically elaborate, adorned by mouldings, sculpted goddesses and gods, donor portraits, and other figures. Sluices, significantly, echoed temple doorways in form and ornamentation.[10]

A huge range of variability exists in the size and degree of elaboration of reservoirs. Some are no more than a few meters long, others as much as 3 km long, certainly representing considerable investments in time and labor. So far, more than 60 reservoirs have been identified in the survey area and well over 100 in the Greater Metropolitan Region. At its maximal extent in the precolonial period, canal irrigation served a more or less continuous area of some 30 to 50 km^2 along the banks of the Tungabhadra. Areas served by reservoirs were more widely separated from one another, but reservoirs watered a similarly large area at their maximal extent (assuming contemporaneity). Although both canal and reservoir irrigation covered large areas, it should be noted that reservoirs dry up completely in the dry season or in dry years and yet require almost as much investment in construction and maintenance as canals.

The temporal distribution of reservoirs is striking. In a wider regional context, references to reservoir construction are temporally bimodal (fig. 5), indicating their importance both during the period of the establishment of the city and empire of Vijayanagara and the initial growth of regional population in northern Karnataka during the 14th century and during the 16th-century intensification of agriculture. If only the region immediately around the city[11] is considered, however, the local chronological pattern in reservoir construction is strongly biased toward the 16th century (Morrison 1995). Reservoirs had been built in South Asia for perhaps as much as a thousand years, so they were not a new invention in this time period (Sankalia 1962), but they did constitute an important form of intensification of regional agriculture during the 16th century.

If these three categories—wet, dry, and wet-cum-dry—were to be sorted in terms of most measures of intensity, wet agriculture would be the most intensive, on the basis of both continuous labor demands and productive potential, and dry agriculture would be the least. Of course, what this ordering does not bring out is the interdependence of these different forms of production. Archaeological research has made clear that very few facilities operated in isolation. Even where facilities (and forms of agriculture) were not physically linked, they could exert significant influence on, for example, the movement of soil downslope and the patterns of runoff and thus have an impact on other nearby facilities (and

10. Among the more common sculptural forms found on sluices are Lakshmi flanked by elephants, Sita, Sita and Hanuman or Sugriva, and Ganesha. In temples, these figures are often located in the center of the lintel over doorways leading into one of the more restricted spaces of Vijayanagara-period Hindu temples. On sluices, they are found in the center of the upper cross-bar, an analogous position. Less common on both temples and sluices are "donor portraits." In both cases these tend to occur to the side of the doorway and often consist of one male and one female figure.

11. Approximated here by the modern administrative district of Bellary, several hundred square kilometers in extent. Bellary District extends only as far north as the Tungabhadra River.

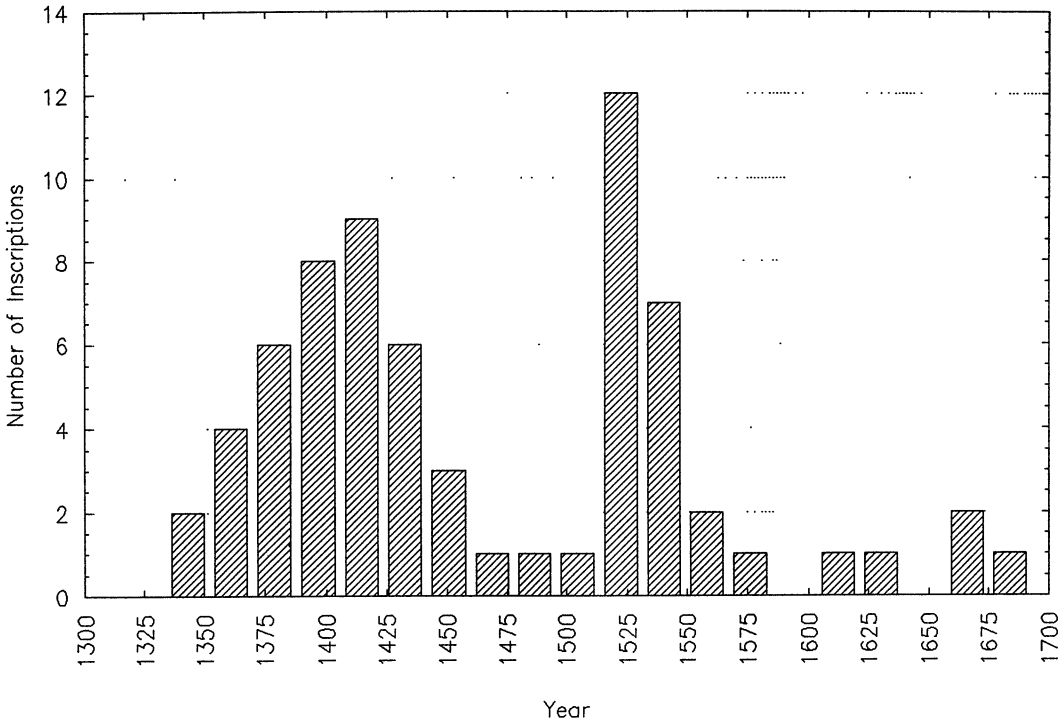

FIG. 5. *Construction dates for reservoirs recorded in inscriptions from northern Karnataka.*

farmers). Because decisions about agricultural strategies have consequences for all subsequent agriculturalists, we have to see the process of intensification as historically contingent. In the Vijayanagara case, early decisions to adopt highly intensive, highly productive wet agriculture set limits on the kinds of strategies that could be pursued in the course of 16th-century intensification. These decisions continue to resonate today, and many of the wet facilities have continued in use until the present (e.g., Sivamohan 1991).

THE HISTORICAL RECORD

Archaeological data indicate that the scales and forms of agricultural production in the Vijayanagara region were quite diverse across the survey area, and these data, in conjunction with dated inscriptions, suggest that this diversity was temporal as well as spatial. However, an understanding of the process of intensification requires consideration of the actual organization of production as well as the bare chronological sequence of change. In order to address this issue, I consider a third line of evidence, the historical record.

There are a number of different forms of written records for the Vijayanagara period, including travelers' accounts, religious and literary works, and, what are perhaps the most useful for this discussion, inscriptions in copper or stone. These inscriptions are generally but not exclusively associated with temples, and they refer overwhelmingly to what could be called ritual and material transactions—temple donations, grants of land, rights in produce, the construction of agricultural facilities, and tax remissions. Inscriptions are helpful not only for dating individual canals and reservoirs but also for providing a glimpse of the way in which agricultural investment was structured.

South Indian temples were major landholders and employers as well as ritual and scholarly centers (Ismail 1984, Nagaswamy 1965, Stein 1978). Temples controlled extensive landholdings, which they generally leased out to individual farmers in exchange for a portion of the produce. Temples themselves could be like small cities, employing hundreds of priests, dancers, scholars, and other functionaries, as well as craft specialists and staffs for their huge kitchens. Temples appear in the historical record primarily as the recipients of gifts of cash, land, and produce rights from specified villages (Stein 1980). Donors included not only kings and members of the royal family but also local leaders, temple servants, merchant groups, and individuals (Morrison and Lycett 1994).

The pivotal role of temples in agriculture stemmed both from their status as landholders and from their involvement in the construction and maintenance of agricultural facilities. Donations to temples can also be considered investments; the temple took individual gifts or pooled smaller gifts and invested them in agricultural facilities, especially reservoirs. The temple was then entitled to a share of the increase in production of the lands watered by the new or newly repaired facility. These rights were shared by the temple with the original donor, who thus received a material benefit as well as religious merit for his or her gift. The donor's portion was given in the form of raw or cooked sacred

food, or *prasad.* This *prasad* could be consumed or sold (Breckenridge 1985). In this way, complex networks of entitlements were set up which linked institutions and individuals to the agricultural landscape and its productivity.

This network of temple investment also had important political implications. The overlordship of the Vijayanagara kings was expressed and recognized in their right to construct and endow temples in their territories and in the expressions of loyalty to them in the donative inscriptions of others. Regional leaders, including those appointed by the center, were also able to forge horizontal ritual and material ties with temples in their own areas and thus subvert efforts at centralization (Appadurai 1978). What may be particularly important for intensification, however, is the fact that temple donations and temple investments often extended across very large areas, crosscutting ecological boundaries (Breckenridge 1985). Thus, donors in dry areas, such as the Vijayanagara region, were able to create rights in produce from more productive zones, such as the alluvial deltas of the east coast. Thus, temple investment was important in facilitating spatial diversity in agriculture that was both ritual/political and economic in character.

Discussion

The case of Vijayanagara sketched out here and its trajectory of agricultural change in the period between the 13th and 16th centuries highlights some aspects of the complex and internally differentiated nature of intensive agricultural landscapes and of the processes of agricultural change. Even given the limitations imposed by the nature of the available evidence, it is clear that the diversity of agricultural strategies in both time and space evident in the Vijayanagara region through the 14th, 15th, and 16th centuries at least matches that of the Boserupian formulation that purports to encompass the entire universe of agriculture. Contrary to Boserup's assertion (1965:57–59) that the apparent internal variability in fallowing regimes within a single "case" represents a false picture created by viewing a system in the process of change, when we actually study agricultural change through time rather than simply substituting space for time it is evident that diversity in productive strategies and scales is maintained on a regional level through time. However, this homogeneous regional view of Vijayanagara agriculture certainly misrepresents the actual strategies of productive units in this highly stratified society. As noted above, decisionmaking takes place at a number of different levels, and the constraints on and possibilities open to different groups of agriculturalists, agricultural laborers, landholders, and others differed in significant ways.

Fallow length as the measure of intensification also falls embarrassingly short in this case. The rapid growth of the city of Vijayanagara in the early 14th century and its dramatic expansion during the early 16th century prompted large-scale changes in the intensity of agricultural production. The course of this intensification was not a univariate or unilinear progression from simple to complex strategies but involved highly intensive irrigated agriculture from the very beginning, and in the area around the 14th-century Kamalapuram reservoir the landscape was dominated by fields—perhaps by paddy rice—from the very beginning of the pollen record. In a Boserupian sequence, this intensive cultivation should follow, not precede, more labor- and land-extensive strategies such as dry farming. Although the data are admittedly weaker here, it seems also to be the case that extensive dry farming, far from being solely an early practice, was practiced in later periods as well and may have been one of the few options open to those with restricted access to prime irrigable land.

Intensification in the 16th century, as indicated by both the archaeological and the historical record, seems to have involved intensification proper, diversification, and expansion. There was, as noted, a second, 16th-century focus on the construction of canals and *anicuts,* facilities which allow for labor-intensive but highly productive wet agriculture, and in the region around the city references to irrigated land increase dramatically in the 16th century. This period also saw a veritable explosion in reservoir construction, indicating a diversification of the agricultural landscape. The involvement of temples as investors and landholders was also important in promoting spatial diversity in agriculture. Grants and entitlements sometimes extended across large areas, crosscutting ecological and political boundaries. The diversity of the Vijayanagara agricultural landscape is, however, much more evident from the archaeological than from the historical record. There are many more facilities and more diversity of form than is indicated by inscriptions, suggesting that a number of productive strategies and scales in the Vijayanagara period are historically "invisible." Nevertheless, there is good reason to believe that the productive strategies of even small-scale farmers were not independent of other forms of agricultural production.

Expansion is indicated by the historical record, most particularly in grants of tax remissions for settlers who cleared new agricultural lands (Stein 1980) and in records of the establishment of new settlements. Archaeologically, we see in the early 16th century a spatial expansion of settlement and of construction in the survey area, as well as in the city itself.

The path of Vijayanagara intensification did not follow a simple progression from longer to shorter fallow periods, nor can it be characterized by any other *single* measure of intensity. Instead, the course of change was complex and internally differentiated, involving the coordination of multiple scales and strategies of production. Neither did this course of change mechanically reflect some single factor such as regional population, though certainly such factors were important. Instead, investment in agricultural facilities and the creation of rights in agricultural produce were dynamically linked, through the mechanism of temple investment, to the ritual and political as well as the ecological conditions

of the period. Changes in agricultural practice during the Vijayanagara period are not simply of historical interest, however. Vijayanagara-era residents of northern Karnataka dramatically restructured the landscape—social as well as physical—in ways that have continuing relevance for contemporary farmers, herders, and other residents.

The totalizing model of agricultural, social, and economic change proposed by Boserup not only does not capture the complexity and diversity of this particular sequence but also mischaracterizes the path of change. It therefore does not constitute a useful model of intensification or indeed of economic and demographic change. In common with other neoevolutionary typological schemes, it defines away internal variation—spatial, temporal, social—in the interest of generating normative forms or types. However, variability itself seems to constitute a significant aspect of the way in which complex agricultural landscapes are structured and the process of intensification itself proceeds. It may be tempting to view contemporary agricultural variability in terms of a putative sequence of change, but when such conjectural histories are evaluated against actual courses of change they often fall short. In this case, the primary difficulty seems to be not that the necessary generality of the model has obscured the richness of the individual case—a common complaint about general models—but that the model has failed on empirical grounds. There is no single measure of intensity that adequately captures Vijayanagara agricultural practices even at a single point in time; diversity is consistently maintained across and perhaps within social and spatial groupings. Even if we attempt to blur or homogenize that picture of diversity—and archaeological data certainly lend themselves to such fuzzy resolution—the sequence of change proposed by Boserup is simply not in evidence.

Although I did not specifically consider above the other aspects of change that are said to accompany the stages of fallow reduction and thus of intensification in the Boserup model (changes in technology, land tenure, gender roles, etc.), the simple fact that fallow reduction cannot be said to characterize the sequence might be sufficient to dismiss this baggage without further discussion. It is not clear that changes in fallow length necessarily lead to or determine changes in these other aspects of social and cultural life. In the introductory sections of this paper I suggested that Boserup's work on agricultural intensification could be viewed as an example of a typological scheme of progressive cultural-evolutionary change and argued that it holds out an untenable view of economic organization and of change itself. Beyond its conceptual difficulties, however, lies an even more damaging lack of correspondence to actual courses of change, and these combined difficulties lead me to suggest that we reconsider this and other similar stage classifications that have persisted in structuring anthropological discourse about long-term change. Although I have not discussed cause here, I do not suggest that the reasons for Vijayanagara agricultural intensification are inexplicable or uniquely determined (see Morrison 1994*a*, 1995). Although regularities in process across cases may indeed be discerned, archaeologists and others concerned with change are not well served by simplistic typological schemes that distort the recognition of such regularities and lead us away from a genuine concern for the processes of change.

Comments

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Morrison and her field research collaborator, Carla Sinopoli, deserve recognition for the recent regional-scale work that they have done to bring the Vijayanagara polity into much sharper anthropological focus. In this article, Morrison examines land use and agricultural intensification around Vijayanagara with critical attention to the oft-cited conceptual framework of Boserup. Since our own spatially broad and temporally deep studies (Feinman 1991; Feinman and Nicholas 1987, 1990, 1992; Nicholas 1989; Nicholas et al. 1986) on the other side of the globe in Oaxaca, Mexico, also have found major problems with Boserup's theoretical stance, we welcome this analysis and find more to praise here than to criticize. Collectively, these findings questioning the general utility of the Boserup thesis are important, since Boserup (1981: chaps. 4 and 5) herself selectively cites several archaeological studies as offering confirmation of her model in historical context.

Several points made by Morrison parallel our own observations. We also found that episodes of increasing agricultural production involved more than just intensification (or increasing returns per unit of land). In Oaxaca, the founding of the Monte Albán state was soon followed by the establishment of many new villages in previously uninhabited (or sparsely settled) areas around the capital city (Blanton et al. 1993:73–75; Feinman and Nicholas 1992; Nicholas 1989; Nicholas et al. 1986). New land was opened for farming. As with Vijayanagara, agrarian expansion into previously underutilized terrain coincided with agricultural intensification.

Likewise, we concur (Feinman and Nicholas 1990) that spatial scale is a key ingredient the neglect of which limits the utility of the Boserup framework. In ancient Oaxaca, from the period of earliest villages, settlement patterns and agricultural strategies varied markedly over space, particularly with distance from major political and economic centers (a pattern still evident in recent times [see Kirkby 1973]). Boserup and her followers are insensitive to intraregional spatial variation because the consideration of such factors as political and market demands and transport distances necessitates the broadening of their models beyond population, technology, and

agricultural production. In preindustrial economies, the direct and indirect control of labor was often a key basis of power, and therefore we see little prospect for understanding historical patterns of land use, settlement pattern, or demography without giving serious attention to politics and the spatial dimensions of political action.

In her consideration of scale, Morrison illustrates another key point relevant to work with written documents in conjunction with archaeological findings. She notes that regional-scale archaeology provides much finer resolution for the spatial diversity of landscape than can be teased from the available written documents. As multifaceted approaches to early historical eras are refined (e.g., Knapp 1992, Smith 1992), it will be interesting to see if more elegant and multiscalar anthropological examinations of geographic space match the increasing sophistication given to cycles of time.

Each of these points is significant, but Morrison's principal finding is that cropping lengths do not increase unilinearly in the Vijayanagara region during an era of political expansion and population growth. Although predictions about cropping length may not seem especially important, they lie at the heart of Boserup's (1965:117–18; Grigg 1979; Grigg 1980:34) conceptual framework. Moreover, such diachronic expectations are not easily assessed. Rarely have archaeologists or historians had the kinds of botanical and pollen information needed (in conjunction with settlement data) to evaluate shifts in past agricultural strategies along this critical dimension (e.g., Feinman and Nicholas 1990:104). By uniquely interdigitating botanical, regional-settlement, and documentary findings, Morrison carries her direct assessment and reasoned rejection of Boserup's framework a step beyond previous archaeological research efforts (but see Diebold 1967 and Rubin 1972 for related critical reviews of this Boserup position).

Although we applaud Morrison's efforts, we also await her fuller interpretations of the temporal and spatial patterning in agricultural land use and production around Vijayanagara. What accounts for the recognized cycles of cropping length and the spatial diversity in land use that she reports? How does land utilization around Vijayanagara compare with that in other precolonial states in South Asia and beyond? Clearly, some of these issues are addressed elsewhere (e.g., Morrison 1995). But if long-term agricultural history and political economy are to move well beyond Boserup's theoretical framework, new conceptual perspectives and more in-depth empirical analyses will be necessary.

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Morrison clearly and effectively identifies the inherent weaknesses of Boserup's model of agricultural intensification. In particular, she objects to Boserup's assumptions about the nature of economic organization and change in which agricultural intensification manifests itself as a uniform, unilineal evolutionary trajectory of "stages" from dry strategies (perceived as less complex) to wet ones. In Morrison's field site Vijayanagara as in many others around the world including several in Hawai'i (Green 1980, Kirch 1985), Boserup's model simply doesn't work. Wet strategies precede dry in some cases, and more often than not the two exist simultaneously, albeit in different ecological zones. She suggests that by adhering to Boserup's rigid and prescriptive formulations, archaeologists have neglected the agricultural diversity and variability often present in the contexts in which they work. Morrison's critique of this aspect of Boserup's model is compelling. However, she goes on to advocate that it is incumbent upon archaeologists to resist definitional explanations by looking closely at how intensification occurs, and it is here that her analysis seems to fall a little short. What emerges from it is an incipient historical regional representation of agricultural intensification which emphasizes wet strategies over dry rather than a detailed holistic examination of simultaneously present and interdependent agricultural processes in this region.

In rather broad strokes Morrison outlines the progression of wet and wet-cum-dry agriculture using ethnobotanical data, historical references, and the presence of agricultural features. Although she draws from several historical sources, she indicates that the preponderance of her references were derived from "inscriptions" most commonly associated with temples. The apparent bias in these records seems to privilege wet and wet-cum-dry agriculture because of the temple's involvement in coordinating these activities. According to Morrison there is a paucity of historical references to dry agriculture in general. She does not speculate as to why this might be the case. Without many historical data and with only planned archaeological investigation, Morrison's discussion of dry-agricultural intensification is limited to documenting the mere presence of dry-agricultural features without unraveling the changes that might have taken place. Given the fact that Vijayanagara is located in a semiarid region where dry-agricultural grains were significant components of subsistence, the lack of substantive data or even speculation about intensification severely hampers Morrison's close analysis of the process of change in this area. If various agricultural strategies interconnect and to some degree influence each other, what impact did dry agriculture ultimately have on the process of intensification?

Morrison also criticizes Boserup's model for its reliance on decreasing fallow period as the single measure of intensification. As an alternative, she uses historical references and the presence of architectural structures to document the process of intensification. Her approach is an improvement over merely considering the fallow period, as it is amenable to quantification, but it is questionable that it really delivers an analysis that is sufficiently complex and detailed and accounts for the noted variability.

Morrison concludes that the course of agricultural change in South India "was complex and internally dif-

ferentiated, involving the coordination of multiple scales and strategies of production." This coordination of agricultural change also seems problematic. Although she notes that "decision making took place at a number of different levels," she suggests that coordination of change fell primarily to the leaders of temples. As landowners, the temples had pivotal roles in agricultural production, constructing and maintaining agricultural facilities. The temples accepted gifts from people which were invested in agricultural infrastructure located in a variety of environmental contexts. In return, the temples provided raw or sacred foods. Morrison implies that the course of agricultural development was coordinated by the temples to create a functioning system of diverse productive strategies.

However, it would seem that the process of agricultural change over several centuries would result not from the coordinating efforts of collectives such as temples but from the action of individuals. It is the sum or accumulation of individual actions that molds the process of change. Different groups of people can differentially affect the process of change through a number of ideological or material means, but it is a discussion of this complex social and political context that is missing from Morrison's analysis. It is possible that the establishment of agricultural resources such as irrigation canals or wet fields provided opportunities for certain individuals to control or influence the action of others. In response, people could have considered alternative subsistence strategies such as dry-land agriculture, which would have somewhat mitigated the control of the temples. The result of these complex political maneuvers would have been the development of a diverse agricultural system that had obvious selective advantages for participants in terms of resource buffering and access to a variety of resources. Despite these omissions, Morrison's critique of prevailing analytical modes for agricultural intensification is insightful, as is her attention to the significance of agricultural change and the process of intensification.

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Morrison presents some very interesting results. The South Indian evidence of a complex history of land use in a precolonial state context has parallels in other parts of the Old World. Irrigated agriculture *combined* with less intensive food production techniques has been discussed regarding, for example, Cambodia during the time of Angkor (Bronson 1978) and ancient Mesopotamia (Adams 1981). In Sri Lanka the epigraphical record mentions swidden produce in periods with highly developed irrigated agriculture (Siriweera 1978, Gunawardana 1971). That Sri Lankan monks ate not just wet rice is indicated by inscriptions in, for example, the Sigiriya region during the 9th and 10th centuries A.D. (Ranawella 1984:206, 207). There was, then, parallel to the use of some of the premodern world's most developed irrigation systems, not only the production of swidden crops but also the appropriation of the same.

Moreover, swidden techniques might be used in radically different economic and social contexts. In Sri Lanka four swidden regimes are discernible from epigraphical and literary sources, the topographical literature, and modern ethnographic and human geographical research. Because of the lack of palaeobotanic field research and rural settlement studies, there is as yet no chronological control. "Yesterday" (probably since at least the 17th century) and partly today, a household-based subsistence-oriented swidden regime was characterized by mixed cropping in the swidden field, combined with other food procurement activities such as hunting and trapping, the collection of wild plants, fruits, and berries, and honey collection. Wet-rice cultivation forms part of the seasonal round for peasants who dispose of land below a locally based tank in years when there is sufficient water in the tank. Land-use patterns are in a state of flux, the importance of swidden and wet-rice cultivation respectively varying with, among other factors, the availability of water in a given year (Myrdal-Runebjer 1994). The 9th- and 10th-century swidden crops mentioned above might have been grown within a similar context.

Morrison suggests that "the opportunities open to different producers and their strategies, even in one small region over a relatively short time, varied widely." There is much evidence to support this suggestion. One example is the observation made in Sri Lanka by Robert Knox in the 17th century: "yet all have not watered Land enough for their needs, that is, such Land as good Rice requires to grow in; so that such are fain to sow on dry Land, and Till other mens fields for a subsistence" (Knox 1981[1681]:167). Inscriptions mention sugarcane, sesame, and cotton as important swidden field crops, each the basis of an important cottage industry, during the time of the dry-zone civilization (Siriweera 1990:144–45). We do not know how the work in such swidden fields was organized. After the large-scale irrigation structures fell into disuse, references to such swidden crops ceased.

An expanding frontier situation might be indicated by the swidden place-names studied by Gelbert (1988). A tentative linguistic dating indicates that this expansion took place at the earliest in the 14th century and ended no later than the 18th or early 19th century (1988:38–39). It covered much of the wet zone as well. In these areas crops which constituted important export items from the end of the 15th century A.D. were grown (Siriweera 1978). Whether the expanding swidden frontier contributed to this development is not yet known. Today there is an increase in cash-crop cultivation in swidden fields over large parts of the dry zone. Parallel to this development an increase in wage labour on swidden fields has been observed (Gelbert 1988). The basic technique of clearing temporary fields by fire is the same, however.

Similarities in the organization of swidden cultivation and its related food procurement activities may be ob-

served in historically and geographically dispersed swidden communities such as the Finnish swidden rye-cultivating settlers in 19th-century Sweden, the Lamet swidden peasants in South-East Asia in the 1940s (Izikowitz 1951:182–83), the Bembas of north-eastern Zambia in the 1980s (Stromgaard 1985:79), and the 20th-century swidden cultivators of Sri Lanka (Myrdal-Runebjer 1994:256, 261: Myrdal-Runebjer and Yasapala 1994:264–73). For example, they all faced a particular material complication (animals' eating what men cultivate) and used this complication to create a nutritional potential (what men cultivates lures animals into man-made traps around or within the swidden field).

Viewing not only the technique itself but the entire seasonal round from a household perspective, each of these swidden cultivating communities obviously faced a specific historically given and changing situation of external relations. The Finnish settlers, for example, are also seen to have been in the forefront in Sweden in exploiting the forest by cutting timber for sale (Bladh 1995:272–73, 347–48); the Sri Lankan swidden cultivators of our study area are now mostly protecting cash crops when they construct the *habaka* (deadfall), the *uladamilla* (fixed wooden spear), or the *rila ugula* (monkey trap) (Myrdal-Runebjer and Yasapala 1994:267–73; Myrdal-Runebjer 1994:255).

Thus there is much evidence to encourage studies of specific historical processes involving not only land use but also the social relations associated with production processes.

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Boserup's *Conditions of Agricultural Growth* argued that population drives both levels of production per space/time unit and productive technology, reversing the view held by scholars at the time (and still held by much of the public). It was clearly a general model. General models are salient and simplified. By their nature, they are not good at explaining the rich details of particular cases, but they are the only way we have of making sense of broad patterns across cases.

There has been an outpouring of productive scholarship pursuant to Boserup's original book. The concept of intensification has been redefined, divided, and implemented in various ways (Turner and Doolittle 1978, Turner, Hanham, and Portararo 1977, Stone, Stone, and Netting 1995, Stone 1966*a*) and repeatedly tested at various scales (examples below). The model's limitations and assumptions have been explored (Cowgill 1975; Bronson 1972, 1975; Grigg 1979); countercases have been presented (Padoch 1985, Erickson 1993), and the model has been altered accordingly (Stone 1996*a*). There have been many studies of diversity within farming systems (Netting 1968, Brush 1977). Scholars have analyzed the effects of factors Boserup originally held constant, such as market incentives (Smith 1975, Boserup 1990), trade (Price 1977), tribute and tax demands (Steponaitis 1981), social production (Brookfield 1972, 1984), risk minimization (Wilk 1985, Nichols 1987), and environment (Stone 1996*a*). Following early critiques of Boserup's overemphasis on fallow shortening (Bronson 1972), there has been considerable research on other aspects of agricultural change, including irrigation (Doolittle 1990), raised fields (Denevan and Turner 1974), and labor scheduling (Stone, Netting, and Stone 1990). Boserupian intensification has been fit into larger models of economic change (Robinson and Schutjer 1984, Lee 1986). Divergent responses to population pressure have been explored (Grigg 1980, Stone 1993); I agree that this is a key topic for further work not just on specialization and diversification but also on other strategies such as abandonment (Stone 1996*a*) and intimidation (Stone 1996*b*).

There is a rich literature and much current research going "beyond Boserup" (of which I have cited only a fraction); still, the latest syntheses find it invaluable as a general framework (Netting 1993, Kates, Hyden, and Turner 1993*b*, Wiggins 1995). It is not easy to reconcile this body of scholarship with so dismissive an attack as Morrison's. It is also worth asking how a case study, which offers neither the demographic measurements needed to test Boserup's model nor an alternative explanatory model, moves us "beyond."

Her attack consists of three basic claims: (1) that Boserup's model is an evolutionary stage scheme comparable to Morgan's scale of savagery to civilization, (2) that the model is not supported by historical studies and has been invalidly tested in comparative studies, and (3) that it mischaracterizes agriculture by lumping diverse strategies. Let us look at these in turn.

Boserup as an obligate evolutionist. The claim is that Boserup's model is necessarily "a totalizing perspective on social and economic transformation." Morrison's case is overstated. Boserup did discuss sexual division of labor in a later book, but her main concern was with the effects of capitalist development, and most uses of Boserup's intensification model have omitted it. She has little material on social and political organization, and in fact *her version of intensification has been shown to crosscut levels of sociopolitical complexity* (Netting 1990). Boserup (1965) does discuss land tenure, but she treats it as a matter of population and land-use intensity as opposed to evolutionary progression. In this it is more of an *antidote* to the evolutionary schemes of Marx and Morgan than "one more example of a progressive, stepwise classification of cultural types." Her case for tenure's being linked to agricultural regime rather than evolutionary stages has been supported empirically (Brown and Podolefsky 1976, Guillet 1981, Netting 1993).

Before readers accept the characterization of "Boserup's unilineal scheme of gradually decreasing fallow length" they should see Boserup's section on effects of population decline and rapid population growth (1965:62–64). Before they accept that the model is dependent on discrete stages they should consider the tests listed below, virtually all of which treat intensification as a continuous variable.

The Boserup model is unsupported. General models

like those of Freud on the psyche and Frederick Jackson Turner on the frontier do not lend themselves to testing; others, such as those of concentric land use, demographic transition theory, and intensification, do. Boserup's argument that farmers intensify when population increases and extensify when population decreases can be tested by comparing population and agriculture both diachronically and synchronically. In contrast to demographic transition theory, which turned out to fit the relevant data very poorly (Abernethy 1995), Boserup's model has done extraordinarily well. A fraction of the analyses supporting it include cross-cultural statistical studies (Turner, Hanham, and Portararo 1977, Brown and Podolefsky 1977), controlled comparisons (Lagemann 1977, Netting 1969), overviews (Gleave and White 1969, Pingali, Bigot, and Binswanger 1987), and collections of case studies (Turner, Hyden, and Kates 1993, Wiggins 1995). There is no shortage of historical studies of population and agricultural change that fit the Boserupian framework (Hanks 1972, Netting 1981, Huang 1990); the recent, comprehensive, historically grounded examination of intensification cited by Morrison (Netting 1993) provided a ringing endorsement of Boserup's general model.

Such studies consistently show residual variation, reflecting that there are other factors at work (of course) and that there is much to be learned. Yet they constitute a body of evidence that is a real challenge to explain away. This challenge is not met by the suggestion that the studies are rigged so that "failed attempts to intensify are simply defined out of existence"; how could this be true, given that the studies all show residual variation? Nor is it met by the claim that the tests falsely equate extensive farmers with "early ancestors"; some of the evidence comes from cases of population decline (Boserup 1965:62; Stone 1996*a*).

"Clinging to life"? I do not know of any *general* model that has been so thoroughly tested and held up so well.

Boserup mischaracterizes agriculture, falsely homogenizing diverse strategies into an invalid scale of intensification. This misunderstands the role of models at different levels of generality. General models always categorize, and categorization conflates differences, or homogenizes, as compared with case studies. As a case study, the Kofyar in their crowded homeland were a well-documented example of diverse cropping strategies (Netting 1968), but in a more general sense they were clearly "intensive farmers" and as such fit into a broad pattern described by Boserup. Boserupian intensification conflates variability just as the concept of *forest* conflates variability among trees.

The issue is what one wants to model, not a matter of "false" homogenizations. If the alternative is "true" homogenizations, examples would have been helpful; if it is no homogenization at all, then all general theorists are in trouble. After all, Morrison's quarrels with Boserup's generality are applicable to Marx: manifestly evolutionary, with "totalizing" stages which do not fit the data very well, popular among archaeologists who like to reconstruct whole societies in a single bound, based on problematic concepts such as *Produktivkräfte*, conflating vital kinds of variability into coarse categories such as "proletariat," and possessed of political underpinnings. Should we dismiss it or build on it? Generations of scholars have chosen the latter, while acknowledging the value of the seminal work.

Boserup's model is obviously more modest than Marx's, but the scholarship built on it has been valuable. I submit that we move "beyond" general models by improving or replacing them rather than attacking them for being general.

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I am very much in sympathy with the goals of this paper and find the data on Vijayanagara fascinating. I am left, though, wondering how far beyond Boserup the author really takes us. Though promised a revolution in the introduction, by the end of the paper I feel fobbed off with some friendly amendments to the existing laws.

Part of my confusion grows from the multiple targets Morrison is aiming at. Sometimes it is hard to tell if the problem is Boserup's own work, that of the archaeologists who oversimplify and misuse it, or even the epistemological basis for all grand models of cultural evolution. There is also a familiar tension between the twin anthropological goals of illuminating particular cases and building general and processual models on a comparative basis.

Morrison's critique of the Orientalist foundations of neoevolutionism in archaeology (and sociocultural anthropology) is, if anything, understated. The past 20 years of revelations on the highly politicized nature of Western images of "the other," the way time is used to create distance, the essentialization of cultural difference, and the invention of tradition seem to have made very little impression on the actual practice of archaeology. Now that the descendants of ancient peoples are no longer quiescent and are even contesting the right of archaeologists to control their past, we should be looking even more closely at the devices we use to exoticize, classify, compare, and rank the peoples of the world.

This is why it is a bit ironic that Boserup should draw so much ire. As Morrison points out, many anthropologists originally welcomed Boserup's scheme because rather than ordering agricultural systems from "primitive" to "modern" it demonstrated the great sophistication and efficiency of techniques that were (and still are) often dismissed as survivals from the distant past. In the hands of Netting, Spooner, and others, Boserup's work forms the basis for many antievolutionary arguments—for an appreciation of the ingenuity, creativity, and sustainability of nonmechanized production systems. Yes, some archaeologists have absorbed the notion of agricultural intensification into the same old progress model, but other anthropologists have found Boserup a useful beginning point for discussing specialization, diversification, and risk reduction, just as Morrison does in this paper.

I suppose I am asking for some caution in blaming Boserup herself for the things that other people have done to her. In my work on modern and ancient Maya agriculture I used Boserup's variables and methods to show how population pressure *or* increased demand could lead to agricultural diversification and how some kinds of intensification were intended to extend seasonality, reduce risk, and fill slack periods rather than simply increase yields (Wilk 1991). Projecting it to the Maya past, I used Boserup's own logic to predict that short-fallow permanent cropping *preceded* long-fallow swiddening (Wilks 1985). Later, Boserup's model was also used to challenge my conclusions because she considered a long-fallow system always less intensive than a short-fallow one. The point is that we can use Boserup's work as dogma or we can use it as a provocative basis for thinking about the dynamics of agricultural change—but we shouldn't blame her for our choice!

There is a more fundamental critique of Boserup's work missing from this paper. Her model was popular partially because it offered some cause for optimism in the face of massive population growth in the developing world on a limited land base. Malthus and the doomsayers of the Club of Rome predicted that India would reach carrying capacity, starve, and die. Boserup told us that it would develop better technologies, invest in the land, work harder, and survive. As Netting (1993) points out, world history seems to support Boserup. At the same time, Boserup made some very dangerous assumptions about the capacity of technology to solve the problems of increasing population growth and limited resources. She seems far too optimistic about technology, especially since so little of it is generated and controlled by farmers anymore. Instead, agricultural innovation and marketing are increasingly in the hands of industrial behemoths, and the intricate fabric of rural social life that sustains the marvelous complexity and diversity of local production systems seems terribly vulnerable to governments and globalized markets.

Morrison's paper demonstrates more of the provocative strengths of Boserup's work than of its substantive or evolutionary weaknesses. Her data on the early intensification of Vijayanagara agriculture and its subsequent diversification can certainly be fit into Boserup's rational-choice model. In any case, it is never quite clear what alternative is being offered. Before I throw out the baby with the bathwater, I would like a clearer idea of what I am going to get in return.

Reply

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I thank all of the commentators for taking the time to respond to this paper. Feinman and Nicholas note that their temporally deep and spatially broad studies in Oaxaca have also identified difficulties with the Boserup sequence of change and with her theoretical stance. Given my focus in this paper on long-term courses of change and on process, this is good to hear. I am also gratified to note their insistence that issues of scale are critically important. After all, if we aim for understanding (perhaps explanation) at one scale or set of scales, what use is a perspective that cannot inform on that scale? Finally, Feinman and Nicholas seem to concur that cropping length and its proposed sequence lie at the heart of Boserup's conceptual framework and that, although they are difficult to investigate either archaeologically or historically, actual courses of change in cropping strategies constitute an important arena for the evaluation of Boserup's model *as a historical sequence.*

I am not certain what Ladefoged means when he writes, "What emerges from [the analysis] is an incipient historical regional representation of agricultural intensification which emphasizes wet productive strategies over dry rather than a detailed holistic examination of simultaneously present and interdependent agricultural processes in this region." Indeed, one of my major points has to do with the coexistence and interdependence of different "forms" of agriculture in the Vijayanagara region. In particular, I point out that these are not sequential; indeed, I suggest that diversity may itself be a critical component of economic strategies. I also point out—and unfortunately there was no room to elaborate this point (see Morrison 1994*c*, 1995)—that not all individuals had equal access to all strategies of production. Agricultural possibilities are keyed to power relations as well as to demographic and ecological parameters (and see Feinman and Nicholas's comments on political power and political action, above).

Perhaps I also did not make it sufficiently clear that, notwithstanding its low profile historically, dry agriculture was extremely important in all periods of Vijayanagara history, as indeed it is today in this region. Ladefoged asks why there are so few references to dry farming in the inscriptional literature. In fact, in a database of 1,610 Vijayanagara-period inscriptions from the northern part of the empire, closest to the capital city (for a more detailed discussion of this corpus of texts, see Morrison 1995; Morrison and Lycett 1994, n.d.), there are 19 references that clearly refer to dry fields or dry lands. Of these, 5 occur as primary gifts in references related to prestation and 14 as secondary gifts. In 12 of those 14 cases, the primary gift was a gift of wet land. Wet and dry land, in these instances, go together, as they do in many other references to, for example, land below a reservoir (Morrison 1993, 1995). In contrast, in this same body of texts there are 62 gifts of wet land, a figure that does not include references to land below reservoirs or canals, which could also be fit into this category. Of these 62 gifts of wet land, 36 occur as the first-mentioned gift and 26 as the secondary gift.

Does this constitute an underrepresentation of dry farming? Yes. Archaeological data make it clear that dry fields covered a much larger area than wet or perhaps even wet-cum-dry fields. Why this underrepresentation?

I suggest that it is because dry agriculture was associated with (poorer, less powerful) people who were not integrated into networks of prestation in ways that gave them a voice. That is, they tended not to commission inscriptions, nor were they (visibly) closely involved in the kinds of transactions recorded in inscriptions (see Morrison 1994*c* for an important qualification to this statement). The fact is, dry agriculture is very difficult to study. The interested reader may refer to my more detailed descriptions of dry-agricultural facilities and features and closer discussions of weed flora in the pollen record (1991, 1995) and may look forward to an extended archaeological, botanical, and historical treatment of dry and wet-cum-dry agriculture in the Daroji Valley, a dry region south of the area discussed in this paper, that is now in preparation. Finally, excavations carried out by the Vijayanagara Metropolitan Survey in 1996 concentrated on VMS-133, a large dry-land terrace system. Botanical and sedimentary data from these excavations and from additional excavations in a variety of agricultural contexts planned for 1997 may help us address the specifics of dry farming in more detail. All of this may add some substance to what I assert here—that dry farming was always present, that it never disappeared, and that it was not a stage in a progression from dry to wet or from extensive to intensive agriculture.

Another misreading of the text seems to come from my use of the word "coordination" (referring to interconnection of forms of agriculture and the implications of changes in one for others; Ladefoged's "interdependence"), which Ladefoged somehow transforms into a suggestion that I attribute coordination of change to leaders of temples. This is quite incorrect. Temples were indeed landowners, but they were not the only ones. Even on their own lands, it is not clear that temples exercised close control over the actual daily decisions made by farmers. Ladefoged reads my discussion of Vijayanagara agricultural production as being much more structured or planned overall than I suspect it was. Temples did not have some grand design to create diversity; in any case, they were only one part of the overall agricultural "scene."

I am puzzled that Ladefoged feels the need to contrast individual action with the actions of temples, which he calls "collectives." Temples were, of course, run by individuals, who did not always agree and who both cooperated with and contested one another. Further, the culturally organized human beings who occupied what is now northern Karnataka between the 14th and 16th centuries could and did act both individually and collectively not only through temples but also through such bodies as households, caste organizations, armies, and so on.

I find Myrdal-Runebjer's comments particularly interesting, since she has been working on similar issues in precolonial Sri Lanka, and this may provide some of the more comparative context that Feinman and Nicholas were hoping for but that could not be addressed in this paper. In particular, she is working on bringing together archaeological, palaeobotanical, and historical data, as I have tried to do, and this congruence of effort should help facilitate critical evaluation of both methods and empirical patterns.

Stone, who, together with Netting and others, has consistently been a strong supporter of Boserup's work, provides the harshest assessment of this paper. Much of the critique, however, relates not to the substance or to the point of my paper but to the seemingly inevitable "population" debate that surrounds any discussion of Boserup's work. Before I address Stone's comments, I must say that I am always bothered by the suggestion that I have not given Boserup her due or her rightful place in history. Indeed, if I may be permitted a brief autobiographical aside, it was exposure to Boserup's work in an undergraduate class that first made me want to be an anthropologist, so I, too, can lay claim to deriving inspiration from her scholarship. At the same time, however sentimental we may feel about it, I fail to see anything wrong with dissecting either the conceptual structure of the argument or its congruence with sequences of actual historical change and rejecting either if it fails to further our understanding of the process of intensification.

Stone's characterization of my paper as "dismissive" of Boserup's work and that of her followers seems rather overstated, particularly in light of a previous paper (Morrison 1994*a*) which devoted considerable attention to aspects of the Boserup model, in that case to issues of cause and structure as well as process and sequence. In that paper—and I am willing to say it again here—I suggested that those who would dismiss out of hand the relevance of human population dynamics to social and economic process were misguided and that, while demographic and ecological contexts of human action are complex and are themselves often partially created by humans, Boserup's attention to the interconnection between population dynamics and agricultural change was indeed a major contribution (and see Morrison 1995). If we have to cast the argument as Malthus versus Boserup, I'll take Boserup every time. Humans, at least most of them, somehow find a way to make a living. We do not, however, have to cast the argument that way and can certainly do better than this simple opposition. In this previous paper (1994*a*) I pointed out that even where the population-intensification debate has faded away, there are elements of Boserup's work that have been absorbed into general progressive models of stepwise cultural evolution. The postulated sequence from forest fallow to bush fallow to annual cropping is one of those elements (here, of course, I go farther in suggesting that Boserup's overall conceptual scheme is itself an example of a cultural-evolutionary model). Evaluating that sequence against data would hardly seem to constitute dismissing the work of Boserup or her admirers.

There is a more fundamental difficulty with Stone's response to my paper. As I have noted, this is *not* a paper about the relationship between intensification and population. It is not a paper about the causes of intensification. In it I consider issues of process and sequence. I ask if we can accept the reconstructed logic of Boserup's

evolutionary scheme, which was constructed by substituting space (contemporaneous variability) for time (change through time). This paper is meant to consider *how* rather than *why*. Here I think Stone himself may be dismissive of the corpus of Boserup's scholarship, seeing it only in terms of a single posited causal relationship and not as a larger, ambitious theoretical scheme.

Although I tried to make this point clear in the paper, I might say once again that I am concerned here not with the demographic question but with, first of all, the logic of Boserup's argument as an intellectual program and, second, Boserup's postulated sequence of change and its relationship to actual trajectories of intensification. Obviously I have presented information on only one trajectory here, and it would be better to have more examples. I do not "test" Boserup's model in the sense Stone expects; there are no demographic data because this "test" is about the *course* of change and not immediately about cause at all. I certainly expect that close attention to process will ultimately help us frame causal issues more intelligently, but that is not my program here. It always strikes me as interesting that those working on long-term sequences of change, either archaeological or historical, seem to have more difficulty with Boserup's quasi-historical sequence of fallow periods and their associated traits than those working with contemporary groups. Certainly it is not possible to evaluate a proposed series of stages or phases such as Boserup's fallow-period stages without recourse to long-term history, given the claims made in such proposals about historical progression.

On to specifics: I am a little confused by Stone's discussion of Boserup as an obligate evolutionist. On the one hand he notes that Boserup treats land tenure "as a matter of population and land-use intensity as opposed to evolutionary progression." By "matter of" I assume he means "determined by."[1] If land tenure is determined by population and land-use intensity, which are themselves arranged in an evolutionary progression (a reversible one, to be sure), then how is it that they are not conceived as part of this progression?

Stone also notes that although Boserup did discuss the sexual division of labor in a later book (1970, in which gendered labor relations are linked to particular packages of fallow length, land tenure, population density, technology, and so on), "most uses of Boserup's intensification model have omitted it." Nevertheless, the argument is out there and is a coherent aspect of the intellectual program. If it is not fair of me to conflate Boserup's own work with that of "archaeologists who oversimplify and misuse it" (Wilk, above), then it is equally backhanded to try and prop up the Boserup scheme by pointing to the work of scholars who have modified and improved it. Stone cites a number of references to the work of Boserup's more vocal supporters (see Morrison 1994*a* for discussion of many of these same sources), but it should be noted that there is an equal number of detractors (again, see Morrison 1994*a* and comments by Feinman and Nicholas, above, among others). Rather than get involved in citation wars, I would reiterate that most of these studies were concerned with the "population pressure" issue and few with courses of change.

Stone is quite right in pointing out that my critique would also apply to marxist totalizing stages. In fact, I drew such stages into my lists of such schemes with the explicit goal of including them in my critique. My not-so-hidden agenda in this paper is to ask anthropologists concerned with long-term change whether we really need these typological models of cultural evolution. Can we face the bewildering variety of past societies and the diverse paths of change without them? Can we discern process and regularity while still acknowledging historical contingency? Can we compare without constructing (or borrowing) totalizing categories that assume a priori both sequences of change and the configuration of "traits" at a given point in the process? My quarrel is not with general models as such or even the generality of Boserup's model; it is with the specific structure and the specific content of Boserup's evolutionary scheme. If variability in agricultural practice is analytically important in understanding change (and this is something that will have to be established rather than just assumed, although my position on it should be obvious), then any analytical scheme that obscures such variability *does* create a false homogeneity. "Truth" or "falsity" is of course a matter of scale, as Feinman and Nicholas also note, but issues of scale should be of critical importance in evaluating the utility of our general models. A model of a flat earth may be workable at some scales and not others, but it is also of note that it is just wrong as a way of describing the world.

I am glad that Wilk has raised the issue of the policy implications of Boserup's perspective, noting that the demographic optimism of her work makes dangerous assumptions about the capacity of technology to solve the problems of increasing population growth and limited resources. This is a serious concern. A Boserup-inspired social policy might indeed consign many people in the future to impoverishment, marginality, and hunger at the very least. Indeed, one also suspects that some people in the past faced a similar fate, even during (or perhaps especially during) periods in which the progressive model seems to "fit." This dangerous optimism Wilk identifies for future demographic growth may also be a

1. Boserup (1965), in a chapter entitled "Systems of Land Use as a Determinant of Land Tenure," described how "natural" (i.e., precolonial or noncolonial) systems of land tenure follow roughly the same basic pattern of development around the world (including that of precolonial Europe), so that there can be seen to be an "affinity between the European past and the Asian present" (Boserup 1965:77). Further, these patterns are keyed to particular systems of land use: "Undoubtedly, the similarity of tenure systems is to be explained by the fact that all native tenure systems are adapted to systems of land use and that these have developed along similar lines all over the world as explained in preceding chapters. The gradual development of more intensive agriculture, under the pressure of increasing population, was accompanied by the development of land tenure which was basically similar despite local variations in many points of detail" (Boserup 1965:78).

dangerous assumption to make about past demographic growth, that is, if we are similarly concerned about the fate of those on the margins. Boserup is often curiously reticent about issues of power, except in contrasting "natural" precolonial situations with the complications stemming from the imposition of colonial rule. This is a topic in itself, one that I expect to give more attention to in the future. All I can offer to Wilk in the way of feeble excuses for not discussing this important issue is, first, that I wanted to avoid the population albatross as much as possible in order to focus my attention on process and on trajectories of intensification and, second, that I was hesitant as an archaeologist to step out from the safety of the past and face the dangers of prognostication.

Wilk correctly notes the multiplicity of targets (at least he doesn't say windmills) at which I aim in this paper (Boserup's own work, archaeological use and misuse of it, and typological models of cultural evolution), targets that I conceive as being closely linked. It may be, to extend his metaphor, that I have succeeded only in spraying a scatter of buckshot against these targets rather than in hitting a bull's-eye, but I at least want to throw out for discussion not the same old tired argument about population density and agricultural intensity but a different question about the nature and course(s) of change—to ask if it is possible to consider both process and contingency and, if so, how we can study both in contexts of long-term change.

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