

## Agricultural Intensification and Vijayanagara : An Overview

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In this paper I would like to present a brief overview of some issues surrounding the study of agricultural change and, in particular, of the process of agricultural intensification. Archaeologists have been enthusiastic participants in debates about the causes and consequences of productive intensification, particularly in the context of agricultural origins and of the beginnings of urban society, but we have been largely silent in discussing *how* intensification proceeds. In part, this lack of interest in the course of change may stem from a feeling that the route of intensification is already known, and can be easily measured in terms of fallow periods or an energetic analysis of labour investment (for a more extensive discussion of these issues see Morrison 1992). The hegemonic Boserupian view (Boserup 1964; Cohen 1977) is certainly at issue here, but even more relevant is the working assumption of many archaeologists that a named process such as intensification is, first of all, a single phenomenon, and one which is similar in all cases — this is, after all, why it is labelled as a process — and second, that it is a strategy of whole societies. I cannot fully address all of these contentions here, but I would like to demonstrate in a small way that these assumptions about the course of intensification do not hold up in one case study from southern India, in and around the city of Vijayanagara.

I suggest, instead, that the course of intensification is complex and highly internally diverse, consisting of multiple strategies of production which can be flexibly employed and combined. Further, the path of intensification seems to be, to a large extent, contextually and historically specific. Finally, in complex societies, we cannot really support a notion that production may be understood primarily in terms of group, or societal pushes, pulls or goals. In agricultural production, many different individuals and groups are involved, directly or not, in the productive process, and power, access to land, labour, resources and knowledge are rarely evenly distributed. Thus, resource imbalances

or demands for surplus, while very real, are not factors or forces which affect all producers similarly. Thus, it will not be surprising to find multiple strategies employed within a single agricultural system, and multiple strategies for change.

### **Intensification**

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 expansion and intensification, a point to which I will return in discussing Vijayanagara land use. The process of intensification is itself also quite diverse, including what may be termed "intensification proper" (Kaiser and Voytek 1983), or the process by which the yield per unit of land and/or labour of an existing resource base is increased, as well as the allied processes of specialization and diversification.

Intensification proper may take the form of increased investments in practices such as ploughing, seed bed preparation, weeding, transplanting, manuring, or the construction of soil and water control facilities. Increased frequency of cropping, possibly facilitated by improved control over conditions of plant growth, is also one strategy of intensification proper.

Specialization, the channelling of resources and/or labour into more restricted channels (Kaiser and Voytek 1983; Tringham and Krstic 1990) is difficult to isolate analytically from intensification proper. Certainly Indian wet rice agriculture can be viewed as a specialized strategy—it entails very specific and labour intensive techniques of field preparation, irrigation, and drainage, and promotes major modification of soil structure.

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 labour. However, diversification implies an increase in the number of components of production, and potentially in the organization of that diversity. Strategies of diversification might not involve agricultural facilities at all, including, for example, the forging of ties and the creation of resource entitlements across regions (Breckenridge 1985).

I would argue that the course of agricultural change during the Vijayanagara period was, in fact, very complex, involving both expansion and intensification, and further that

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. In the region around Vijayanagara, intensification proper, as an option for change, may have been available only to certain producers. Two other strategies of intensification evident in the record, diversification and expansion, may have represented possibilities for a different, less privileged producers or groups of producers.

### **Vijayanagara**

I would like to discuss one particular case of agricultural intensification in southern India, in the region surrounding the large, pre-Colonial city of Vijayanagara. In attempting to chart the course of intensification through the Vijayanagara period, I have employed three different lines of evidence relating to Vijayanagara land use: analysis of fossil pollen and charcoal, archaeological survey, and historical records (Morrison 1992).

In the Vijayanagara area, rapid changes in population and political and economic organization in both the mid-14th and the early 16th century entailed dramatic restructuring of regional agriculture and land use. The city of Vijayanagara was the capital of an areally extensive empire which claimed hegemony over most of southern India between the 14th and 16th centuries A.D. The city itself probably contained somewhere between 300,000 and 500,000 people at its height in the early 16th century. Located along several trade routes, Vijayanagara was an important market city as well as a centre of government and a military outpost.

Vijayanagara is situated on the Karnataka plateau, a semi-arid region receiving a low and temporally variable rainfall of less than 500 millimetres per year. For this reason, and because almost all of the rain falls within three months of the year, productive agriculture in this region requires the use of fairly specialized agricultural strategies having to do with the control and storage of water (Kanitkar 1960).

The empire was built extraordinarily rapidly; large areas of southern India were claimed by Vijayanagara as early as the mid-14th century. But it was in the beginning of the 16th century that the tempo of political, demographic, and agricultural change in the Vijayanagara region, and in the empire, really increased. Large-scale population movements, sometimes of entire communities, were a feature of life in South India throughout the 16th century (Breckenridge 1985; Ludden 1985; Stein 1980). It is not quite clear what these

mean for the Vijayanagara region, but we do know that there was a major expansion of construction activity in the city at this time (Fritz, Michell and Nagaraja Rao 1985; Rajasekhara 1985), that many new settlements were founded around the city, and that several large temple complexes were built (Filliozat and Filliozat 1988). The early 16th century was also one of increased militarization, during which the size of the standing army probably increased (Stein 1980), and when attempts were made by several emperors to centralize control of the empire. In terms of agricultural production, 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.

The city of Vijayanagara has been fairly intensively studied, but the region surrounding the city, and in fact all non-urban areas in this time period, had never been investigated. The Vijayanagara Metropolitan Survey project represents an attempt to address this lack, by examining the content and spatial structure of the immediate productive and demographic hinterland of the city.<sup>1</sup> Although the project is still in progress, we have been able to isolate some very interesting patterns of land use, settlement, fortification, and transportation (Morrison and Sinopoli n.d.; Sinopoli and Morrison 1991).

## Pollen

The consequences of past land use, and of agricultural intensification should be visible in the record of regional vegetation, in the form of increases in the pollen of crops and field weeds, and decreases in trees and shrubs as agricultural land encroaches on forests and as the pressures of firewood collection and grazing increase. In order to study the vegetation history of the Vijayanagara region, I collected three cores from the stratified sediments of the 14th century Kamalapuram reservoir, located just to the south of the city. The pollen data are reported in detail in Morrison (1992; n.d.). The Kamalapuram pollen record extends from approximately the mid-14th century up to the 20th century, and is dominated by pollen from grasses and herbaceous species. Most food grains plants are grasses, and in general, grasses live in open or disturbed soils such as fields. The pollen record reveals a very high percentage of grasses in the vegetation early on. This proportion undergoes a long and sustained decline through time, with several rebounds in the more recent (Colonial and post-Independence) periods. This strong patterning seems to indicate that in the very early part of the sequence, perhaps the

1. Also see note 1 on p. 273

14th century, the agricultural landscape was grass-dominated, possibly a result of focus on grain production, and certainly indicating large-scale modification of vegetation. The pollen record in no way presents a picture of "natural" vegetation, but shows a long history of major human impact on the environment.

The pollen record appears to show at least two major periods of cultivation, the earlier in the Vijayanagara period, and the later probably in the Colonial period. There was a clear regeneration of trees and shrubs in the middle period, when agriculture was in decline and the reservoir became choked with aquatic vegetation. It may be significant that the later periods show relatively more trees than in 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 (Sewell 1900). The Vijayanagara and more recent agricultural landscapes were also somewhat differently structured with regard to non-grain cultigens. Coconuts (*Cocos nucifera*), in particular, are much more prominent in the recent periods. Although coconuts were grown in the Vijayanagara period, they clearly did not have the importance that they do today. What this seems to indicate is that Colonial and modern agriculture were much more focused on the production of cash crops and Vijayanagara agriculture on food grains. The record of microscopic charcoal in the Kamalapuram sediments closely follows the record of intensive agriculture, with the largest charcoal peaks occurring in the Vijayanagara and recent portions of the record (Morrison 1992).

### **Historical Data: Inscriptions**

The historical record of the Vijayanagara period has provided the basis for nearly all reconstructions of Vijayanagara history and society. However, it is not possible to discuss this large and important corpus of information here. Instead, I would like to present a few of the results of a quantitative analysis of Vijayanagara period inscriptions which inform on the tempo and distribution of grants relating to agricultural facilities. In a study of 1538 published inscriptions from 11 districts in Karnataka (Morrison 1992), the overall distribution of inscriptions was temporally bimodal (Fig. 1), with an initial peak in the 14th century coincident with the founding and early expansion of the city, and a later peak in the 16th century. The 14th century peak is less pronounced and is more temporally diffuse than the briefer but more intensive 16th century Vijayanagara inscriptional record.

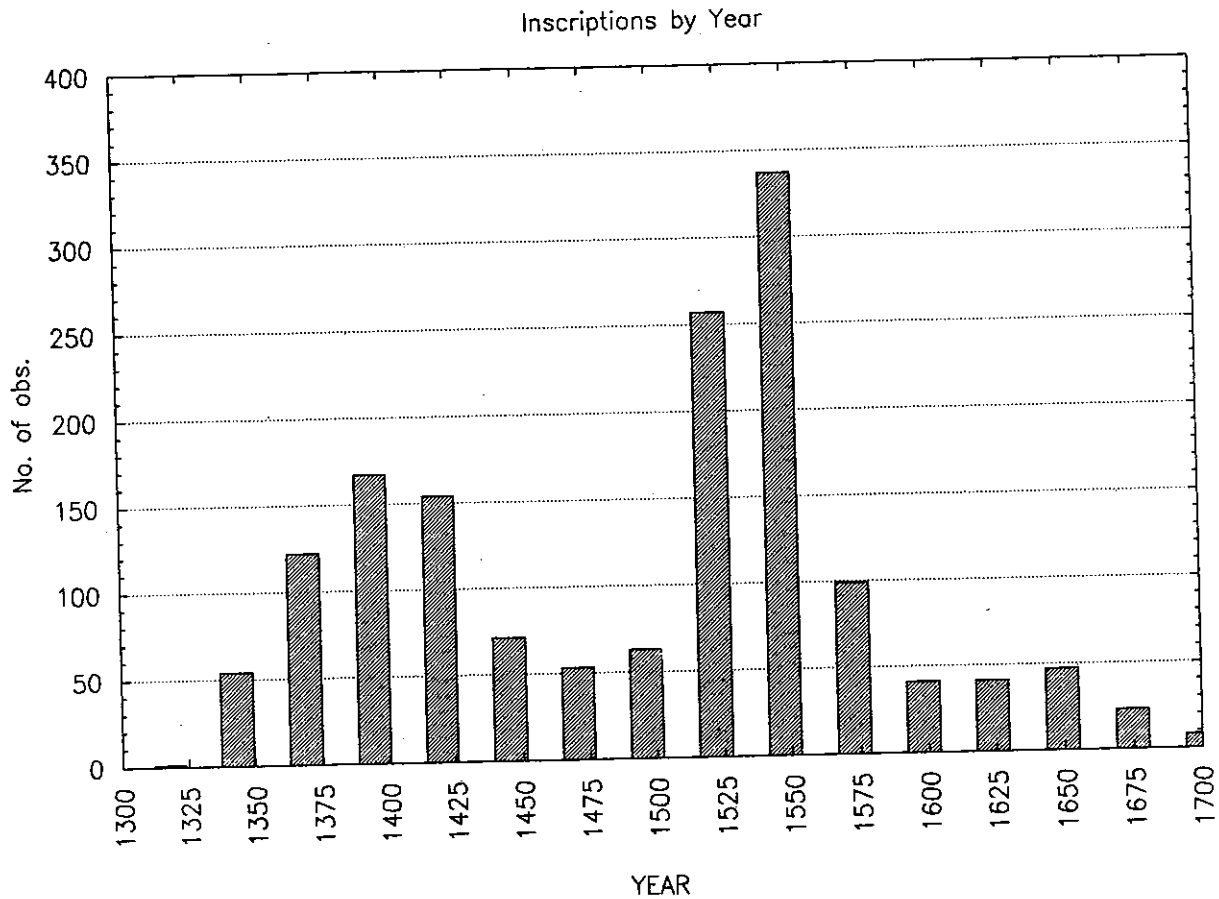


Fig. 1. Vijayanagara inscriptions : Overall temporal distribution.

Inscriptions were recorded for a variety of reasons, and they relate to a variety of topics. Notwithstanding their ritual-political context, however, Vijayanagara inscriptions also encode important economic and ecological information. Combined with analysis of regional archaeological patterns, inscriptions can provide data on the tempo of, for example, the construction of agricultural facilities. Fig. 2 shows the temporal distribution of inscriptions referring to the construction of reservoirs in all of the 11 districts of central and eastern Karnataka examined. The combined pattern is also bimodal, with the larger peak falling in the 14th century. When the data are disaggregated by district, however, a rather different pattern emerges (Fig. 3). Although the number of inscriptions is quite small, the pattern from Bellary District, in which the city of Vijayanagara was located, reveals references to reservoir construction clustered tightly together in the middle 16th

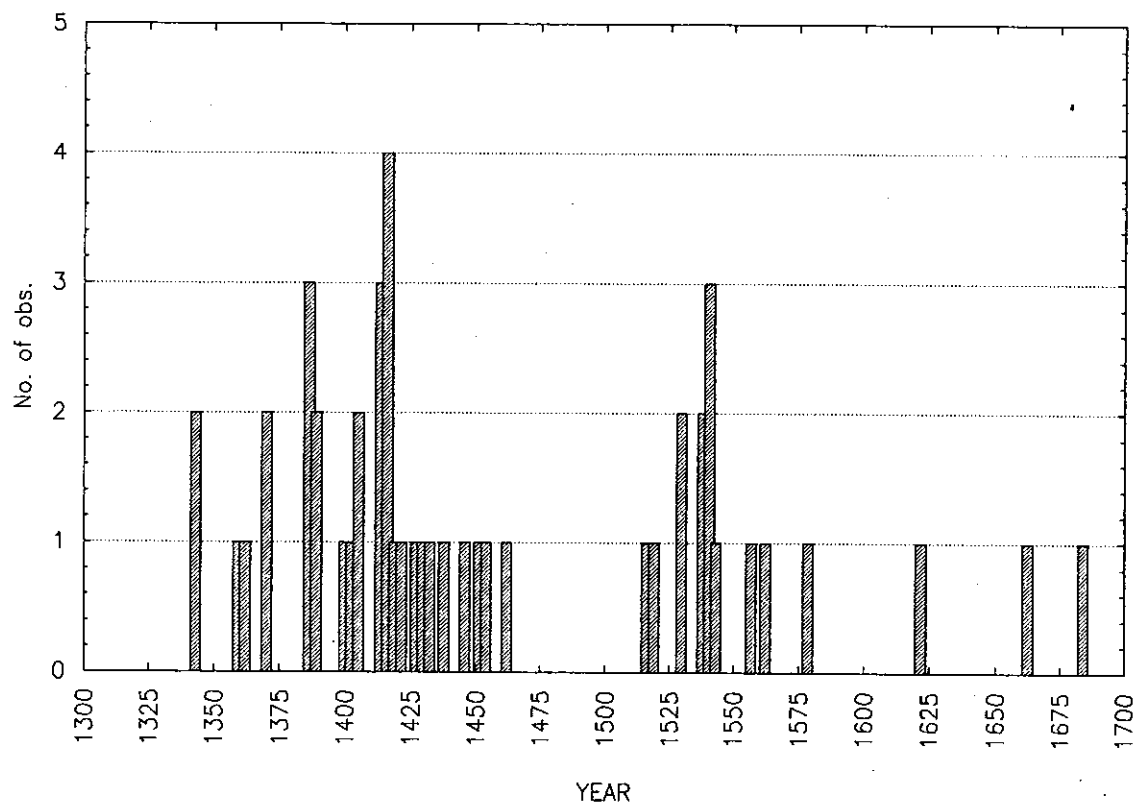


Fig. 2. Vijayanagara inscriptions referring to Reservoir Construction : All Districts.

century, a pattern seen in no other district containing more than two inscriptions. This late focus on reservoir construction is consistent with the archaeological data from the region, and points to the great importance of the city in structuring land use, and to the importance of reservoirs in the 16th century agricultural intensification of the survey area.

### Survey: Agricultural Production and Facilities

In discussing South Indian agriculture, it is common to draw a distinction between "wet" and "dry" cultivation, differentiated, as the terms suggest, on the basis of water availability. Thus, wet agriculture is based on perennial supply of water, while dry agriculture consists primarily of rainfall-dependent production. There is also a third form of production, "wet-cum-dry" cultivation, in which the water supply is seasonal, but does involve some form of water collection and storage facility. There are important implications of water supply not only for the type of crop grown, but also for the potential number of crops per year, and harvest security and consistency. There also exist relationships between these categories and the scale of production, the degree of

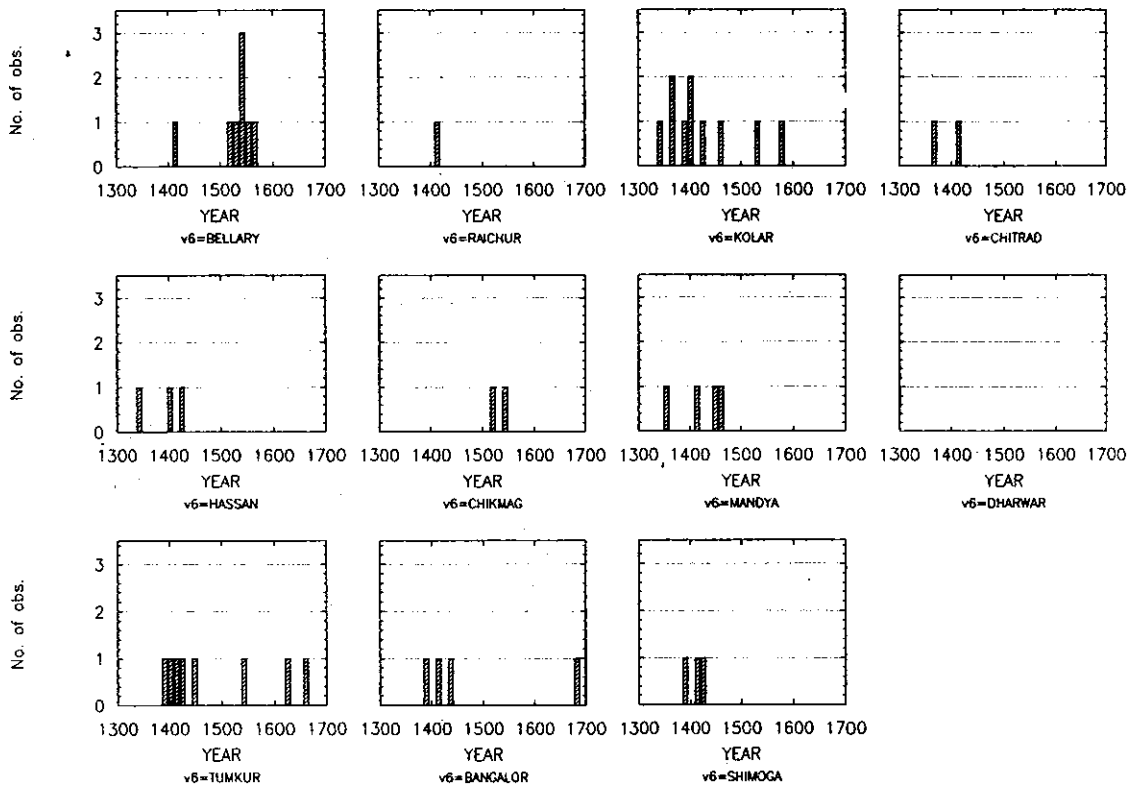


Fig. 3. Vijayanagara inscriptions referring to Reservoir Construction : by Districts.

investment and control exercised by non-cultivators, and the labour organization of the cultivators. Agricultural facilities in the survey area associated with each of these categories show the great range of diversity in productive strategies and scales in the region.

Wet crops such as paddy rice, sugarcane, and tree crops require a secure and abundant source of water, but with such a supply, they can yield multiple crops per year. However, wet agriculture is only possible with the aid of labour and capital intensive facilities such as canals, canal-fed reservoirs, and wells. The operation of these irrigation networks, such as the extensive Vijayanagara canal system, was complex, requiring considerable coordination and careful scheduling. Other "wet" agricultural facilities were associated with the canal network and include the Kamalapuram reservoir and a massive aquaduct, which carried water from a canal across the river to irrigate a large island.



The dates of these wet agricultural facilities are quite interesting. Several of the most "intensive" features of the entire agricultural landscape date to the early Vijayanagara period. The Kamalapuram reservoir was constructed in the mid-14th century, and several of the canals also date to the early Vijayanagara period. Wet agriculture was not exclusively the product of the 16th century intensification, but conformed to the general bimodal pattern of agricultural investment.

Dry crops include sorghum and millets, traditionally the most important food grains in the region. There are a wide range of agricultural facilities associated with dry farming, such as check-dams, gravel-mulched fields, and terraces. There is a much greater range of scale in dry facilities than in wet facilities, and dry agriculture covered a much larger area than did wet agriculture. The relatively small scale of dry farming facilities, their lack of inscriptional notice, and the scheduling demands of dry farming suggest that the organization or production of dry-farmed crops was quite different from that of irrigated crops.

It is difficult to trace the temporal development of dry farming because of the difficulty in dating features associated with dry farming. However, there are a few clues, such as the location of small settlements vis-a-vis the dry farmed areas, and the presence of physical links between dry facilities and other kinds of features. Although it is difficult to say for certain, dry farming strategies appear to have been present throughout the Vijayanagara period. A pattern which does emerge clearly, though, is the extensive degree of landscape modification and interconnection of features across the entire survey area (Morrison and Sinopoli 1992).

The third category, wet-cum-dry cultivation, is dependent upon seasonal sources of water, of which the most important are runoff-fed reservoirs, or tanks. Reservoirs capture seasonal runoff of the monsoons, impounding water within an earthen embankment, usually faced with masonry. There is a large range of variability in the size and degree of elaboration of reservoirs. Water reaches the fields through tunnels constructed underneath the embankment. The tunnels are regulated by sluices, which may be large and stylistically elaborate. Although they watered a large portion of the survey area, reservoirs are very uncertain sources of water; they may dry up completely in the dry season or in dry years, and yet require almost as much investment in construction and maintenance as canals. As noted, reservoirs, while they are certainly not new features of the Vijayanagara landscape, constituted an important form of intensification of regional agriculture in the 16th century.

If we were to sort these three categories - wet, dry, and wet-cum-dry - in terms of a measure of intensity, clearly wet agriculture would be the most intensive, both on the basis of continuous labour demands as well as productive potential, followed by wet-cum-dry, and then dry agriculture. What this ordering does not bring out, however, is the interdependence of the different types of production. There was no simple progression of types in the course of Vijayanagara intensification. Because decisions about agricultural strategies have consequences for all subsequent agriculturalists, we have to see the process of intensification as historically contingent. And in the case of Vijayanagara, 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 sixteenth century intensification.

### **Discussion**

The route of Vijayanagara intensification included intensification proper, diversification, and expansion. In terms of intensification proper, there was a (second) 16th century peak in the construction of canals and canal related facilities, facilities which allowed for labour intensive but highly productive wet agriculture. Also in the 16th century, there was a veritable explosion in reservoir construction, indicating a diversification of the agricultural landscape. The diversity of the Vijayanagara agricultural landscape is a very striking pattern, and one which is much more evident from the archaeological than the historical record. There exist a much larger number of facilities and a greater diversity of form than are indicated by inscriptions, suggesting that there were a number of productive strategies and scales in the Vijayanagara period which are historically "invisible."

Expansion is most clearly indicated in the historical record, particularly in grants of tax remissions for settlers who cleared new agricultural lands (Stein 1980). Archaeologically, we can see in the early 16th century a spatial expansion of settlement in the survey area (Morrison 1992).

I have tried to bring out in this discussion the complex and internally differentiated course of intensification. 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 path of this intensification was not a simple, unilinear progression of 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, and not precede, more labour and land extensive strategies such as dry farming. While strategies of intensification proper, including the construction of additional canals, were pursued in the 16th century, other, contemporaneous agricultural practices involved reservoir irrigation, at least some dry farming, and a spatial expansion in farming. Thus, the course of intensification was neither simple nor directed. The historical invisibility of dry farming suggests that elite groups and others whose activities are recorded in the historical record had little to do with dry facilities or farming. All of these elements taken together constitute Vijayanagara intensification, but it is only when this "single" process is taken apart that we can begin to see its workings.

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