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Shifting cultivators in South Asia: Expansion, marginalisation and specialisation over the long term

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ABSTRACT

This paper will consider alternative perspectives on the long-term history of shifting cultivation in India and Sri Lanka. Ethnographic and historical accounts of shifting cultivation, often by groups marginal to centres of urbanism and agrarian civilisation, are reviewed. Shifting cultivation persists in hill regions which are more marginal for sedentary, high intensity agriculture and state procurement of taxation. This can be considered as a strategy both to exploit more marginal lands and to avoid state domination. The origins of this historical equilibrium are hypothesized to lie with the expansion of later Neolithic agriculture (4000–3000 BP) and the development of hierarchical polities in the Indian plains in the Iron Age (mainly after 3000 BP). The archaeological record of early agriculture indicates that cultivation precedes sedentary villages, suggesting that shifting cultivation may have been a widespread economic system in the Neolithic, in both the Ganges Valley and the Deccan Plateau of South India. These areas are more suited to sedentary cultivation that could support higher population densities. Therefore, as populations grew in the Neolithic the economic system shifted to sedentary agriculture. The expansion of trade networks, hierarchical societies and demographic density pushed shifting cultivation practices into increasingly marginal settings, where this became an interdependent strategy. Specialist hunter–gatherers trading in forest products became an increasingly important aspect of forest exploitation as did cultivation of 'cash crop trees'. The potential to detect the effect of some of these processes in archaeological and palynological evidence is explored.

1. Introduction

Broad-brush classifications of shifting cultivation frequently refer to systems in which fields are abandoned after regular, short periods of cultivation (from a few months to a few years) in favour of new, previously uncultivated, areas of land. Shifting cultivation (or swidden) provides a system of cultivation which is land extensive and generally less labour intensive than fixed permanent field agriculture. It has often been associated with wetter tropical regions and hill zones remote from urban civilisations. Colonial and post-colonial governments, as well as their Medieval precursors, have usually taken a negative view of shifting cultivators. Perhaps, pragmatically, as they are harder to pin down in censuses, taxation and military recruitment, and have often been seen as destructive of forests (Guha, 1999; Scott, 2009). Indeed, Scott (2009) has recently characterised shifting cultivation in Southeast Asia as a fundamentally state-evasive economic and political strategy, a definition which can be equally applied to South Asia.

Ethnographic and development studies in Southeast Asia have shown that labour intensive lowland rice cultivation that has tended to support high population densities is less efficient in terms of labour return but more efficient in yields per unit of land (e.g. Barrau, 1962; Geertz, 1963; Boserup, 1965; Hanks, 1972; Spencer, 1966). From such observations shifting cultivation has often been characterised as more 'primitive' or ancient and prone to replacement by 'advanced' sedentary farmers. In addition, shifting cultivators tend to be 'tribes' with more egalitarian social structures than adjacent plains' polities. In the social evolutionary schemes of previous generations of anthropologists these were regarded as precursors for the hierarchical chiefdoms and states associated with sedentary, more intensive agriculture (e.g. Service, 1962; Sahlins, 1968; Johnson and Earle, 1987). However, this directional, historical hypothesis has been deconstructed in more recent anthropology on the basis of historical evidence, especially from southern China and Southeast Asia (see Scott, 2009). Rather, as Scott (2009) demonstrates for the hill zones of Southeast Asia

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which he dubs 'zomia,' being tribal and being a shifting cultivator has acted as a political strategy to avoid or escape heavy state demands for labour and taxation of agricultural produce (especially rice), at least over the past 1000 years or so. A similar situation can be read from the historical records of central and peninsular India (Guha, 1999). Swiddening tribes are thus only definable in relation (and opposition) to coexisting polities, rather than as the historical predecessors of polities. This raises the question of how both agricultural systems and the inter-relationship of a swiddening 'periphery' and a sedentary agricultural state 'core' began. In this paper, we review the ethnographic present of shifting cultivation in India and Sri Lanka. We then sketch our current understanding of the development of this mode of subsistence in relation to sedentary farming using available archaeological and palaeoecological evidence.

The role of prehistoric shifting cultivation provides a potential contrast between the early evolution of agricultural systems in South Asia and those in better studied temperate regions like Europe and China. From ethnographic observations in regions such as Southeast Asia, scenarios of socioeconomic evolution have been posited in which long-fallow, shifting systems (usually with hand tillage only) have been replaced by short-fallow, permanent field systems with more intensive methods (including irrigation, field system construction and animal drawn ploughs/ards). Such schemas have been widely deployed by prehistorians, often in the interpretation of prehistoric land use systems in temperate zones, from Britain (e.g. Childe, 1958; Barrett, 1994) to China (e.g. Chang, 1970,1986; Bray, 1986). Whilst in some areas of temperate forest slash-and-burn systems appear to have developed on the margins of richer soils and higher population density from the later Neolithic (Rosch, 1996), a role for shifting cultivation as an initial form of agriculture in Southwest Asia or Europe has been largely discredited through problem-oriented archaeobotanical research (Bogaard, 2002, 2005). The role of shifting cultivation in the early millet agriculture of China has also been critiqued (Ho, 1977), and it clearly played no part in the initial rice systems there that have been documented so far (Fuller and Qin, 2009). Therefore, it appears that early agricultural systems of the wet tropics can be contrasted with early agricultural systems of the sub-tropics and temperate zones to suggest two distinct agricultural developments: fixed-field systems, often focused on cereal crops in the non-tropics/sub-tropics and a tropical shifting cultivation inferred to precede more permanent field systems, often focused on vegeculture and arboriculture (e.g. in New Guinea: Denham, 2004, 2005; Denham and Haberle, 2008; or in the Neotropics: Piperno and Pearsall, 1998; Dickau, 2010).

Evidence from the South Asian subcontinent (including India and Sri Lanka) has rarely been examined within this context. We aim to provide a macro-regional distribution map of shifting cultivation traditions, and examine how the persistence of such systems in modern times is correlated with environmental zones, crop choices and linguistic affiliation. The purpose of the present paper is to outline the most likely history of shifting cultivation systems in the Indian subcontinent, and consider how the present day distribution of shifting cultivation in India and Sri Lanka is derived from the agricultural systems of prehistory. Based on archaeological data, in particular archaeobotany, we argue that contrary to other regions in which early grain crops were domesticated (such as Southwest Asia or China), Indian cereal cultivation was initially based on long-fallow, shifting systems and, unlike early swidden systems elsewhere in the tropics, was focused on cereal crops rather than vegeculture. Nevertheless, as more productive and intensive fixed cropping systems for grain developed in later prehistory, shifting cultivation moved onwards to less agriculturally productive zones, where it became a stable but fluctuating adaptation that interacted with the economies of the sedentary farming plains.

2. Situating shifting cultivators in India – ethnohistorical accounts and assumptions

There are three groups of people relevant to the discussion of shifting cultivation in India: hunter–gatherers, shifting/swidden agriculturalists and settled agriculturalists. Hunter–gatherers that live in the hills of India have been the subject of stigma in the past but are now considered by anthropologists and historians as fundamental parts of the economic trade systems of past and present India (see Morrison, 2002), responsible for the collection and distribution of low-bulk high-value forest produce, e.g. honey and spices. For most of these 'forager-traders' of South Asia it is unlikely that they come from "pristine" traditions of hunting-and-gathering dating to before the Neolithic, as they are enmeshed in relationships of exchange with cultivators involving the importation of crop produce (Kennedy and Possehl, 1979; Kennedy, 2000; Lukacs, 2002; Morrison, 2002). From the perspective of settled agriculturalists and townsfolk of the plains, hunter–gatherers and swidden cultivators have often been grouped together as "tribals" or "hill peoples" (e.g. Singh, 1994a). Since the colonial era the term "tribe" in India has come to be politically and legally defined as a minority ethnic group that falls outside (and usually below) the traditional caste hierarchy of the towns and villages of the plains. Settled agriculturalists have, conversely, been traditionally regarded as 'advanced', intensive, lowland crop farmers, and are divided on the basis of conventional agricultural geography into three regional groups (Fig. 2): irrigated rice farmers of the northern Gangetic plains and peninsular coastal zones; sorghum and millet farmers of the peninsular region and Gujarat; and wheat farmers of the central plains, northwest India and Pakistan (e.g. Randhawa, 1962). It should be noted that in conventional maps of Indian agriculture shifting cultivation systems are not included (Fig. 2). As explored through historical evidence (see Scott, 2009 on China and Southeast Asia; see Guha, 1999 for India), this lower or 'barbarian' status of shifting cultivators is not a product of recent ethnography or colonialism but has been the state-centered system for classifying marginal swiddening tribes for as long as there have been literate states. In the geographical treatment of India, swidden agriculture, like foraging, has been relegated to hill tracts that are dubbed areas of "isolation" (Richards, 1933).

Recent environmental historians have explored how shifting cultivators and foragers were seen negatively by the colonial era administration, as they were in earlier epochs, as 'primitives' in need of conversion and absorption into a settled plains farming way of life (Guha, 1999; Skaria, 1999; Pratap, 2000). These regions have been interpreted in some classic archaeological syntheses as secluded areas in which social evolution was retarded and where "primitive" traditions persisted (Subbarao, 1958; Agrawal, 1982; Allchin and Allchin, 1982; Chakrabarti, 1988).

Current thinking suggests that although they are often held in contrast in ethnographic literature, the three groups cannot be considered in isolation from each other. It is evident that the economic strategy of shifting cultivators and hunter–gatherers is highly flexible and interchangeable (Supplementary Table 1: Comments). The decision to practise shifting cultivation, wage labour or permanent agriculture, or to collect forest produce, for example, is based on a wide range of ecological, demographic and socio-political factors, too complex to detail here (Morrison, 2002; Scott, 2009). The fluidity between primary occupations (not to mention secondary occupations) means that none of these groups exist in isolation from the other, either economic or cultural. This strong characteristic is highly likely to have occurred

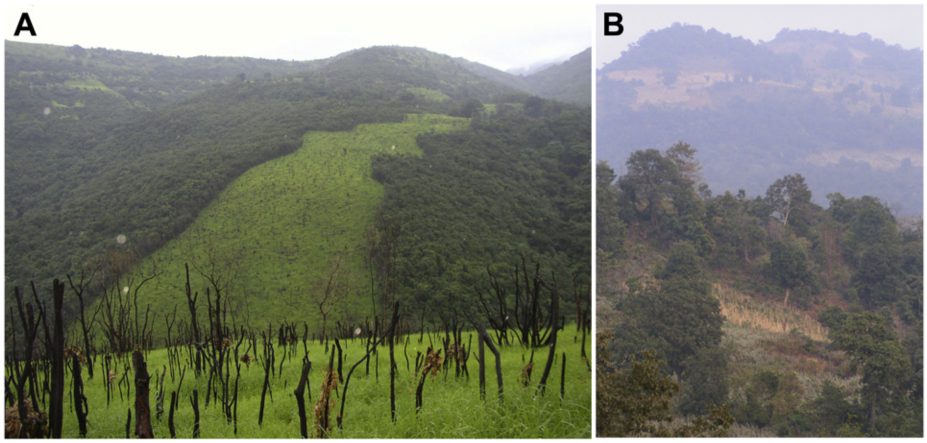

Fig. 1. Examples of recent shifting cultivation plots India. A. A swathe of swidden (*kumri*) cleared in the moist deciduous tropical forests for *kumri* cultivation in the Western Ghats of Maharashtra, planted with millets, predominantly *Eleusine coracana* (Sept. 2003). B. Small plot of shifting cultivation (*jhum*) in the Simlipal Hills area of northern Orissa, planted with *Sorghum bicolor* and interplanted with pulses and other crops (Dec. 2004). Photographs by D.Q. Fuller.

archaeologically, potentially leading to crossovers in cultural artefacts and reducing the chances of distinguishing shifting cultivators from other groups, such as hunter–gatherers or settled agriculturalists, within the archaeological record.

The marginalisation of shifting cultivators within India has largely occurred within the historic period through a variety of socio-political and economic factors (see Guha, 1999; Pratap, 2000 for a full discussion). These include an increase in the value of sal (*Shorea robusta*) and teak (*Tectona grandis*) timbers and subsequent expansion in plantations from the early 19th century, when such timbers came to serve British naval building (Rangarajan, 1996; Asouti and Fuller, 2008), as well as colonial agricultural improvement programmes aimed at dramatically increasing the area of land under permanent field systems. However, as an agricultural system shifting cultivation is not necessarily one that lends itself to marginalisation, evidenced by the fact that it continues to be practised today in many countries. We consider shifting cultivation to be a specialised subsistence strategy that balances population density against environmental conditions. While shifting cultivation has been displaced in the heavily populated plains it has remained well-suited to the wet tropics of India.

3. Modern shifting cultivators in India

In order to provide a baseline from which to investigate the long-term history of shifting cultivation in South Asia, we surveyed and mapped ethnographic sources of modern ethnic groups that carry out shifting cultivation in India (Fig. 3). For Sri Lanka better maps are available (e.g. Farmer, 1950), and we return to discuss Sri

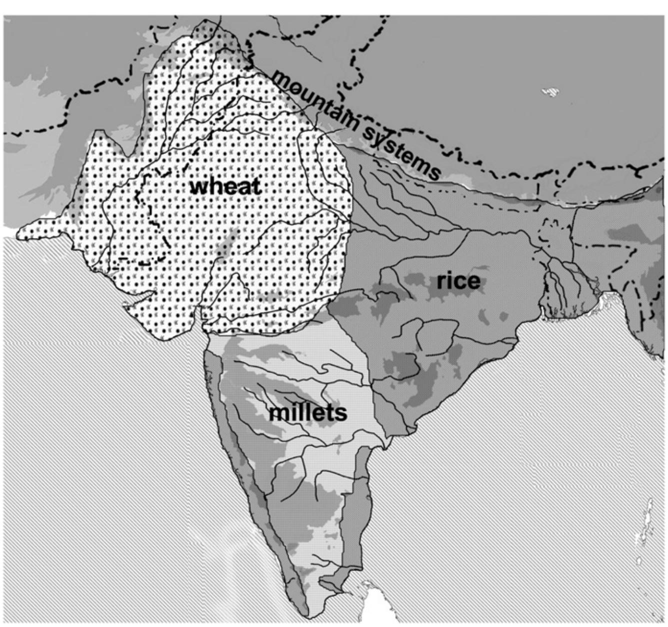

Fig. 2. Conventional agricultural geography of India, in which the subcontinent is divided into three zones with differing emphases (based on Randhawa, 1962). There is a fourth zone, not labelled separately here, of Himalayan agriculture. This is a different tradition of agropastoral systems incorporating shifting cultivation, however terraced rice farming has become increasingly abundant. Note the absence of any shifting cultivation.

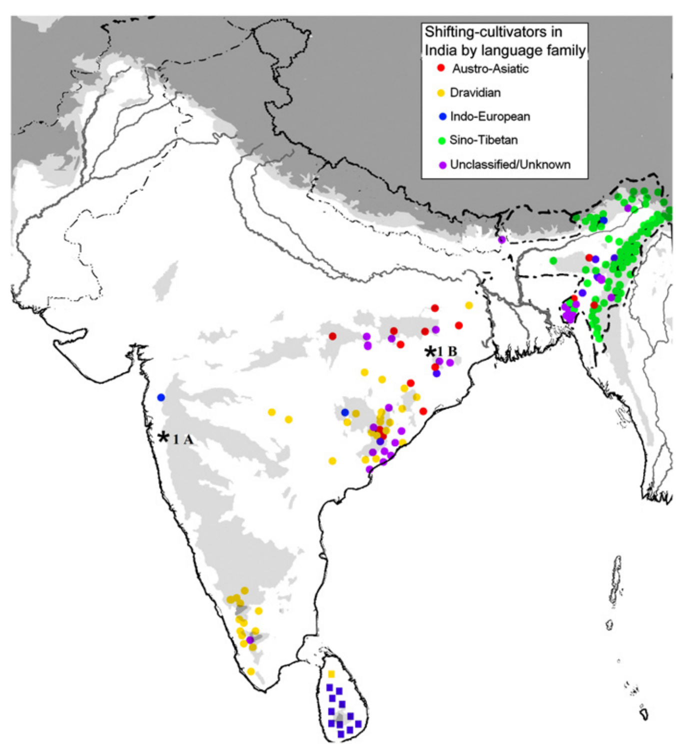

Fig. 3. Distribution of named ethnographic shifting cultivators, with language family group indicated by colour (based on Supplementary Table 1). Dots in Sri Lanka are simplified from the map in Fig. 9 (below). Approximate locations of recent photographs (Fig. 1) are indicated by an asterisk and figure no.

Lanka below (Section 4.5). Drawing primarily on publications of the Anthropological Survey of India, such as 'The Scheduled Tribes' (Singh, 1994a), and a range of regional sources, we compiled ethnic groups that are reported to carry out shifting cultivation or to have done so within the modern/colonial period (Bhowmick 1994; Grigson 1949; Jagirdar 1987; Mehta 2004; Mohanty 2004; Patnaik 2005; Prasad 1995; Roy 1981; Seeland and Schmithusen 2002; Singh 1988, 1994a,b,c, 1995a,b, 1996, 1998, 2003; Sinha 1985). We recorded both the crops noted as being cultivated by these groups and their staple foods. Because the crops grown and consumed by groups may have as much to do with cultural tradition as particular adaptations to shifting cultivation systems, we attempted to control for shared cultural descent (cf. Mace and Holden, 2005) by recording the language family affiliation of each group using the same anthropological sources, Van Driem (1999) and the on-line ethnologue (Lewis, 2009). Additionally, we have highlighted the groups that consume or grow rice, millet and tubers as we identify these as culturally distinct crops that form fundamental parts of specific crop packages within the archaeological record (e.g. the South Indian Neolithic millet complex, see Section 4). We plotted the distribution of these groups based on the administrative districts and/or geographic features from which they are reported.

In order to assess the effect of broad ecological factors on distribution we then determined the dominant vegetation type, drawing on the vegetation maps of Meher-Homji (2001). Our survey revealed 168 named groups that practise/have practised shifting cultivation in India. These groups are detailed in Supplementary Table 1. This list is not exhaustive and, in particular, economically marginal segments of the major caste Hindus (i.e. those within the caste system, not "untouchables") who carry out shifting cultivation in the forested boundaries of sedentary cultivation may have been excluded. Additional caveats with this dataset should be noted. Due to the nature of the sources, which are anecdotal and descriptive, it is difficult to determine accuracy or to quantify the data. In addition, not all descriptions record the same details. Thus whilst it was possible to collate information on crop species cultivated by the Bondo, for example, we do not have such data for the Bhutia. The nomenclature for many of the groups may also have created confusion. These are only sometimes self-applied ethnic designations, and smaller groups, e.g. the Maria, are commonly put under the umbrella of a large, well-known group based on minor similarities or linguistic affinity, e.g. the Gond. Nevertheless, this survey provides a useful first approximation of the geographic and ecological distribution of shifting cultivation in India and the crops cultivated.

In general these data show a pattern of shifting cultivators largely confined to mountainous zones, with the majority situated in the Northeast. This pattern is as one would expect from predictions based on the historical patterns of Southeast Asia (cf. Scott, 2009); in areas of isolation (*sensu* Richards, 1933), or high "friction" (*sensu* Scott, 2009: 40–50), lower populations recognized as "tribes" tend to carry out shifting cultivation with or without some hunting and gathering. Very few groups occur in areas under substantial permanent cultivation, for example the majority of the Indo-Gangetic Plain. Economically there is a heavy reliance on grains, with ~75% of the groups reported to consume rice and nearly 30% reported to consume millets. Approximately 25% are reported to consume tubers and maize. As discussed by Scott (2009: 201–205), maize, which was introduced in the last 500 years, was well-suited to extending shifting cultivation to high elevations and supporting larger populations in these marginal environments.

As is evident from the map (Fig. 3), there are three main groupings of shifting cultivators: the Northeast peninsula group, the Southern group and the Northeast group. Several shifting cultivators occur on the Northeast peninsula, clustered around two mountain ranges: the Vindhya Range and Eastern Ghats, both providing degrees of inaccessibility to state powers of appropriation (or produce or labour). For the eastern Vindhyan/south Bihar area, an ethnohistorical account of shifting cultivation is provided by Pratap (2000), who considers its probable archaeological correlates and the historical evidence of its gradual incorporation into the state under British colonialism. Further south, the history of the Bastar region is considered by Sundar (1997). The Northeast peninsula area includes groups speaking languages of the Munda subfamily of Austroasiatic, as well as outlying Dravidian languages. Although those speaking Dravidian appear to have a reduced reliance on rice, this is partly due to the fact that they were less well-documented in the literature. Taking this into account, there is no discernible pattern in foods grown and consumed within this group, suggesting individual adaptations to ecological and social factors of the region.

The small cluster of Dravidian groups in the south largely occurs in the states of Kerala and Tamil Nadu. Unfortunately there is limited data about these groups. However, rice is generally reported to be the dominant crop, with millets second and roots/tubers last. The extent to which these statistics could be biased by the fact that shifting cultivators may consume a lot of rice obtained in trade (for cash crops or forest products) from lowland permanent rice farmers is unclear. The historical pattern in Southeast Asia (Scott, 2009) and in Southwest India (Morrison, 2002) would suggest that consumption dominated by rice may not equate with swiddens dominated by upland rice due to trade and exchange between different economic groups. Only 3 of the 14 Austroasiatic groups were actively practicing shifting cultivation when they were recently surveyed, but this was in tandem with settled agriculture or animal husbandry.

The Northeast group is by far the largest and most detailed in the sources. This is to be expected as this region is mountainous, has a high ethnic diversity and constitutes part of the broader Southeast Asian hill country, or 'Zomia', which has tended to operate on the frontiers and interstices of states focussed on lowland rice cultivation (Scott, 2009). For the most part, these groups are concentrated in zones of higher rainfall that are regarded as tending naturally towards denser forests, such as Tropical Moist Deciduous forests, and some Himalayan sub-temperate/sub-tropical forests. At first glance there is a surprising focus on 'millet' (Fig. 4), which due to the sources has to be taken broadly, but in general is expected to mainly include *Eleusine coracana*, *Panicum milaiceum* and *Setaria italica*, with occasionally the occurrence of other millet species (see Fuller, 2006: Table 1). However, the crops frequently appear to be strongly correlated with language family suggesting that a significant bias in the preference for millet is found in Sino-Tibetan (or Tibeto-Burman) speaking groups, who presumably can trace their ancestry to mountain millet cultivators radiating out of China in prehistory (cf. Van Driem, 1999, 2003; Sagart, 2008).

Shifting cultivation practiced on the West side of India, particularly in the Western Ghats of Maharashtra, is more widespread than this map indicates, probably as many of the practitioners are classed as Maharati caste Hindus rather than tribes. On our map this region is only represented by the blue dot of the Kokna tribe, near the area explored historically by Skaria (1999), and the asterisk of our photograph. Nevertheless it is clear from anecdotal observations, including those by us (in the area of photo in Fig. 1A) that shifting plots throughout this region were dominated by cultivation of small millets, including *E. coracana* and *Panicum sumatrense*. Other millets known to be cultivated in this region are also probably subjected to shifting cultivation, including *S. italica* and *Echinochloa colonum* subsp. *frumentaceum* (cf. Kobayashi and Kimata, 1989).

Relatively few groups, regardless of language family, are reported to rely heavily on root/tuber cultivation, although there is

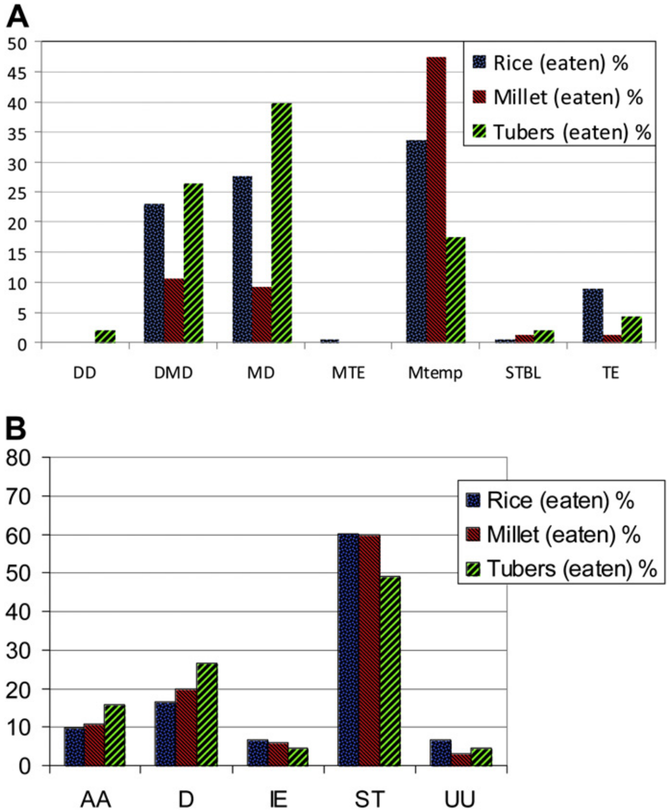

Fig. 4. Charts comparing the reporting the proportions of type of dietary staple amongst shifting cultivators, compared by (A) vegetation zone and (B) language family. Abbreviations: DD = Dry Deciduous, DMD = Dry to Moist Deciduous, MD = Moist Deciduous, MTE = Montane Tropical Evergreen, Mtemp = Montain Temperate, STBL = Sub-tropical Broad-leaved, TE = Tropical Evergreen, AA = Austroasiatic, D = Dravidian, IE = Indo-European, ST = Sino-Tibetan, UU = Unknown/unrecorded.

a stronger prevalence of tubers in Moist Deciduous (MD) and Dry–Moist Deciduous (DMD) zones with 15–25% of the Austro-Asiatic and Dravidian speaking groups documented consuming them (Fig. 4). In shifting cultivation traditions reported from across mainland and island Southeast Asia, vegeculture of various crops is considered a prominent component (Geertz, 1963; Spencer, 1966; Scott, 2009: 195–207). Thus, there are macro-regional contrasts within South Asian agriculture. This may reflect the divergent Neolithic roots of agriculture in South Asia, which on current evidence was highly biased towards seed crops, as opposed to more vegecultural origins in many parts of Southeast Asia (the latter is, at least, in evidence in New Guinea and presumably surrounding parts of Island Southeast Asia: see Denham and Haberle, 2008).

4. Shifting cultivators in the archaeological record

Archaeological evidence for early agriculture suggests that cultivation developed before sedentary settlements (Fuller, 2006). Well-preserved and studied archaeobotanical evidence for crop cultivation comes almost entirely from sites that appear to be more or less sedentary small villages, dating after 2500 BC and mainly after 2000 BC in both the Ganges plains and in peninsular India. That such sites already have fully established crop packages, indicating either morphological domestication or distribution beyond the range of wild progenitors, implies that cultivation had begun earlier than the establishment of permanent settlements. This leads to the hypothesis of 'silence before sedentism' (Fuller, 2006) in which the earliest stages of cultivation were carried out by more mobile, and less archaeologically visible, economies. The lack of archaeological material suggests the use of systems in which fields and settlements were abandoned and shifted on a regular enough basis to prevent the build up of deep stratigraphies. Based on the distribution of wild progenitors and density of early permanent villages, we suggest that these shifting cultivation regimes were initially established in the semi-arid plains of the Indian peninsula and grassland–woodland mosaic of the Gangetic alluvial plains (Fig. 5). As population densities grew, more intensive sedentary and fixed plot cultivation can be inferred to have developed in these regions. At the same time shifting systems of cultivation supporting lower density populations colonized wetter zones and hill forests, as suggested by the spread of arboriculture species (see Section 4.4). Such systems became relegated over the long term to environments more marginal for the cereal agriculture traditions of early India.

Although evidence is indirect, it is possible to outline a few regional sequences of agricultural development towards fixed-field sedentism in the plains and colonisation by shifting cultivators of adjacent hill forest areas. We build inferences from archaeological evidence of early sedentary agriculture and the introduction of field-tree arboriculture, as well as available regional pollen evidence for the opening or transformation of woodlands that precedes sedentary agriculture, to suggest the local beginnings of shifting cultivation in some parts of India.

4.1. Southern Deccan

The southern Deccan provides evidence for a distinctive early agropastoral village complex from ca. 2000 BC with poorly documented origins. Based on the recurrent, unique, archaeobotanical crop package of millets (*Brachiaria ramosa*, *Setaria verticillata*) and the biogeography of their wild progenitors, which includes the

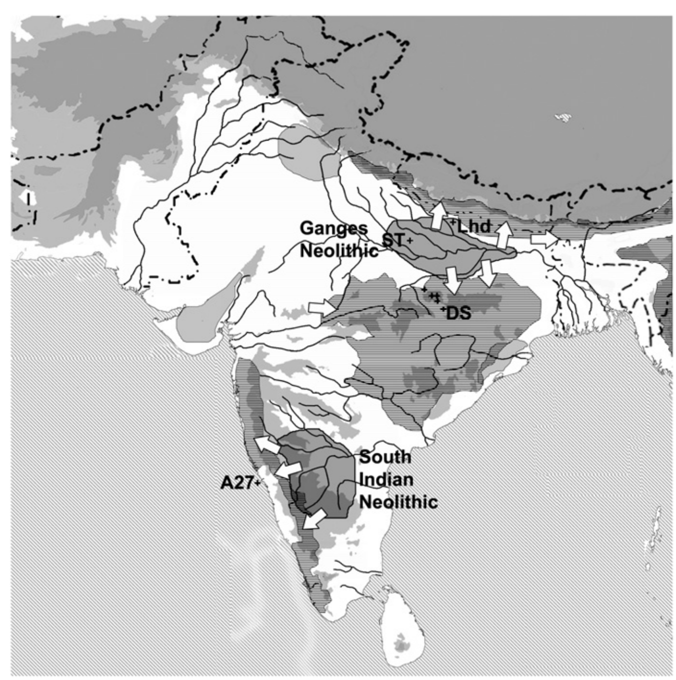

Fig. 5. Map of the regions of postulated initial Neolithic cultivation (grey areas) based on Fuller (2006). Major areas proposed to have had initial agriculture based on systems of shifting cultivation labeled, with white arrows indicating general directions of subsequent expansion of shifting cultivation into Moist Deciduous or Moist-to-Dry Deciduous tropical woodlands (hatched zones). Sites of palynological data discussed in the text indicated: A27: Indian Ocean sea core S128-A27; ST: Sannai Tal; Lhd: Lahuradewa Lake; DS: Dongar-Sarbar Swamp.

Southern Peninsula, it has been argued that this represents a local centre of plant domestication, although domesticated animals (e.g. *Bos* and *Ovis/Capra*) are likely introductions to the area (Korisettar et al., 2001; Fuller et al., 2004; Boivin et al., 2008). Sites with domestic fauna, characteristic ceramics, and mounds of burnt dung ash ("ashmounds") suggest that this Neolithic food production tradition dates back to ca. 2800–3000 BC (Fuller et al., 2007). Archaeobotanical evidence from these sites shows the use of mungbean (*Vigna radiata*), horsegram (*Macrotyloma uniflorum*), and two millets (*B. ramosa* and *S. verticillata*). The discrepancy between the start of this tradition, associated with seasonally occupied sites, and the start of well-stratified, more permanent sites with well-preserved archaeobotanical evidence (ca. 2200–2000 BC) indicates that for about a millennium mobile forms of settlement were dominant. These probably exploited a shifting cultivation system of millets and pulses.

The factors contributing towards this rapid development of permanent settlement, as well as increased social complexity, inferred from the presence of metal work and personal ornaments, have yet to be explained fully. However, the introduction of new crops, for example wheat and barley ca. 1900–1800 BC and African crops (e.g. *Pennisetum glaucum*, *Sorghum bicolor* and *Lablab purpureus*) ca. 1500 BC, would have required agricultural intensification and, it is likely, fixed-field systems. We suggest that this expansion and intensification pushed shifting cultivation into the mountain range of the Western Ghats. This movement of people contributed to the development of arboriculture by allowing the trade of fruits and movement of tree species from forests to lowlands. Indeed, by ca. 1400 BC we have evidence for mango and citrus cultivation in the area (see Section 4.4). Support for this assertion comes from deforestation evidence in a pollen core taken off the west coast of India which captured material brought downstream from the Western Ghats (Fig. 6). This evidence shows a regional pattern of reduced tree pollen and increased grass pollen ca. 1500 BC. However, rather than the a shift from evergreen tree taxa to deciduous taxa, which is what would be expected if the trend were primarily driven by aridification, we see a marked increase in grass pollen that track to reduction in rainforest indicators. This shift is indicative of forest clearance. Additionally, oxygen isotope and dinoflagellate evidence relating to sea temperatures suggests climate change over the same period, highlighting a potential factor influencing agricultural and social change in the area (see Fuller and Korisettar, 2004).

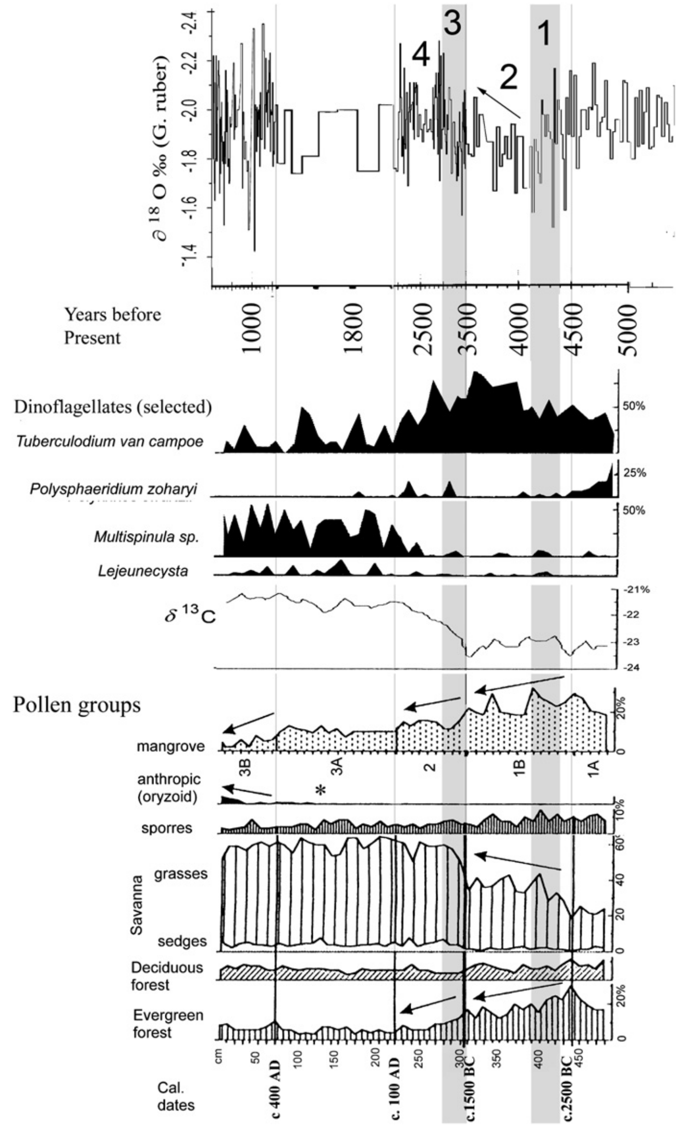

Fig. 6. Correlations between climatic and environmental change proxies, indicate four phases discussed in the text. Lower spectra show pollen, stable carbon isotopes and dinoflagellates from a core near the Karwar coast (SK128-A27) (after Caratini et al., 1994), while the top graph shows oxygen isotope levels in the Arabia sea (after Staubwasser et al., 2003). The Arabian Sea isotope data has been rescaled to match to the stratigraphic time scale of the Karwar core.

4.2. Central India

Central India can be defined as the plains north of the Tapi river, separated from the Ganges to the north by the Vindhya Hills, east by the Aravalli hills of Rajasthan, and west of the hills of Bastar (Fig. 5). This region's early agriculture is generally very poorly documented and there remains little hard archaeological data from the central area, most of which is in the modern state of Madhya Pradesh. Nevertheless, the haphazard finds that are available (e.g. from Kayatha (Vishnu-Mittre et al., 1985)) as well as those from Rajasthan (Kajale, 1996; Pokharia, 2008), suggest that a winter cereal agriculture focused on wheat and barley occurred in the region ca. 2500–2000 BC (Fuller, 2006). Palynological evidence from a number of swamps and small lakes in Eastern Madhya Pradesh (Chahuan, 1996, 2000, 2002), however, suggests a major shift in the vegetation beginning in the third millennium BC (Fig. 7) which could be regarded as an initial phase of shifting cultivation prior to the more widespread establishment of sedentary agriculture. Pollen cores indicate that between 3000 and 2000 BC the composition of forests changed with a rise in sal (*S. robusta*). The palynological evidence suggests that 'climax' sal forests were marginal to non-existent prior to ca. 2500 BC, and the dominance of sal is strikingly correlated with dates for early Neolithic settlement in this region. This is perhaps no coincidence, and it has been suggested that the rise of sal forests in this period is at least partly anthropogenic as the species lends itself to woodland management practises, including fire clearance (Asouti and Fuller, 2008). We suggest that an earlier Neolithic phase of shifting cultivation may have promoted the expansion of sal forests in the period between ca. 3000 BC and ca. 1800 BC. After this time, woodland as a whole declined, including sal. Archaeologically this period witnessed the expansion of the Malwa cultural tradition, with a multiplication of sites across the region connected to the increase in apparently sedentary and definitely agricultural sites practicing two seasons of cropping (Kajale, 1988; Fuller, 2006). In this situation it is likely that shifting cultivation moved into the Western Ghats, the Satpura Hills and the Vindhya Range, and eastwards towards the 'tribal belt' of the hills of the northeast peninsula.

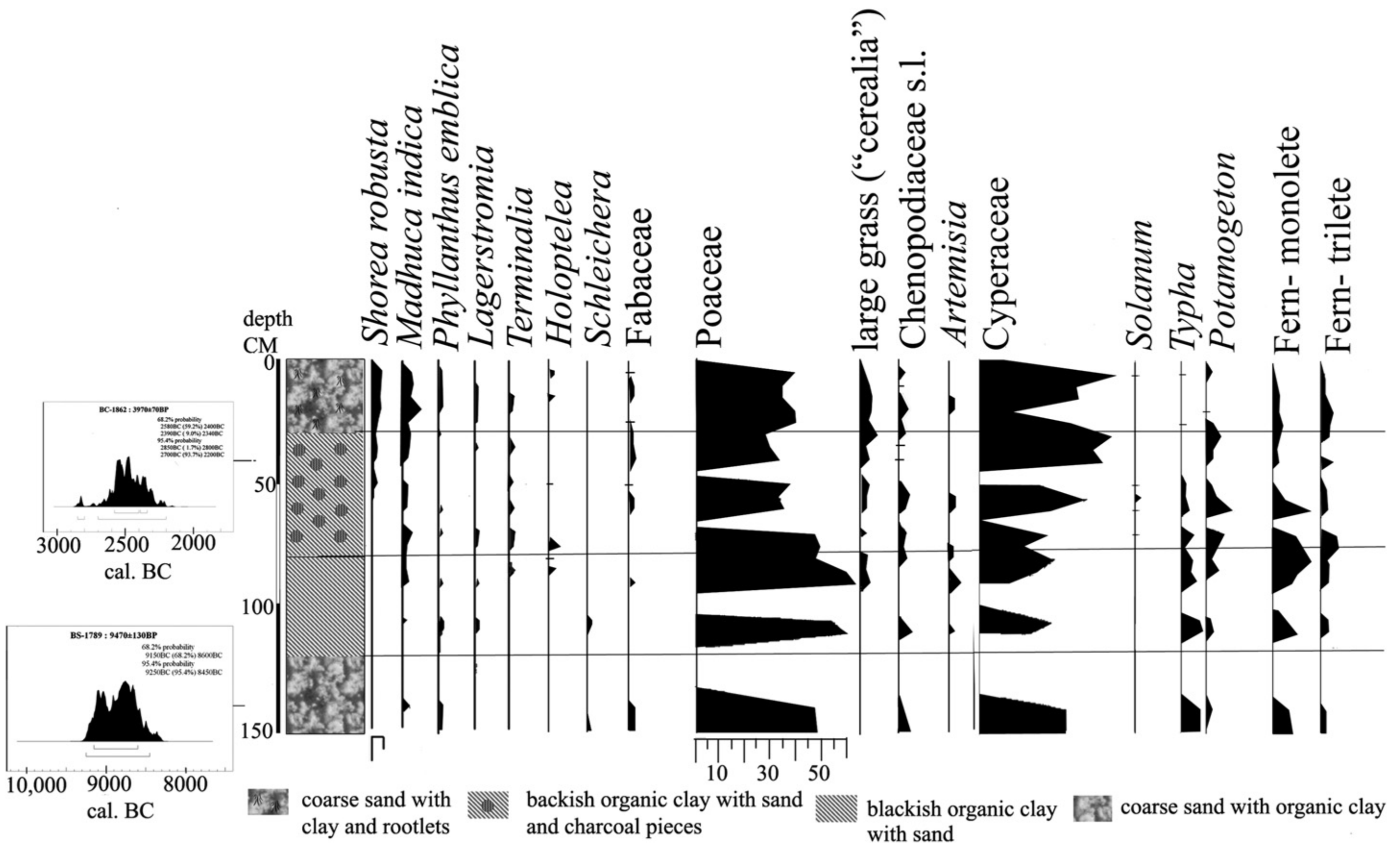

Fig. 7. Selected pollen spectrum from the core of Dongar-Sarbar Swamp pollen spectra, eastern Madhya Pradesh (after Chahuan, 2002).

4.3. Ganges plains

Deeply stratified settlements of the Neolithic are well known from the Ganges Plain, but few of these date much earlier than 2000 BC. At Mahagara, which is well dated to between 1800 and 1600 BC, there is evidence of huts, cattle pens, and phytolith evidence for the routine practice of all the steps of rice crop processing, including threshing (which produces archaeobotanically distinct straw waste) and de-husking (which produces husk waste) (Harvey and Fuller, 2005; Harvey, 2006). Sites with equivalent late Neolithic ceramics (Pal, 1986) and similar village mound formations are widespread. Samples from these sites dating to after 2000 BC have produced relatively rich, crop-dominated archaeobotanical assemblages with evidence for diversified and double cropping systems: winter cereal and pulses (wheat, barley, lentils) as well as summer rice and pulses (mungbean, urd, horsegram) (Fuller, 2006; Harvey, 2006). On the basis of the settlement pattern and crop repertoire, settled agriculture seems secure. This implies that earlier sites, often with few recovered botanical remains, and thin poorly preserved stratigraphy, are parallel to those of south India. Habitation sites were being regularly relocated and any cultivation carried out was of low intensity and left little recoverable archaeobotany.

This scenario finds congruence in available pollen, phytolith and microcharcoal sequences. Cores from Sanai Tal lake (Singh, 2005) show microcharcoal from ca. 15,000 BP, suggesting a long sequence of anthropogenic activity within the area (Fig. 8). Evidence for 'cerealia' pollen is also suggested throughout this sequence. However, 'cerealia' identification is a difficult process which relies upon a gradation in size between wild and some domesticated grass species (wheat, barley, rice), and therefore this must be taken with caution, especially as there is no archaeobotanical evidence to corroborate cultivation prior to ca. 7000 BC. Lahuradewa lake (ibid., Chauhan et al., 2009) shows microcharcoal from ca. 9200 BP, rice phytoliths from just after this time and 'cerealia' pollen from ca. 7000 BP (Singh, 2005). Saxena et al. (2006) identify 'cultivated' rice bulliform phytoliths from ca. 7000 BP, however it is still unclear how reliable methodologies for distinguishing between wild and cultivated rice species using phytoliths are (Harvey, 2006). Additionally, the discrepancies between macro-botanical evidence and initial claims for rice domestication on the basis of phytoliths in the Ganges, and especially in China, cast serious doubt on the reliability of phytoliths (see Fuller et al., 2010a: 120–123; Fuller and Qin, 2010: 141). Despite this, we once again have compelling indications for the long continuation of some form of rice management, if not shifting cultivation, within the Ganges Plain. The evidence indicates a period of ca. 5000 years of low level anthropogenic activity between 3000 and 8000 BC, when archaeobotanical evidence suggests rice exploitation began (Tewari et al., 2008), and domestication and sedentism around 2500–2000 BC (Fuller et al., 2010a). Our survey of shifting cultivators shows that the largest population still inhabits the hills at the far east of the Ganges–Brahmaputra plains, however whether this is due to environmental suitability or the fact that the area is isolated is unclear.

4.4. Arboriculture and shifting cultivation

Of particular interest is that almost all groups within our survey are reported to have a heavy reliance on forest products and arboriculture or cash crops. This immediately highlights that these are not isolated ethnic groups with isolated economic systems. Indeed, as explored by Morrison (2002, 2007) in relation to

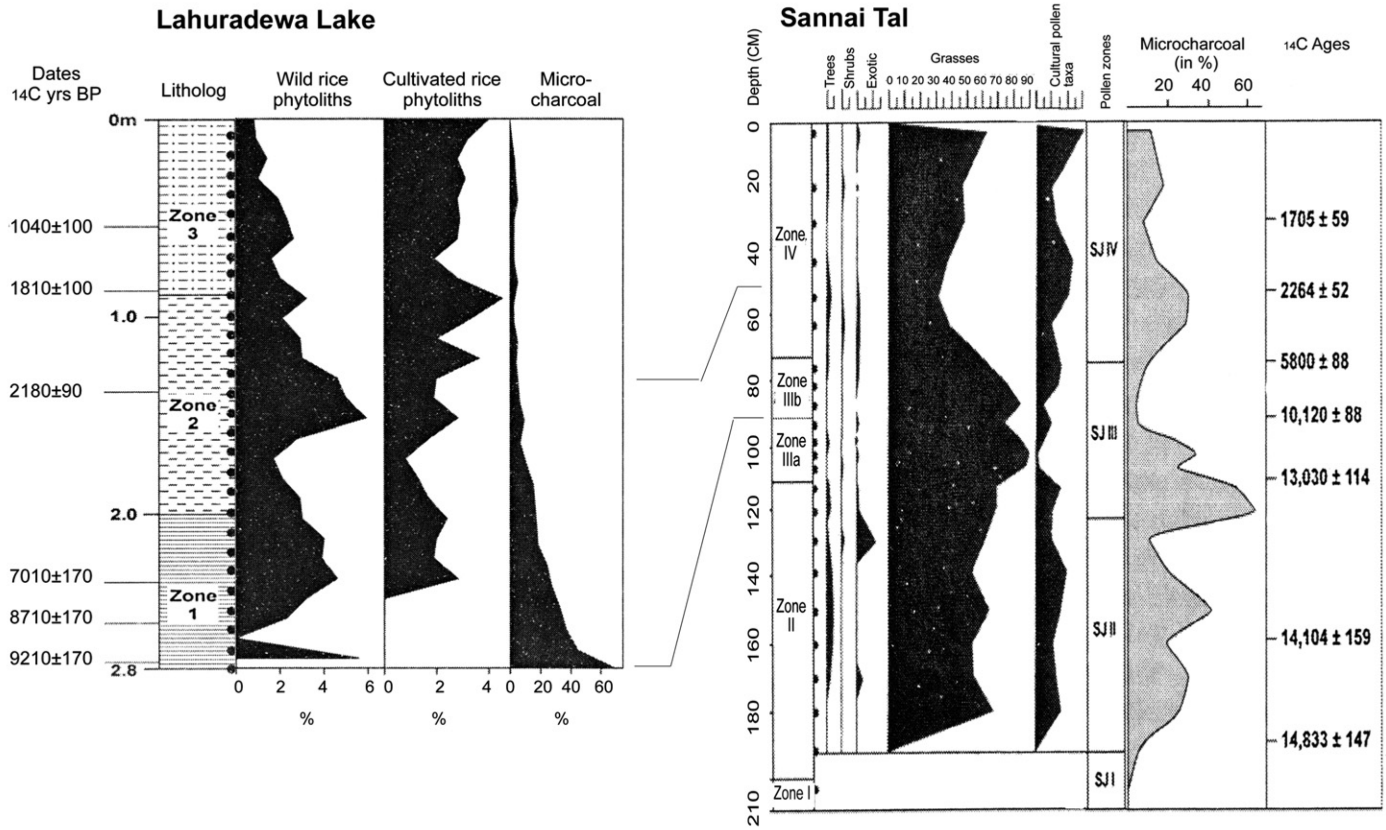

Fig. 8. Selected phytolith, pollen and microcharcoal spectra from cores at two Ganges plains lakes which indicate land use patterns, including vegetation burning from the terminal Pleistocene through middle Holocene, prior to the establishment of sedentary agriculture (after Singh, 2005; Saxena et al., 2006).

ethnographic “hunter–gatherers” of South India and Malaya, the access to forest products and the production of forest cash crops has provided a persistent arena for interaction and specialisation between lowland, intensive agricultural polities and small-scale hill-dwelling groups, for at least the past 2000 years. Scott’s (2009) historical work suggests that this is likely to have been the case throughout the hill forest country of South and Southeast Asia back to the Iron Age. Therefore persistence of these economies is likely to be determined in part by the availability of desired, high value, low quantity forest products. Aside from tree fruits, such as mango, oranges, and jackfruit, other native tree species with a long-term history of non-subsistence economic value, e.g. the aromatic resins: *Boswellia serrata*, *Commiphora* and *Vateria indica* (Asouti and Fuller, 2008) are likely to have been exploited in this way. Equally, several valuable spice plants native to forested areas in South Asia such as peppers and cardamoms, e.g. *Piper nigrum* and *Elettaria* in the southwest (Western Ghats) and *Piper longum* and *Amomum* in the northeast (Assam), have a long history of trade. This is evidenced by the recovery of spices from early port sites such as Mantai, Sri Lanka (unpublished data), and importation into the Roman world demonstrated by Red Sea finds of around 2000 years ago (Cappers, 2006). The earliest evidence for black pepper comes from the Egyptian mummy of Ramses II (ca. 1200 BC) (Plu, 1985; see Boivin and Fuller, 2009: 153–154) long before there is evidence for cultivation on the coastal plains of South India but shortly after the colonization of parts of the western Ghats by shifting cultivators (see Section 4.1).

The ecological distribution of forest products, in particular fruit trees, is focused on the Dry–Moist Deciduous zones of South Asia. These areas are therefore plausibly the source of several domesti-cates, such as mango (*Mangifera indica*), citrus fruits (*Citrus* sp.), and jackfruit (*Artocarpus heterophylla*), which are now cultivated on the plains. If this is true, then the first occurrence of these in the plains provides a minimum age estimate for some shifting cultivation colonisation of appropriate Dry–Moist Deciduous hill country. It is logical that these trees were first managed in their native zones once cultivation, probably shifting cultivation, became established. Subsequently they were transferred as cultivars to the plains. Although relatively sparse, archaeobotanic evidence (Table 1) clearly demonstrates that by the late second millennium BC important fruit tree species were present outside of their native geographical and ecological zones. This suggests that the expansion of permanent settlement and fixed-field agriculture had pushed shifting cultivation into more forested environments over a period as small as 500 years, focused on the middle of the Second Millennium BC.

4.5. Sri Lanka and ‘chena’ agriculture

Sri Lanka, situated off the coast of South India, is broadly ecologically divided into the dry and wet zones (Fig. 9), with shifting cultivation, or ‘chena’, largely occurring within the dry zone and around the margins of the wet zone (Farmer, 1950). In Sri Lanka there is less of a sense of shifting cultivation being marginal to the plains and urban centres and it is instead interspersed with more intensive irrigated agriculture (mainly rice), supplied with water from the network of large and small irrigation tanks (large irrigation tanks are indicated in Fig. 9). Today chena agriculture continues to be a viable practise and many people employ it to a greater or lesser extent along-side other agricultural activities.

Table 1
Summary of evidence for selected cultivated trees species that originate in forested hill zones, where they are likely first managed by shifting cultivators and then transferred to sedentary farmers in the plains.

Species	Native area	Earliest archaeological evidence for anthropogenic exploitation	References
Mango (*Mangifera indica*)	Western Ghats and Northeastern India through Southeast Asia; disjunct distribution through Western Ghats and Sri Lanka	Late second millennium BC. Wood charcoalrecovered from 2 sites in the middle Ganges plain: Narhan and Senuwar (by 1400 BC); wood charcoal from Southern Neolithic Period IV, Sanganakallu, Southern Deccan (1400–1300 BC)	Asouti and Fuller, 2008; Saraswat, 2004; Saraswat et al., 1994
Citrus (*Citrus medica*)	Eastern Himalayan foothills through Northeast India, Yunnan; Disjunct population in southern Western Ghats	Early second millennium BC. Citrus fruits recovered from 1 site in Punjab: Sanghol; wood charcoal from Sanganakallu by 1400–1300 BC	Asouti and Fuller, 2008; Saraswat, 1997
Jackfruit (*Artocarpus heterophylla* syn. *A. integrifolia*)	Western Ghats	Late second millennium BC. Wood charcoal recovered from 1 site in the central Ganges valley: Bihar.	Asouti and Fuller, 2008; Saraswat, 2004

It is highly likely that early agriculture and crop domesticates spread to Sri Lanka from South India (Fuller et al., 2010a). There is an increase in the prevalence of rice finds in the 3rd century BC, a period which saw the expansion of the social elite and urbanism, although urban polities might have been established some centuries earlier (Coningham and Allchin, 1995; Coningham, 2006).

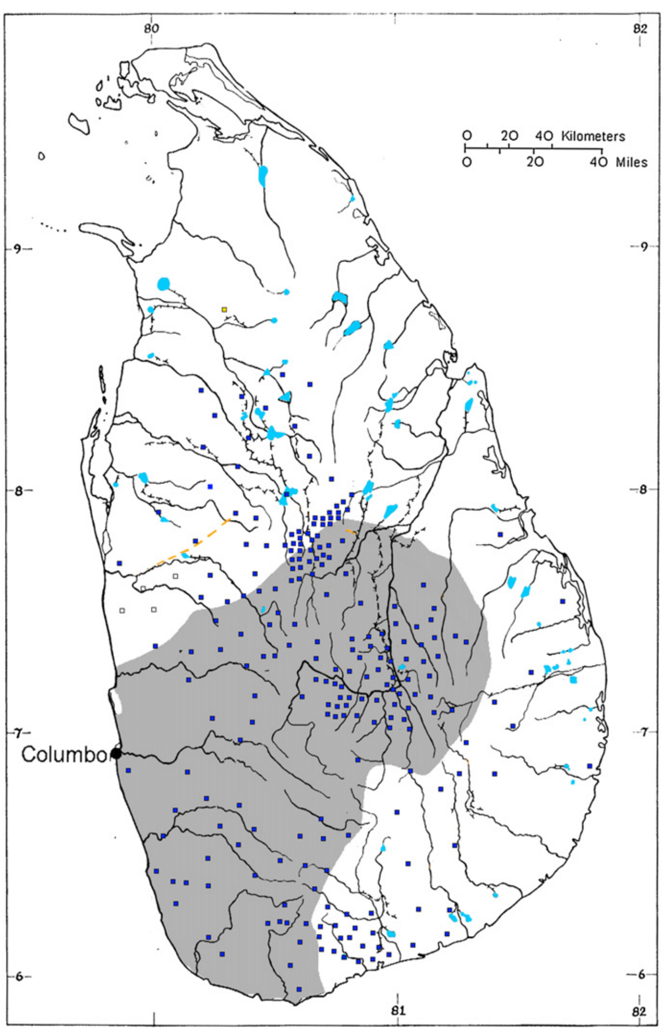

Fig. 9. Map of the distribution of shifting cultivation (*chena*) in Sri Lanka, based on Farmer (1950). Each square represents 1000 acres (based on 1946 data); also shown in light blue are major irrigation tanks, and the divisions between the wet zone (>250 mm annual of rainfall (grey)) and the dry zone (120–190 mm/year). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

The landscape of the dry zones of Sri Lanka is littered with tanks and irrigation systems. Direct dates on these tanks, often via thermoluminescence dating, suggest that the earliest were built by the 2nd century BC, indicating that the social expansion was associated with increased irrigated rice agriculture (Myrdal-Runebjer, 1996). Earlier evidence for agriculture is sparse, however several scholars have suggested that shifting cultivation was important prior to the introduction of wet-field rice (Gunawardana, 1978; Siriweera, 1986; Myrdal-Runebjer, 1996). In this situation, early exploitation of the dry zones is suggested, and the earliest evidence for domesticated rice comes from the dry zone site of Anuradhapura, at ca. 900–600BC (Deraniyangala, 1992). Rainfall levels are such that even this earliest rice is suggestive of the advent of tank irrigation, if on a small scale. Present land use patterns indicate that shifting and small-scale chena systems and wet-field rice cultivation are used in combination and probably were throughout history (Gunawardana, 1971; Myrdal-Runebjer, 1996). Within the wet zone chena occurs in the forested margins of permanent field systems, many of which were created during the agricultural intensification programmes of the colonial period. Shifting cultivation is more frequent in the dry zone, however, and often occurs in both the forested field margins and within dry or semi-dry tank beds (ibid.; Fig. 9).

Shifting cultivation has not become relegated to the highland or Dry–Moist Deciduous areas in the wet zone of Sri Lanka, in contrast to the marginalisation of swidden that we have outlined for India. This is perhaps due to the fact that these areas were important sources of forest products, fruits and spices during the introduction of domesticated crops and agriculture from South India.

5. Conclusion

We have outlined a long-term history of shifting cultivation in India and Sri Lanka. From ca. 7000 BC to ca. 2500 BC shifting cultivation, or some other form of low intensity rice management and gathering, contributed to subsistence on the Gangetic plains of India. As explored elsewhere, this form of management need not have selected for domestication traits in rice, and this proto-*indica* may have only become domesticated when cultivation-adapted genes evolved in *japonica* were introduced around 2000 BC (Fuller and Qin, 2009; Fuller et al., 2010a). By this time the first permanent settlements appeared and became increasingly prevalent from 1800 to 1600 BC. Two cropping seasons became well-established, and fixed-field systems are inferred. Demographic growth over this period is expected to have pushed shifting cultivation into the forested highlands of eastern and central India, and perhaps parts of the Himalayan foothills. It is also possible that emerging social hierarchies and the demands of emergent chiefs promoted an alternative political strategy of more egalitarian, hill-dwelling shifting cultivators.

In the Southern Deccan and Central India we posit parallel trajectories. A mobile society, possibly that responsible for ash-mound sites, practised shifting cultivation in South India, primarily of millets, from around 3000 BC. After this settlement expansion and sedentism became established between 2000 and 1500 BC. This is expected to have pushed a frontier of shifting cultivation into the Western Ghats. In Central India shifting cultivation altered the forests around 3000–2000 BC and, again, settlement expansion pushed shifting cultivation into the hills of the Ghats, the Vindhya Range and probably the hills of Orissa and elsewhere in Eastern India. The latter is probably indicated by the lithic-defined Neolithic surface sites in the north Orissa hills that lack stratified archaeological material (Harvey, 2006; Harvey et al., 2006). Between ca. 2000 BC and ca. 1500 BC the trade of forest products, particularly fruit, between hill and plain dwellers became significant. It was in this context that fruit trees were translocated, leading to the development of arboriculture within the lowland plains and the domestication of certain fruits, such as citron, mango and jackfruit. Certainly by Iron Age times (after ca. 1000 BC) the trading interconnections of hill-dwelling swiddeners and plains farmers were widespread and well-established, and this formed the basis of the kind of economic interdependence and strategic political divergence that Scott (2009) has identified as typical of the relationship between rice-centric states and shifting cultivators. This interrelationship, which provided rare forest products for the social elite, may well have been necessary for the rise of urbanism in the Gangetic plains or in peninsular India.

Although limited, we have shown that archaeobotanical finds, permanent settlement sites and palaeoenvironmental records can indicate shifting cultivation. However, evidence is sparse. Further work aimed at investigating palynological and microcharcoal sequences is needed across South Asia, as is the identification of more temporary and semi-permanent Neolithic settlement sites. Systematic archaeobotany will allow the development of domestic crops within India to be examined in increasing detail. Current hypotheses suggest that cultivating crops in areas in which native progenitors are found will increase the back flow of genetic material, prolonging the development of morphologically distinct 'domestic' cultivars (Allaby, 2010; Fuller et al., 2010b), and thus finding evidence for pre-domestication cultivation and early shifting cultivators may go hand-in-hand in South Asia. Mobile forms of agriculture allow for the interaction of a higher number of populations and subpopulations than fixed agriculture, potentially leading to increased diversity within both agricultural and wild plant populations. Archaeologically this may hinder the identification of cultivated/domesticated and wild plant material as morphological crossovers would be more common. Nevertheless, this has been an important source of agrobiodiversity over the long term.

Ethnographic, archaeological and palaeoenvironmental sources have shown that instead of being marginalized 'primitive' groups confined to the forest, shifting cultivators played an active role in shaping both the long-term ecology of India and its political and social history. Our survey of shifting cultivators indicates that there are at least three separate cultural traditions, inferred from language family affiliation, of shifting cultivation in India. Considering this in relation to inferences of archaeology and palaeoecology, we conclude that current evidence suggests that early in the agricultural history of several regions of India shifting cultivation developed in the semi-arid plains and then dispersed into hill zones of higher rainfall. This process can be suggested to have contributed to the adoption and spread of new tropical forest crops, especially several fruit trees, and probably also contributed to the use and trade of other botanical products (from spices to medicinal plants). Contrary to this, shifting cultivation in Sri Lanka has been largely confined to the dry zone due to the established importance of the wet zone for forest products early in the agricultural history of the island.

The process leading to crop domestication and the development of agriculture in India took around 5000 years. Whilst archaeological evidence for the development of permanent fixed-field agriculture is diffuse, it is highly likely that shifting cultivation was the primary agricultural mechanism used during this time. As such, the origins of agriculture have been difficult to find in South Asia. In addition, this suggests an early history of shifting cultivation based on cereal crops that differs from that of postulated vegecultural origins or grain-based fixed-field systems that have been archaeologically documented in other world regions.

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