

The 'Tisali' System of Farming - A Relict of Shifting Cultivation in the Western Ghats: A Case Study of Koyna Valley

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Abstract

Shifting cultivation has many variants in the tropics. The area known for this kind of primitive cultivation, causes enormous destruction of forests and degradation of the environment. But in some areas, where the practice has been stopped by State intervention and forests are no longer available for burning, the practice has taken a different form. Koyna valley is one such area where a modified form of shifting cultivation, locally known as Tisali, is practised. The evolution of this practice, its areal extent, the associated crops, their suitability and yield, the continuance of this practice and other aspects of this system of farming are discussed in the paper with a case study of Koyna valley in an area of over 200,000 hectares.

The authors try to probe into the historical background of this practice, the motivation that the farmers have in continuing this practice. The rationale of land use adopted by them with a general economic profile of the area is examined with a focus on a specific village and its people.

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Shifting cultivation is one of the earliest known methods of farming evolved by the early nomadic communities when sedentary farm practices were not known, forests were abundant and the settled village communities had not appeared on the scene. The practice has surprisingly persisted through millennia despite the development of agricultural technology and better methods of farming. It involves burning of forests to make clearings, cultivation of cleared patches for a couple of years and then abandoning them as fallow for a much longer period, to be reclaimed once again after several years. Burning of the forest, a long rotational fallow and use of primitive tools are a characteristic feature of this system. Largely con-

finied to the tropics with a humid rainy climate, luxuriant forest growth, and undulating hilly terrain, the system is still widespread in Latin America, Africa, Southeast Asia, Burma and India. Besides environmental conditions, like the humid and forested hilly terrain, shifting cultivation shows a strong traditional bond with tribal communities. In India too, it is largely, though not exclusively, practised by the tribals.

Shifting cultivation in India is very common in the North Eastern hilly region and Orissa, besides the hilly Eastern Ghats region of Andhra Pradesh, Madhya Pradesh where it is moderately practised, and parts of the Western Ghats where it exists in a modified form. The present paper traces the changes in shifting cultivation, referred to

as *Kumri* in Western India during the last couple of centuries and throws light on the present practice of *Tisali*, a variant of *Kumri*, in the Western Ghats region of Maharashtra. A case study of this modified system of shifting cultivation in the Koyna valley is also included.

Shifting Cultivation in the Western Ghats: Past and Present

Shifting cultivation was widely practised in the Western Ghats, extending further north along its forested heights till the south-west extension of Aravalis in Dungarpur district. The earliest mention of shifting cultivation in the Western Ghats, albeit in the entire country, is mentioned in the report of Francis Buchanan (1807) who wrote an elaborate account of what he calls 'cumri' or 'cotu codu' in the Western Ghats, followed by captain Forsyth (1871), who wrote about *dhya* cultivation, as observed from the vantage point of Panchmarhi. An important contribution to the understanding of *rab* - a term used for burning of collected biomass, including branches, twigs, leaves and cow dung - was made by John Augustus Voelcker (1893) in his report on the improvement of Indian agriculture. He elaborates on the importance of *rab* to the farmers of the rainy districts of Western Bombay Presidency. Others who contributed to the understanding of shifting cultivation in the Western region, especially Maharashtra and Gujarat, include T. B. Naik (1950-51), who discussed the agricultural economy and the practice of shifting cultivation among the 'Aboriginals of Gujarat'. Almost at the same time, Shaha (1952), a Forester wrote a note on the 'Economy of Shifting Cultivation in South Konkan' where-in he expressed fear that the sub-cl-

max stage of evergreen forests may give way to a deciduous character because of excessive burning, and pronounced shifting cultivator a bad economist. The qualitative information from the above sources is supported by well documented statistical information about the extent of shifting cultivation in Maharashtra and other states by the report of the Commissioner of Scheduled Tribes and Castes (1956-57, 1960-61). The 1956-57 report of Tribal Commissioner unambiguously talks of shifting cultivation in Bombay and states that "*In the state of Bombay shifting cultivation is practised in the areas of Alibag, Pen, Panwel, Karjat, Nagothana, and ranges of Kolaba district, and in the district of Dangs, annually over an area of 72,300 acres by about 25,000 tribals. In Kolaba district, shifting cultivation is practised by Thakurs and Karkaries and in Dangs district by Kunbis, Konkans, Varlies, Marchis, and Bhils. In Kolaba district it is done by rab burning and planting Nachani in the 1st year and Vari in the 2nd year. Two weedings are undertaken during the season, and the same area comes under cultivation after two to three years. Dangs district follows this method by heavy lopping of the trees. The burnt patches are used almost exclusively for seed beds, and the seedlings are transplanted in the adjoining unburnt areas where trees are heavily lopped to remove shade. Assistance is now given to Katkaris holding Dhali plots for developing land and if the scheme is successful, shifting cultivation will be considerably reduced* (pt. II Appendix, p. 83). Shifting Cultivation in Maharashtra and Gujarat also finds a place in 'The Report of the National Commission on Agriculture' (1976) which discusses state-wise the practice of shifting cultivation. Of late, S. Worah (1991) has

thrown some light on the practice of shifting cultivation in the Dangs district of Gujarat. All references that talk of shifting cultivation in Western India during the 20th century, in reality, refer to the *tisali* system, a relict and a modified form of shifting cultivation, and not the traditional shifting cultivation that involves burning patches of forests.

Kumri, a regional term for shifting cultivation in the Western Ghats has been variously described by foresters and gazetteers produced in the fourth quarter of the 19th century. "In the uplands one of the most marked forms of tillage was the growing of crops on burnt unploughed hill clearings manured with wood ashes. Known as 'Kumri', this was practised by Konkan Ate Maratha or Are Kunbis and forest and hill tribes. Tenure wise, the practice had two categories, viz. 1. Vargdar where the owner got his land worked by tenants and 2. Sarkar kumri where the actual husbandman paid for the land he cleared." Another account from the Gazetteer of Bombay Presidency (vol. XXI. 1884 p.56 -Belgaum) reads as follows. "The steep slopes of Sahyadri are suitable. The dense coppice growing on such slopes is cut down, allowed to dry and then burnt. The ashes are hoed into the soil and nachni or ragi (*Eleusine coracana*) is sown. If the patch has had due period of fallow, a very abundant crop results. During the second season a crop of sava (*Panicum miliare*) is grown on the same ground. The field is then relinquished for a long period of fallow. If left alone for 20 years, it will be found again to be densely covered with coppice". Such accounts of *kumri* can be found in most of the early gazetteers of Bombay and Madras presidencies.

The establishment of forest departments and the introduction of systematic forestry in Bombay and Madras presidencies brought to fore the evils of '*cumri*'. The practice was described as a pernicious system of cultivation laying waste thousands of sq. miles of valuable forests of fine timber which were replaced by a worthless scrub (Stebbing 1921). The need for timber further accelerated the process of conserving forests and restricting '*cumri*', the prime destroyer of forests by indiscriminate burning year after year. It was in 1807, that the earliest efforts were made at forest conservation in Bombay where ship building timber was in great demand. (Progress Reports of Forests 1871:I *Indian Forester* vol. XVII:99). By the third quarter of the 19th century *cumri* was virtually stopped in the Western Ghats, and large chunks of forests were declared as reserved.

***Tisali*, a Variant of Shifting Cultivation in the Western Ghats and Koyna Valley**

The commonest contemporary form of shifting cultivation in the Western Ghats is the practice of *tisali*, a vernacular term used by the farmers of Western Ghats, particularly in the erstwhile districts of Bombay presidency. It is a variant because, though it does not directly involve felling and burning of forests in-situ as in the case of *kumri*, the well known form of shifting cultivation. It does involve a system of rotational fallow, known as '*pher-phar chi pad*' in Koyna valley, and the burning of biomass in the fields known locally as *rab*. The practice of *rab* has a sequence of pollarding (cutting branches, twigs and leaves from tree tops) of trees in the forests, collection of twigs and leaves, transporting the collected woody and leafy matter to the fields, drying and then

burning it, followed by planting. Other variants of traditional practice of shifting cultivation are known to exist.

Ruthenberg (quoting Miracle 1967, 1970) mentions several variants of shifting cultivation, like Cut-burn-plant; Cut-plant-burn; Cut-bury in mounds-plant; Cut-add extra wood-burn-plant-hoe; Cut-wait one season-plant; Burn and plant; and Burn-hoe-cut-plant. Along with several variants mentioned after Ruthenberg (1976), one may add 'Pollard forest trees - collect twigs and leaves - transport them to the field - dry and finally burn'. In the process, while the long fallow is practised, rudimentary techniques are used, the fertility is largely derived from the ashes of the burnt bio-mass, grass and dung, yet, the destruction of the forests is minimal and no timber is lost.

One is not certain if the system of *tisali* closely linked and necessarily based on the practice of *rab* has been there in the forested hills of the Western Ghats since long and existed concurrently with *kumri* or it developed as a substitute following the discontinuance of *kumri*. The revenue records of Satara district of Maharashtra talk of *tari*, *tisali* and *kumri* at the same time, giving a three tier system of land use. The existence of these three types of land use, the last of which is virtually discontinued, is inherent in the response and optimal adoption by farmers to the regional conditions of relief and environment. The early settlers who colonised the mountainous areas were attracted by the relatively level fertile fluvial terraces that were once covered with forests. These flat river side plains were soon cleared and offered permanent sites for agriculture for the settlers who grew rice, a crop that promised maximum return. The land was

fertile, and heavy rainfall provided adequate moisture during the growing season, and an assured yearly crop of rice. Such lands came to be recognised as *tari*, literally meaning wet or moist land. Away from the rice fields on the slopes and at higher levels forests were annually burnt for *kumri*. The British, before imposing a complete ban on *kumri*, through their forest departments, surveyed the forests and allotted large parcels of forest, on payment of rent, to those who preferred practising *kumri*. This discouraged the farmers as they were required to pay the rent every year, regardless of the land being under crops or not. A few of them who retained possession of such lands in the forested area or close to it became regular tenants and owners, and the introduction of the Forest Act did not change their status. Thus, much of the infertile land on slopes or higher residual surfaces owned by farmers belongs to a category where they practise *tisali*, a triennial system under which the land is cultivated for two or three consecutive years and then left fallow for a period ranging from three to six years before the farmers return to cultivate them again. The land under *tisali* system is usually a tenure land, owned by the farmers, and the practice of the triennial system is imposed on them by poor soil and other environmental conditions that don't permit an annual system of farming on the one hand, and restriction on burning of forests on the other. The situation is different in the tribal area of Dangs where land ownership was rare and the tribal communities used to select any patch of open land for *rab* regardless of its ownership. The practice of *kumri*, once widespread, continued for some time till it was banned under the Forest Acts of different provinces, which classified forests as reserved and protected

offering only limited rights to the early settlers. Today, the hilly region has only two systems of agriculture, *tari* and *tisali*.

It must be noted that *tisali* and *rab* are both inter-linked phenomena. While the former refers to the three year system of cropping followed by a long fallow, the latter is only one aspect of the agricultural practice, meant to impart fertility to the soil, and involves collection and burning of cow dung, wood, twigs, leaves and grass, in the fields where *tisali* is practised.

Despite the ban on and discontinuance of *kumri* and forest burning, the hill farmers continued collecting huge mass of branches, twigs and leaves from the forest to burn these in the field, a practice called *rab*. There was resistance from the forest departments to this practice, and the acceptance of pollarding associated with *rab*, as an official policy was not a smooth affair. There was a virtual storm after the appearance of Dr. Schlich's manual on forestry which recommended pollarding. (Indian Forester 1886 vol. 12:21, Indian Forester 1890 vol. 16:304-05) as he argued that the 'trees may be cut over just as an ordinary coppice'. One may surmise that the acceptance of pollarding as a practice by forest departments led to the adoption of this alternative method of shifting cultivation, the *tisali*, supported by the practice of *rab*. Incidentally, it may be emphasised that more than *tisali*, it is *rab* that signifies shifting cultivation not only in Koyna valley but the entire Western Ghats, in Maharashtra and Gujarat.

Distinction between Tisali, Rab and Kumri : While the *kumri*, as noted earlier, is a classic example of shifting cultivation,

starting with the burning of forest patches, *tisali* is a triennial system of farming in the hilly region of the Western Ghats where land is cultivated for three consecutive years and then left fallow for several years. The *rab*, on the other hand, is a near substitute for *kumri* in the sense that unlike *kumri* it does not involve cutting and burning of forest patches and is confined to only pollarding the trees, lopping their branches, twigs and leaves, their transport to the specified fields and then burning them in a specified manner. Another point of note is the fact that in case of *rab* the burning of collected material covers only a fraction of the area of the field to be cropped.. The ash after burning of the *rab* is not always spread over the entire field, and not infrequently the *rab* patch is used as a nursery usually for *nachni* (*Eleusine coracana*). *Nachni*, the first year crop in the *tisali* system after a long fallow, in Maharashtra and Gujarat, is usually transplanted.

Similarities and Contrasts between Tisali, a Modified Form of Shifting Cultivation and Kumri the Traditional Shifting Cultivation : In their basic parameters both the practices are alike but differ in many respects. The rotational fallow involving rotation of fields, not crops, the most central feature of shifting cultivation, is common in both the practices. The burning of biomass to fertilise the fields, an inalienable feature of shifting cultivation is also found in both the practices but with a difference. In shifting cultivation practice, patches of forests are burnt to make a clearing, while in the case of *tisali*, biomass is collected and then burnt in the field earmarked for sowing in a specific year. The collection of leaves and

dry matter, often twigs and not trunks and branches, from the neighbouring forests does not harm the forests. Both the practices are labour intensive and use indigenous equipment, though in *tisali* land is some times roughly ploughed before sowing. In both cases, Eleusine coracana is one of the principal crops though North East India is an exception where indigenous varieties of rice are still the dominant crops in *jhuming*, a regional term applied to shifting describe cultivation.

The contrasts relate to land ownership, type of farming and the varieties of crops grown. In most other parts of India like Andhra Pradesh, Orissa and the states of North East, or even the northern parts of Western Ghats and Dangs in Gujarat, shifting cultivation is largely practised by tribal communities, whereas in the Koyna valley it is also practised by certain caste groups, like Marathas who own the land as permanent tenants. Ownership of the land in most other parts of the country, particularly in the North-East, rests with the clan or community and every family is allotted specific parcels of land for its use by the community, often represented by the clan chief. Mixed culture is the common form of shifting cultivation and many times a dozen crops, with different life cycles and maturity periods, are grown simultaneously in the same field. In the *tisali* system, this is replaced with monoculture, where either *nachni* or *vari* or *khurasani* is grown in a three year succession. The destruction of forests is minimal - in fact they are hardly affected - in *tisali* unlike *jhum*, *podu* or *dhya* system where forest burning is invariably the first step in the practice.

The Areas of Field Survey and Research: Though the authors of this paper surveyed virtually the entire stretch of Western Ghats north of Koyna valley, intensive field work was confined only to Koyna valley, Peint taluka of Nashik district and the district of Dangs in Gujarat. (figs. 1 & 2). The present paper is restricted to examining the conditions and the practice of *tisali* cultivation in Koyna valley.

While the general comments in the paper are based on the observations made on most of the sites, specific details about the crops, inputs in the practice and the system's productivity are based on the data collected during several field visits and the village records of villages in Koyna valley, specifically the upper Koyna valley. Records of individual holdings, input-output, the specific treatment during the cultivation period and other data are collected from a few villages, with a focus on Parsond, a village about 10 km west of Mahabaleshwar hill station, as the crow flies, and just about a couple of km west of the Koyna river, in the hilly terrain. Wherever comparisons are made names and locations of villages and sites are mentioned.

Sites of Shifting Cultivation in the Western Ghats

Theoretically, the entire stretch of Western Ghats and its flanks inhabited by tribal communities would appear to impose the practice of *tisali* on the farmers. But the extent of shifting cultivation in Karnataka and Kerala is very limited for two main reasons. The first is the occurrence of well preserved forests which have been protected by the successive governments. The introduction

of teak plantation in Karnataka and Kerala and the plantations of tea and coffee, at higher and lower altitudes respectively, occupies large areas which otherwise would have been subjected to shifting cultivation. There are other plantation crops like cardamom, cocoa and pepper requiring high rainfall leading to a more productive utilisation of the hilly terrain. Another important factor is a relatively small tribal population in Karnataka and Kerala as compared to Maharashtra and Gujarat. The total estimated area under shifting cultivation is only around 4,000 hectares in Kerala (?), and in Karnataka it is around 1000 hectares. These figures given by the Commissioner of Scheduled Tribes and Scheduled castes (1956-57), an overestimate even fifty years ago, have no relevance with the reality as *tisali* is not much of a practice in these parts today. In contrast, the estimates of area under shifting cultivation in Gujarat and Maharashtra, though an underestimate, is 30,000 hectares (Commissioner of Scheduled Castes and Scheduled Tribes, Report 1961). This estimate, the authors are certain, refers to *kumri* which has all but disappeared from the Western Ghats region during the last fifty years. It does not include the areas under *tisali* system, based on long rotational fallow and *rab*.

The slopes and relatively flat areas in Western Ghats, and the western foot hills and spurs extending into Konkan, that lie in Satara, Ratnagiri, Raigarh, Pune, Thane, Nashik and further north in Dangs are the scene of shifting cultivation. It is practised not only by the tribal communities, as generally believed, but even by settled village communities of Marathas and other caste Hindus. Also, the practice is not only confined to forest land as in Dangs, but even

the tenure lands owned by the farmers are subject to it. In fact, the *tisali* form of shifting cultivation in Sahyadrian Maharashtra is largely confined to the land, once covered with forests but now reclaimed and owned by the farmers.

The communities practising this mode of cultivation include the Marathas and Kunbis, both caste Hindus, living in the hilly terrain, and tribes like the Warlis, Katkaris, Mahadev Kolis and the Koknas, who have taken to farming, and practise *rab*. Further north, the Kolis, the Koknas and the Dangs of Dangs, in Gujarat, who were once practising shifting cultivation indiscriminately, were forced to resort to the practice of *rab* for growing inferior millets because of Government restrictions. The situation in Dangs, today, is completely changed because of intervention by the State Government and the allotment of tenure land to the landless tribal families.

Physical Characteristics and Terrain Conditions of the Areas Practising 'Tisali' in the Western Ghats: It is known that shifting cultivation is largely confined to the tropics. These regions have a few common important bio-climatic features. They are warm and humid, they have generally a heavy rainfall and they are rich in forests and vegetal wealth. These may represent the optimal conditions for shifting cultivation. And, undoubtedly, in most situations, these areas are, or were once, the favourite sites for shifting cultivation. The occurrence of tribal groups, not conversant with better methods of farming, represented a convergence of physical as well as cultural features, that inevitably led to the practice of 'shifting' cultivation.

sive factor is terrain, the ethnic status of the people is less of a consideration, yet it is a verifiable fact that irregular dissected terrain and forested areas are inhabited by tribal communities, who practise shifting cultivation, adopting at the same time, a settled annual system of farming in the flat valley plains at lower levels.

If one takes a longitudinal (north-south) profile of the crest line of the Sahyadris, one encounters variable altitude ranging from 650 m to 1450 m. Leaving aside the wide open gaps in the mountains where the valley plains extend westward truncating the divide, the range is a complex of alternatively arranged hills and dales with some residual high altitude plateaux, like Mahabaleshwar or slightly lower ones like the one represented by Bhimashankar.

The flat valley terraces, east of the divide and close to it, with dependable high rainfall are occupied by paddy. The terrain marked by frequent patches of shifting cultivation lies largely to the west of the divide. This is the area wedged between the Sahyadrian crest line on the east and the low coastal strip on the west. The valley heads, the foot hills and the spurs descending from the divide westward, before they flatten out in the Konkan region, are the favoured sites of shifting cultivation. The width of this intervening strip is 15-25 km, depending on latitude. It is usually wider in northern Maharashtra and Gujarat and narrows down southward.

The Mid-Level Surfaces, the Favoured Sites of Shifting Cultivation: The general impression that the west-face of the Sahyadris is a razor-edge escarpment, flat-

tening into Konkan westward and the upland (Desh) eastward does not represent the correct picture. The escarpment, the western face of the Sahyadri, with exception at a few places, is neither rectilinear nor immediately confronted by Konkan lowland. It is represented by several parallel scarps and mid-level surfaces. In the northern part of Konkan and south Gujarat, there are two parallel scarps that intervene between the coast and the mountain. The first marking an abrupt descent from the edge of the Deccan plateau comes to an abrupt end and is confronted westward by a relatively flat surface which may be occasionally as wide as 25-30 km, and descends westwards to the coastal plain over a subdued and gentle escarpment through a series of minor descents. This relatively flat surface (300-400 m ASL) is what is termed here as the mid-level surface which was once covered with forest. The significance of this mid-level surface becomes evident when one realises that this longitudinal belt lying about 350 m ASL, and abutting against the main Sahyadrian scarp is largely and often even exclusively inhabited by the tribal groups. This level is more conspicuous north of 19° N latitude, and widens further north in Dangs in Gujarat. In Gujarat and Maharashtra, the tribal population living in association with the hills of Western Ghats is perched on this 350 to 400 m surface. The district of Dangs, the Jawahar taluka of Thane district and the Peint taluka of Nashik district are clearly perched on this surface. This mid-level surface in South Maharashtra, is either very narrow occurring at a higher level or altogether missing. Starting from north to south, the mid-level surfaces juxtaposed westward to the Sahyadrian face has much up the concentration of tribal population as well as the

Table I

Concentration of Tribal population in different Talukas lying along Western Ghats

Talukas	Districts	State	Annual Rainfall (mm)	Percentage of Tribal Population
1. Dangs	Dangs	Gujarat	1780	93.96
2. Dharampur	Valsad	Gujarat	2410	
3. Bansda	Valsad	Gujarat	1881	
4. Waghai ¹	Dangs	Gujarat	2218	
5. Surghana	Nashik	Maharashtra	2100	95.77
6. Peint	Nashik	Maharashtra	2352	94.95
7. Murbad	Thane	Maharashtra	2534	24.63
8. Shahapur	Thane	Maharashtra	2588	32.74
9. Mokhada	Thane	Maharashtra	2467	93.46
10. Vada	Thane	Maharashtra	2534	56.88
11. Jawahar	Thane	Maharashtra	(N. A.)	93.52
12. Pen	Raigarh	Maharashtra	2866	
13. Patan	Satara	Maharashtra	1831	0.49
14. Jaoli	Satara	Maharashtra	over 3000 mm	1.41 Tahsils in
15. Mahabaleshwar	Satara	Maharashtra	6225	6.81 Koyna Valley

1. included in Dangs

practice of shifting cultivation, thus establishing the unfailing association and spatial convergence of tribal communities and shifting cultivation. (Table I) The following talukas, occupying the above mid-level surface, from north to south, represent areas where shifting cultivation is practised.

Thus, besides the flat undulating higher surfaces and valley slopes and divides close to the divide line, the mid-level surfaces west of the crest line, in the northern part and the dissected terrain with lower hills in the southern part of Konkan are the main sites of shifting cultivation.

The Non-feasibility of Annual System, a Reason for the Continuance of Tisali:

Though the anthropologists emphasise the cultural and the ritualistic tradition of the farming tribal communities, it is the impracticability of an annual system because of terrain conditions and infertility of the soils that a longer fallow becomes necessary and the farmers begin to subject such land to *tisali*. The dissected terrain with sloping land suffering under severe erosion, and without any prospect of water retention in the fields does not admit an annual system. The poor leached soils in the humid rainy area, are devoid of not only the bases but even the

clay, with poor moisture retention and cation exchange capacity (CEC). The soils are extremely leached and too infertile. And even the periodic cultivation of such lands is possible only after the soil is enriched by extradaphic sources like ash from the burnt up forest patches, or derived from the burning of accumulated vegetal material, as is commonly done during the practice of *rab*.

A minor element that has supposedly some bearing on the continuance of shifting cultivation is the food habit of the hill people in the Western Ghats region. The hill farmers, it is true, have been traditionally eating certain cereals, more specifically *nachni* or *ragi*, as their staple food which they would not like to discontinue. So, while the cultivation of rice on the fertile river terraces strengthens their agricultural economy, the utilisation of the least fertile land their income and at the same time provides them their supplements of traditional food. The hill farmers of the rainy Western Ghats and those on its flanks from Gujarat to Karnataka are used to eating *nachni* as a staple food, the same way, as the dry plateau farmers of Karnataka and Maharashtra have *jowar* (sorghum) as their staple food for generations. But the most compelling factor is the poverty of these hill communities who engage in hard toil, while practising *rab* for some petty return from poor soils. The practice is, undoubtedly uneconomic, yet it continues. To give an idea of how infertile the soils in this region are, the results of the chemical analysis of the soils in the Koyna valley is reproduced below.

As can be seen there is quite a change in the composition of soil from the composition of parent rock. The most obvious change is the leaching away of CaO, MgO,

Na₂O. There is also leaching of potassium (K₂O), but it may have been replenished over the years by cultivation and occasional burning of vegetal material. Besides these bases, there is leaching of silica, and relative increase in concentration of aluminium as well as iron. It is this concentration of aluminium and iron that promotes the formation of latosol, ferricrete and in the ultimate analysis, laterite and lateritic crusts, making the soils intractable and highly acid. Left to themselves, these soils may in due course turn into ferricrete, but their cultivation leaves a residual mass of organic material and improves their texture without letting them deteriorate further. If the same soil is examined depth wise, to a depth of 28 cm, there is no insignificant change. The only significant change is the concentration of nitrogen, minute though it is, on the surface there is a slight increase in the iron content. But the sudden drop of nitrogen content is obvious.

Koyna Valley - Some Characteristic Features

The Koyna valley, a tributary of Krishna, with a near north-south alignment unlike other rivers of Deccan plateau, literally furrowing the crest line of Sahyadris occupies a structural lineament. Administratively, it lies in Satara district of Maharashtra. Originating from the north-western flank of the Mahabaleshwar plateau, the river flows at an altitude of around 800 m ASL in the source region till it joins Krishna river, further down at 600 m ASL, and is bordered on both sides by forested hills, undulating higher surfaces, often turned into grazing grounds, and moderate to steep slopes. The

Table II

Results of the Analysis of the Soils from Koyna Valley. This is an upland soil (800 m ASL) village - Pethpar, Survey no. 18 and 25, taluka Mahabaleshwar, distt. Satara, approximate rainfall 3000 mm.

Properties and Chemical Constituents	Soil in Survey No. 23	Soil in Survey No. 18	Parent rock
pH	5.7	5.85	7.9
Organic Matter %	0.73	—	—
SiO ₂ %	32.5	32.6	48.03
Al ₂ O ₃ %	20.9	21.68	14.48
FeO %	1.08	1.35	—
Fe ₂ O ₃ %	16.57	17.71	14.6
CaO %	1.96	1.40	11.14
MgO %	0.89	2.18	5.00
P ₂ O ₅ %	0.31	0.29	0.34
Na ₂ O %	0.20	0.10	1.67
K ₂ O %	1.14	1.20	0.45
MnO %	—	—	0.11
N %	0.24	0.24	—
TiO ₂ %	2.62	2.62	3.58

Site- Pethpar village in Mahabaleshwar taluka, west of Koyna river: Analysis- Geomorphoc Lab., Deptt. of Geography, University of Pune.

area of the entire basin may be roughly 4000 sq km. The upper part of this longitudinal valley, surveyed by the authors, extends for over 70 km from the source down stream, and covers an area of about 2000 sq. km. It receives one of the heaviest rainfall in western India, averaging around 2500 mm. Here, the valley side slopes merging into mountain tops carry either reserved forests or appear topped by high altitude plateau, often grass covered which are the favourite sites of shifting cultivation. In fact,

these high altitude surfaces were once covered with luxuriant forest but a prolonged practice of *kumri* resulted in their destruction. The land was occupied and owned in the middle of the 19th century by the valley farmers on a paltry rent.

The valley bottom is interspersed with a string of small villages, all along the river, bordering the narrow serpentine plain, not exceeding a few kilometres. These are the main settlements of the region. Isolated for long, these villages depend for a meagre

though assured agricultural produce from the cultivation of the river terraces, besides engaging themselves in grazing, shifting cultivation on higher slopes and a clandestine exploitation of forests in the vicinity. Seasonal dairying during the monsoons and the post monsoon period is a supplementary source of income. Paucity of land has forced many of them to migrate to larger towns in search of jobs. The lower half of this area carries a reservoir meant to feed the hydro-electric power plant, located at the foot of the Sahyadrian scarp, with a head of 800 m, across the continental divide. *Tisali* system of shifting cultivation accounts for over fifty thousand hectares, roughly one fourth of the area of this part of the basin.

The Environment: The area has a long history of ecological and cultural evolution. Lithologically, a part of the Deccan trap province, it is oriented to a line of structural weakness, with steep valley side slopes in the upper two thirds of its course. The rainfall, one of the heaviest in Maharashtra, is over 3000 mm though not as heavy as on the neighbouring Mahabaleshwar plateau which receives over 6000 mm of rain. With a deep weathering profile, heavy rainfall, and a temperature inducing vegetal growth, the valley once supported impenetrable forests. The early settlers who entered the valley rummaged through the forests and used it freely. The river terraces were colonised with settlements close to paddy fields, and the forests in the adjacent hills were burnt for shifting cultivation, the extent of which depended on the available manpower. This continued for several centuries till the arrival of the British on the scene. The land survey of Koyna valley during the course

of settlement (1860-62), delineated the areas of dense growth and classed them as reserved forests, granting only some residual rights to the farmers in the neighbouring villages. These included the right of way, access to springs, temples and water courses, as well as the privileges of grazing, gathering dead wood, thorns and other minor products. In some parts, the forests were also allotted to farmers for practising 'wood ash' cultivation a term used by the British for *kumri*. During the settlement survey, the land, both forested and cultivated, were surveyed, their areas determined, and specific survey numbers allotted. The settlement survey restricted the freedom of the farmers, *kumri* was stopped and the practice persisted only in the form of *tisali*.

Kumri in the Land Classification System of the Mid-19th Century and its Discontinuance : The land use and the type of cultivation in the mid-19th century were very different from to-day, as can be judged from the settlement reports prepared by R. G. Gordon (1960-reprinted). The forests till the arrival of the British were neither properly managed nor strictly controlled. The interest of the rulers, in this case of Satara, was minimal and confined to the collection of royalty in timber wood like teak, maintenance of private reserves, locally called *kurans* in the vicinity of their headquarters and the preservation of forests around the forts to increase their inaccessibility and invincibility. The cultivated land was managed by the village *patils* who paid some annual rent to the ruler. The forests were free for all and the villages nearby used them not only for grazing, collection of forest produce, fuel and timber but also for *kumri*

which involved the burning of forests and making of clearings. That there was a great deal of unauthorised clearing and cultivation by villagers is clear from the letter by Capt. W. C. Anderson, Superintendent, Revenue Survey Assessment of the Southern Mahratta Country to the Collector of Satara in January 1856. The letter reads: " Till recently, these villages (in Koyna valley) were held by the *Patils* on payment of a certain fixed yearly sum, the appointment of which among *rayats* was left very much for settlement among themselves. The system of *rayatwari* collection has been introduced in the place of village system formerly existing". He further adds " The lands hitherto devoted to *kumri* or *dulliran* cultivation have been divided into revenue survey numbers of 15 to 30 acres in the manner and with aim proposed in paragraph 19 of the joint report made by Dr. Gibson and myself dated 11th Dec. 1853. The assessment of these lands will vary from Rs 0 -3-0 to Rs 0-1-0 per acre. From what I have seen and heard, I anticipate that the people will readily agree for whole numbers and cultivate part in rotation each year. Each cultivator, in this case, instead of squatting in different parts of the jungle each year, becomes tied to his own particular holding and have an inducement to attempt improvements for which the numerous springs on the hills supply such great facilities".

The revenue records of 1860, collected from the district revenue office at Satara, written in Modi, an old script of the regional language Marathi, use a terminology that was later adopted by Survey and Settlement Manual (R. G. Gordon, 1959 reprinted). Classified from the revenue point of view the entire land was grouped into two broad classes:

A. *Kirdsar* (Cultivable);

B. *Nakirdsar* (uncultivable)

The cultivable land was further sub-divided into:

1. *Jirayat* (rainfed farming)

2. *Bagayat* (irrigated farming)

3. *Tari* (rice lands)

Jirayat land is further divided into *jirayat*, *khushki*, *tisali* and *kumri*.

It appears that *kumri* and *tisali* as systems of hill farming existed concurrently for some time. While *kumri* was discontinued after the introduction of Forest act, *tisali* as a type of shifting cultivation continues to this day.

Shifting Cultivation in the 19th Century as evident from the Cropping System

Among the earliest sources that give an idea of the cropping system of Koyna valley as it existed in the 19th century, one may include the Settlement Reports, old revenue records and the gazetteer of Satara district, all dating back to 19th century. Unfortunately, the data from Settlement Survey or even the gazetteer are not village wise but refer to whole *talukas*. Thus, the data given below represent a regional phenomenon. The crop composition of Javali *taluka* which also included Mahabaleshwar *taluka* in the 19th century, is derived from two sources given in (Table III) below. The primary division of land use is as follows:

What emerges from the above data is the fact that there was a relatively lower percentage of land under cultivation (19.5%) in Javli (now Jaoli) *taluka* in late 19th century, as compared to a much higher area

Table III

Crop Composition and Land Use of Javli Taluka in the 19th Century

	Area in hectares	Percent of Geographical Area	Percent of NSA
Geographical area in 1885	81,066.69	100 %	
Net Sown Area	15,450.91	19.05	100 %
Rice	1,253.31	1.546	8.11
<i>Nachni</i>	4,133.86	5.009	26.75
<i>Vari (Sava)</i>	3,689.11	4.55	23.87
<i>Rala (Kang)</i>	440.29	0.54	2.84
<i>Kodra (Harik)</i>	27.11	0.033	0.175
Area under shifting cultivation crops (<i>Ragi, Vari, Rala, Kodra</i>)	8,340.37	10.28	53.97
Rotational Fallow	22,212.80	27.40	
Area affected by shifting cultivation	30,553.17	37.68	
Other Crops			
<i>Bajra</i>	1,038.94	1.28	6.72
<i>Jowar</i>	2,567.32	3.16	16.62
Wheat	425.32	0.52	2.75
Maize	4.45	0.005	0.028
Barley	17.80	0.02	0.115
Pulses	1,046.50	1.29	6.77
Oil Seeds	904.87	1.11	5.85
Forests	26,079.15	32.16	
Other Uses	17,323.80	21.36	

Source of data: Selections from the Records of Bombay Presidency, N0. CCLXXXV-New Series-Paper Related to the Revision of Survey Settlement of Javli taluka-1894 Letter from E. C. Ozanne, Survey Commissioner, Land Records, p.41; and Gazetteer of Bombay Presidency Vol. XIX, Satara , 1885. The data originally in sq. miles and acres are converted into hectares.

under cultivation presently. Today, over 32% of the entire basin (incorporating 349 revenue villages) and over 23% of the main basin (comprising the area of 204 revenue villages) of Koyna river is under cultivation (see Appendix B and C). This meant an increase of 25 to 50% in the cultivated area over the last century. It appears certain that more land has been reclaimed during the last century and a quarter than ever before. The lands newly reclaimed by cutting and levelling of slopes on the outer edge of the terraces has invariably gone to rice, an annual crop.

In the cropping system of the 19th century, over half the acreage of net sown area was held by crops that formed the main components of *tisali*. In fact, *nachni* was the most important crop holding more than a quarter of the Net Sown Area, and together with *vari*, these two crops accounted for over half the Net Sown Area (Appendix-A1). The situation is considerably changed today. The farmers of Koyna valley have tried to convert as much of land as possible to an annual system of farming, planting rice. The result is that whereas rice accounted for 1.5% of the total geographical area and only 8% of the net sown area, in the 19th century, today the crop covers around 6% of the geographical area of the basin and stands out as the principal crop of the basin with 25% of the net sown area. Proportionally, the relative importance of *nachni* and *vari* has declined. Individually *nachni* today occupies only 4% of the geographical space of the basin and accounts for only 17% of the cropped area as compared to 26% in the last century (Appendix A & C). In fact, today, the acreage of all the crops grown under shifting cultivation don't add up to as much as the area under rice alone. Thus the infe-

rior millets have yielded their predominant position to rice, partly because of shrinkage in their acreage but equally as a result of increase in the rice fields. Obviously, shifting cultivation in the basin was far more rampant earlier than it is now.

Thus, the relative importance of shifting cultivation has decreased and the crops associated with this system occupy only 3 to 5% of the geographical area and hardly one fifth of the Net Sown Area of the basin.

Identification and Estimation of Area under Tisali Cultivation: It is not difficult to identify the parcels of land that have been cultivated under the *tisali* system and left fallow. While travelling in the valley or making a survey of the agricultural landscape of the village, one spots burnt and deserted patches not currently cultivated and left fallow. Irregular shapes, disturbed soil and absence of any vegetal cover present the tell tale signs of the status of the land as fallow. Such patches as carry some vegetation and don't appear bare also can be spotted with the contrast in vegetal growth with the neighbouring field. The fields currently carrying some crops are obvious and can be identified with the nature of the crops. But the observation of such fields, though useful in understanding the site conditions and the ecology of the crops, does not help in determining the extent of shifting cultivation (*tisali*) in terms of hect-araage devoted to this system of farming. The area given to shifting cultivation can be estimated with the help of these crops and the area of rotational fallow.

It must be emphasised that in the hilly Western Maharashtra, the crops associated

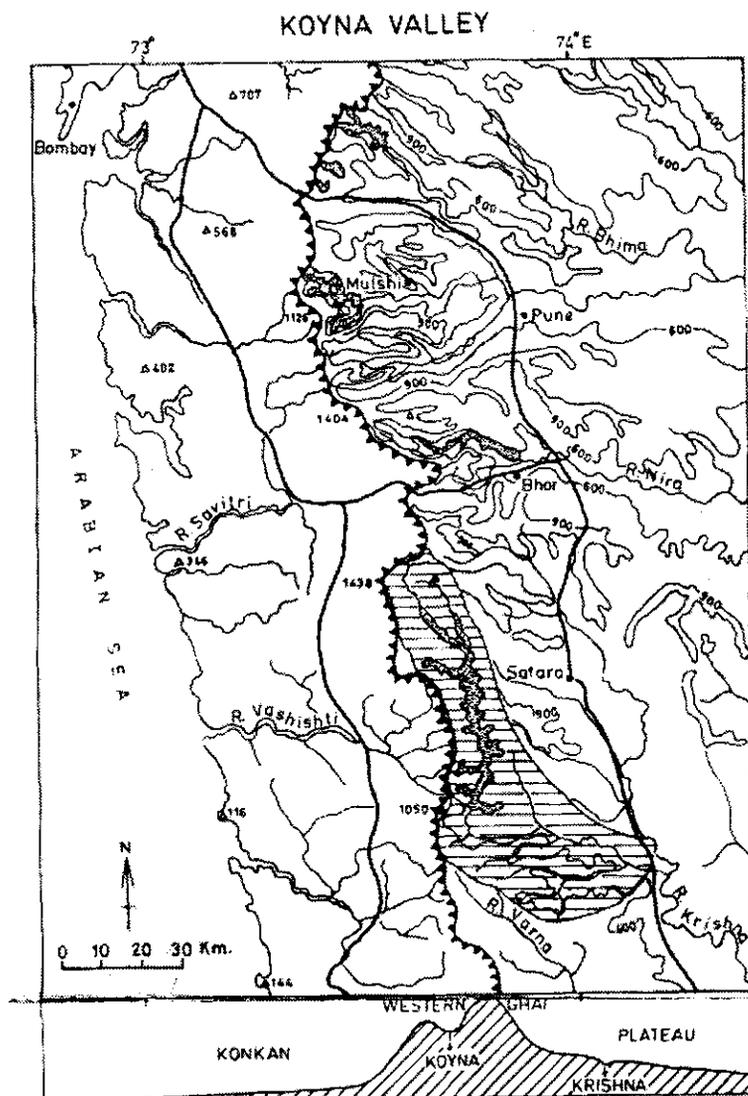


Fig. 2 Koyna Valley

with the *tisali* system are not many. These crops, often termed inferior millets, are typical of the *tisali* system of cultivation. These, in the order of their importance, are as follows:

1. *Nachni, Nagli, Ragi* or Finger millet (*Eleusine coracana*, G)
2. *Vari, Warai* or *Proso* (*Panicum miliaceum*, L)
3. *Rada, Rala, Kangooni* or Fox tail millet (*Setaria italica*, B)

4. *Kodra* or *Kodo* millet (*Paspalum scrobiculatum*)
5. *Khurasani*, *Ramtil* or Niger seed, (*Guizotia abyssinica*)

As a rule, any field that is to be subjected to *tisali* and is given the *rab* treatment and carries one of the above crops depending on the order in the sequence of three years. Usually, a field, after several years of fallow, carries *nachni*, the second important crop of the region after rice, followed by *vari* in the second year and then *khurasani* or *rada* in the third year. In the Koyna valley *rada* is a preferred crop to *khurasani* which is cultivated in the less rainy northern parts of the Sahyadri.

Thus, in a specific agricultural year, if the area devoted to these four crops viz. *nachni*, *vari*, *rada* and *kodra* is known that would represent the area under shifting cultivation. And if the area under rotational fallow is added, it will give the total area affected by shifting cultivation. (fig. 3 & 5) This also means that this would represent the area where shifting cultivation was practised at one time or other. One may summarise by saying that:

The area presently under shifting cultivation, is the area under (*Nachni+Vari+Rada+Satu*); the four principal crops usually grown in shifting cultivation and the total area under shifting cultivation or area affected by shifting cultivation = Area under crops typical of shifting cultivation + the area under rotational fallow.

Areal Units and their Data Base: The data available for land use and cropping pattern for Koyna valley at different periods don't refer to an identical territorial unit, since the

land use and crop data are based on revenue units and don't take into account the basin boundaries. The earliest available records (1885/1894) that include Koyna basin relate to Javli taluka as a whole, then a much larger unit that also included the present Mahabaleshwar taluka. Much of the Koyna basin, though not the entire basin, lay in this taluka. The land use and crop data of Javali available for 1885 give a reference point with which the present situation can be compared. Since the territorial units, though overlapping, are not identical, the acreage under different uses or crops is converted into percentages of total area to facilitate comparison. (Appendix F)

The present basin of Koyna spreads over four talukas viz. Javli, Mahabaleshwar, Patan and Karad, and includes 349 villages and an area of 207,720 hectares. The data for the entire basin is available circle wise, a subdivision of taluka, and village wise. The area of the basin thus delineated cuts into areas of very moderate rainfall, level terrain and even better soil. Keeping this in mind, and our purpose of isolating the area of *tisali*, the basin is limited to only three talukas viz. Patan, Javli and Mahabaleshwar. To make it more representative, the villages beyond the basin boundary have been deleted from these talukas. Also, such villages as are deserted following the building of Koyna reservoir and the submergence of part of the basin, have been deleted. Thus, what is referred to as the basin proper in the following pages consists of 208 villages with an area of 128,089.4 hectares. Further down the scale, a sample of 26 villages is taken across different cross sections of the valley from east to west. (fig. 2A) And, to get a closer view, data from a few villages are quoted as illustration. Thus, the spread and intensity of

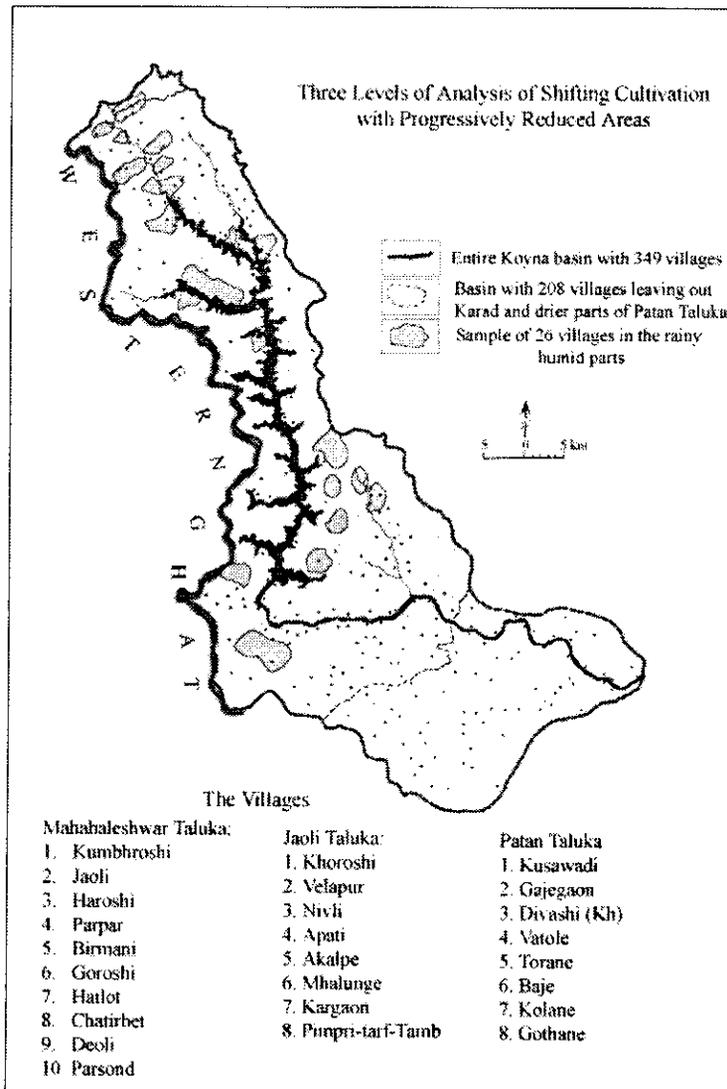


Fig. 2 A Village Parsond

shifting cultivation have been investigated at different levels of aggregation of data, and compared on a relative scale of percentage of areas under different crops and uses.

Looking at the cropping pattern and the land use in 1885 of Javli *taluka*, much of which falls in Koyana basin and which included, then, the present Mahabaleshwar

taluka, one finds that almost one third of the area (32.3%) was covered with forest, 10.2% was under the crops typical of shifting cultivation as mentioned above, and 27.4% was under rotational fallow. This suggests that 33.7% or one third of the area of the *taluka* was subjected to shifting cultivation (Table III).

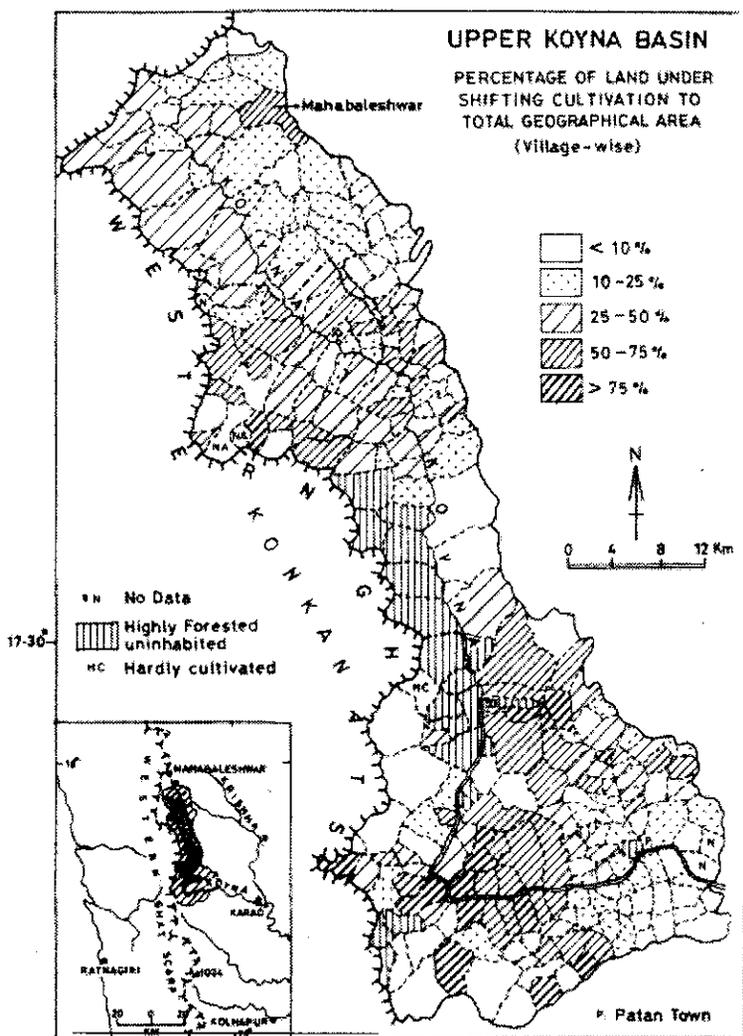


Fig. 3 Upper Koyna Basin - Land under Shifting Cultivation

The contemporary picture of the basin in terms of land use and shifting cultivation is very different from what existed a century before and depends on how much and which part one takes as representative of the basin. If one takes the entire basin that cuts into different topo-climatic zones, the picture would be different from the one that is based on a few selected sites in the wet hilly part of the basin.

Here, the extent and intensity of shifting cultivation is investigated with the help of three different and unequal areal samples.

1. In the first case the entire basin spreading over four *talukas* viz. Karad, Patan, Javli and Mahabaleshwar - all forming parts of Satara district and comprising 349 villages is taken into account. It cuts partially into the dry eastern parts of the basin (Appendix-B).

2. In a second case the basin area confined to relatively wetter parts of the basin lying in only three talukas and comprising only 208 villages is taken for study (Appendix- C).
3. In the third case, only 26 villages along three or four transverse cross sections of the valleys reaching up to higher levels are taken for examining the extent of shifting cultivation (Appendix-D).

Changes in the Scale of Shifting Cultivation and the Crop Combination:

The land use pattern of the entire basin represented by four talukas as mentioned above is very different today from what it was in 1885 (See Appendix E). Though the net sown area including grass has substantially increased over the last century from just over 19% in 1885 to 23.7% in 1992 for the basin proper and 32.4% for the entire basin, the share of crops associated with shifting cultivation has dwindled considerably, and the four major crops associated with shifting cultivation occupy only 3.68% of the area with 19.25% left as rotational fallow. Thus, the total area affected by shifting cultivation comes to 22.93% of the total geographical area. This represents the changes in land use over time as well as the character of crop combination which is not the same and suggests a decline in the area devoted to inferior millets. Part of the cultivated acreage that was originally grown with inferior millets has been taken over by rice, and the inferior millets typical of shifting cultivation, have remained confined to the really least productive infertile lands.

The wetter part of the basin represented by 208 villages shows a slightly higher pro-

portion of the area under shifting cultivation and an equally higher percent under rotational fallow. In this case the crops (*Nachni, Vari, Rada* and *Sattu*), typical of shifting cultivation occupy 5.7% of the area chosen for study, and rotational fallow account for 32.93% of the area. Thus shifting cultivation spreads over 37.58% of the area.

In the third case where only 26 villages within a distance of 15 km on either side of the river have been taken, the picture changes and the percentage of Net Sown Area (NSA) declines as we move higher up westward towards the continental divide. Here in the irregular dissected terrain, the NSA comes down to 8.89% with only 3.54% of the geographical area given to the crops typical of shifting cultivation, though the rotational fallow remains fairly high at over 32%, indicating that a much larger period of fallow is necessary because of high rainfall and excessive leaching of the soil. The area affected by shifting cultivation (36.14%) is not much larger (see Appendix D).

A Generalised View of Landuse: If one takes a generalised view of the land use, leaving aside their quantitative presentation, there appear four major components of land use in the hilly area of Koyna valley. These are: 1. Forests, 2. Net Sown Area. 3. Rotational Fallow and 4. Other uses like village sites, roads, water bodies and uncultivable land.

The relative importance of each of these uses varies with relief, level of dissection, availability of flat and moderately sloping land and the intensity of shifting cultivation. There is hardly any village in Koyna valley

where there are no forests. These usually occupy 1/3 of the land, sometimes rising as high as 40%. In fact, the entire area was once covered with forests; what remains is the left over from the process of colonisation by the farmers and the *kumri* practised in the last century. The hills once covered with forests were the convenient site where *kumri* was practised unrestrained, since made illegal and the forests declared 'reserved'. The forest land on the slopes and higher reaches once allotted for *kumri* and held on by the farmers turned in due course completely infertile and could support only a triennial system now known as *tisali*, leaving the land fallow for two or more years.

The Net Sown Area in this hilly region varies between 10 and 20% of the geographical area. This demonstrates the limited agricultural potential of the area. In the villages located on the river terraces, the NSA may exceed 25 %, but usually it lingers around 20%. Higher up away from the streams, the NSA declines to 10 % or even lower with more area under forests, rotational fallow or even remaining uncultivable, essentially because of lateritisation. The grass covered rotational fallow sometimes even exceeds 50%.

Rotational Fallow: This is the most significant component of land use in this region which throws light on the extent and intensity of *tisali* and the length of fallow cycle in the region. As mentioned earlier, the land under inferior millets in this study is taken to mean the land currently under *tisali*, with addition of area under rotational fallow one arrives at rough estimate of the total area affected by shifting cultivation.

Rotational fallow usually varies from 25 to 35% of the geographical area of most villages, invariably rising as one goes away from the stream towards the divide. In some of the hilly villages where shifting cultivation is the main agricultural activity, the fallow land may rise to two thirds of the geographical area. This can be illustrated with the case of Kandat (Table VI), a village located on the divide line of the Western Ghats with an area of 1473 hectares. With a population of 178 (1991), the village has just 44 hectares of land under crops, much of it under *nachni* (*Eleusine coracana*) which is the principal crop of the village. The small patch of forest (35 hectares) on which the villagers depend for their fuel and *rab* is shrinking daily. With latosol covering the entire area, there is no scope for either intensive cultivation or increasing the hectarage. Growing around 50 hectares of grass for cattle that supports their seasonal dairy industry, the villagers keep a large area (929 ha) under rotational fallow, thus permitting a ten year cycle of shifting cultivation.

The table in Appendix-E gives the land currently under shifting cultivation and the total land affected by shifting cultivation in Koyna basin or part of it at different times.

As can be seen from the table, the area under *tisali* in the entire basin, which includes all the villages including those in the drier eastern parts, has declined during the last 120 years from 33% in 1885 to 23% in 1992, though in the more rainy and hilly areas confined to just over 200 villages, the area affected by shifting cultivation still remains above 37%. And even with a smaller sample of 26 villages, the ratio of area affected by shifting cultivation remains around one third. Obviously, the entire basin in-

cludes a large number of villages in the drier parts, further east, where shifting cultivation is absent, a fact that brings down the ratio of land under *tisali*.

The Actual Practice of *Tisali* in Western Maharashtra

There is hardly a village in hilly western Maharashtra where shifting cultivation is the exclusive mode of cultivation. The entire area under shifting cultivation is confined to the hilly terrain with an annual rainfall of 2000 mm or above and is confined to a narrow strip on either side of the water divide of the Western Ghats.

The Field Practice: The most important aspect of the practice is choosing the parcels of land for treatment in the current year. It has to be pointed out that the agricultural land in this zone where the practice is prevalent is grouped under two categories: 1) Those survey numbers or parcels of land which are cultivated annually and never kept fallow except for part of the year, after the harvest, and 2) those which are cropped periodically undergoing several years of fallow. These two groups are exclusive sets. *Tisali* is entirely rain fed, and practised on impoverished flat or sloping land in areas of heavy rainfall from which forests have been either completely cleared long ago or

are subjected to occasional slash and burn. It is seldom, if ever, found that a fertile part of a flood plain or lower terrace is degraded and put under shifting cultivation. Secondly, much of the land either under the annual system or under *tisali* is tenure land and owned by the peasants. Thus, a farmer has to choose from among several pieces of land which support only periodic cultivation. Normally, a farmer remembers the period of fallow that a specific parcel of land has undergone but he also decides the level of recuperation of a specific plot on the basis of the visual density of grasses and shrubs and other kinds of vegetal growth. The number of years that a specific parcel is kept fallow is not fixed and may vary from four to seven years.

Pre-Transplant or Pre-sowing Treatment of the Field

The most important treatment before sowing is *rab*.

Rab: A Substitute Practice for Slash and Burn - Rab, a familiar practice in the hilly area carries some resemblance with 'Slash and Burn' of the traditional practice of shifting cultivation. The word has an obscure origin, but appears to be of Marathi origin. In Marathi, the regional language of the area, the infinitive '*rabavne*' means cultivation or

Organic Material Used in *Rab*

Matter used in <i>Rab</i>	Koyna Valley	Neighbouring Mula Valley	Average Dry Weight kg/acre
Twigs and Leaves	2000 kg	2000 kg	2000 kg
Cow Dung	800 kg	600 kg	700 kg

growing of crops. It is likely that because in the hilly areas of the Western Ghats, particularly Maharashtra, the preparation of the field and the subsequent process of cultivation started with collection and burning of the vegetal material, the practice was termed as *rab*. *Rab* is also practised for preparing nursery beds for rice. But, most commonly, it is associated with the utilisation of infertile patches of land. It consists of collection of leaves, twigs, grass, cow dung and any other organic material, spreading these in the chosen fields, letting them dry and setting them on fire before the burst of the monsoon in the beginning of June. The burning of *rab* is usually done in the month of April and continues till the end of May. The practice is aimed at fertilising the soil by the ashes of the burnt organic matter, besides the belief that a sudden rise in temperature during burning destroys the pests and the weeds which often retain their bulbs and seeds in the soil. It is to be noted that not the entire field area is subjected to *rab* but only a part of it. Usually, the *rab* patch occupies 1/4 to 1/6 of the area of the plot where the ash is spread and which benefits from the manual quality of the ash.

Before the monsoon, usually in the month of March, the farmers collect wet leaves twigs and some times even branches of trees from the forests. A visitor to Kokan can witness in the piedmont region, west of the Sahyadri, trees particularly of *ain* (*Terminalia tomentosa*) denuded of all their foliage, following their pollarding by the farmers for the purpose of *rab*. The sequence in which different types of material is arranged in smoothly laid horizontal layers, starts with cow dung, tiny branches of trees and twigs overlain by shrubs, leaves and grass, covered with a layer of soil to pre-

vent the lighter material from being blown away before as well as after burning. The pile of *rab* matter that is subjected to burning is 50 to 60 cm high. The ashes, after burning, is usually mixed with the soil.

Roughly, two to three tons of dry weight of woody material and dung is used for every acre of land to be cultivated. The benefits of *rab*, though usually confined to the burnt patch, are distributed over the entire field, firstly because the saplings taken from the nursery take the nutrition from the *rab*, though these are transplanted over the entire field. Equally significant, however, is the change in the site of the *rab* in the same field for three consecutive years during which the land is cultivated. If the *rab* patch measures one third of the area of the plot, in three consecutive years, the entire field is covered in which case all parts benefit equally.

The 'Rab' Effect: This long standing practice has to be seen in the light of the fertility and other soil conditions it creates to improve the productivity of the system. Besides amelioration of soil conditions, a lot of other nutrients get added to the soil that result in increase in yield. Among the beneficial effects, some of the most well known are increase in pH value which is invariably low in high rainfall areas, sudden rise in temperature of the soil that kills weeds and even pests and finally leads to the addition of some nutrients that are derived from the burnt bio-mass. The increase in the pH results from the elimination of hydrogen cations as a result of very high temperature achieved during the process of burning of the *rab*. Increase in the pH towards neutral is certainly a step towards saving the crop from the effects of excessive acidity.

Table IV

Composition of 'Rab' Residue and Adjacent Soil Showing the Fertility Effect of 'Rab'

Constituents	Rab-Residue % by weight	Adjacent Soils % by weight
SiO ₂	34.05	34.09
Al ₂ O ₃	18.1	18.0
Fe ₂ O ₃	18.65	21.6
FeO	4.63	1.25
CaO	7.45	0.91
MgO	-	-
TiO ₂	2.38	2.44
Na ₂ O	2.41	0.2
K ₂ O	2.44	0.7
N	0.23	-
P ₂ O ₅	0.71	0.27

Even in the 19th century, the effects of *rab* were qualitatively examined and it drew the attention of the Revenue officials, Agriculture scientists and foresters alike. J.A. Voelcker, an expert appointed by the Government of India, to report on the measures for the improvement of Indian agriculture, had a very close look at the practice of *rab* and wrote the following comments in his report (1893) "*As regards the advantage, still more the necessity of rab, there have been continuous contentions between the cultivators and those who have supported them on the one hand, and the forest department on the other, the latter maintaining that the practice is a wasteful one and that lopping of trees injures the forests greatly. In 1885, a Forest Commission was appointed in Bombay to enquire into the matter, and Mr. Ozanne, Director of Land Records and Agriculture, Bombay Presidency, conducted a number of experiments. which, though not*

absolutely conclusive or complete, went far to show that the Rayat in rab areas was adopting the only ready means by which he could cultivate his rice crop with profit. He pointed out that there are defined limits to rab cultivation, viz. the districts where the rainfall is very heavy and continuous. - Mr. Ozanne's experiments also showed that the brush wood and shrubs when used as rab material give just as good results as boughs of trees do.

Rab results in the liberation of some of its dormant constituents and the supply of ready made food for the plants. Then, again, the addition of mineral matter from the materials burnt must conduce to the richness of the soil, and, while supplying plant food, would, at the same time, render the soil so porous so that it would not retain excessive moisture, as might be the case, were natural manure of green leaves to be used"

To assess the fertilising effect of *rab*, the *rab* ash was chemically examined and compared with the chemical composition of the adjacent soil. The following table distinguishes the composition of the burnt *rab* material that gets added to the soil and the composition of the adjacent soil.

The analysis of the *rab* residual when compared with the soil in the adjacent area clearly demonstrates the possibility of an enrichment of the soil particularly in calcium, potassium, phosphorus and nitrogen.

The Fertility Effect of the Rab: By distributing the localised effect of the *rab* patch over the entire field one can deduct the fertility effect on the land under shifting cultivation, i.e. the level of nutrients added per acre of land. To determine that, the residual

ash from the *rab* patch was collected immediately after the *rab* patch was burnt and the fire cooled down. The ash was collected from a small area of one sq. foot. Usually the *rabbed* area in the field varies from 1/5 to 1/10 of the total area of the plot. Though the residue from *rab* gives a qualitative idea about the nutrients, usually the mineral matter, that are derived from *rab*, the quantitative estimation would be highly variable and would depend on the fraction of land which is covered by the *rab* pile and the latter's thickness. Though there are references to *rab* pile as thick as 90 cm, (Voelcker, 1893) the authors have never witnessed a heap of *rab* thicker than 40 cm. It depends on the enterprise of the individual families and the manpower they can garner to collect biomass. Secondly, the ratio between the area of the plot subjected to ridding is also highly variable, the smaller the fraction of land under *rab*, the less will be the availability of nutrition per unit area of the plot to be sown. Thus, scaling up from one sq. foot, to the size of a *rab* patch, an uncertain quantity, would not give a correct picture. But assuming that the *rab* pile from where the sample was collected is spread over 1/3 of an acre of land that is to be cropped, it will give 2.87 tons of ash. Such a thick pile, if spread over 1/3 of an acre, would not require only 2 tons of dry biomass, as suggested by the farmers, but several tons.

One can see that apart from silica, iron, and aluminium, which are not nutrients, the most important nutrient that gets added in considerable quantity is potassium besides calcium which helps in neutralising the acidity of the soil. Phosphorus and nitrogen also get added though not in such substantial quantity as potash.

The Crops associated with *Tisali*

The four main crops in the *tisali* system, as suggested in the beginning, are *nachni*, (*Eleusine corcana*) also called *nagli* or *ragi*, *vari* (*Panicum miliaceum*), *kodo* (*Paspalum scrobiculatum*) and *rala* (*Setaria italica*). In some areas *khurasani* (*Guizotia abyssinica*) is also grown in the last year before the land is left fallow. Three years of consecutive cropping is followed by five or six years of fallow. Both, the years of cropping and the fallow period is highly variable and vary widely from one region to other as also with individual farmers. The first year crop after the fallow is *nachni*, followed by *vari* in the second year. The third year, the land is occupied either by *kodo*, *rala* or *khurasani* (locally also called *til* or *karal*). This general sequence is not followed universally. In some cases *nachni* is grown for two consecutive years in place of one followed by *khurasani* in the third year. In some areas, the land is left fallow only after two years of cropping. Irregular terrain has led to a farmer's holding being scattered. Where is inconvenient from the point of view of supervision. The different parcels of land in which he grows *nachni* are seldom contiguous, and each parcel of land, howsoever small, is treated separately.

Growing of *Nachni* : Unlike in many other regions of India, specifically Orissa, *nachni* in Western Ghats is invariably transplanted, though *nachni* can also be sown by broadcast method. It is likely that the farmers by applying partly the technique used in rice cultivation were able to increase the yield and therefore adopted transplant method for *nachni* as a permanent feature. The method of transplant of *nachni* is slightly different

Table V

Input Value per Acre of Land under *Nachni* in Koyna and Adjacent Mulshi Valley

Expenditure Head	Mulshi Valley		Koyna Valley	
	Quantity	Cost in Rs.	Quantity	Cost in Rs.
1. Collection of biomass, twigs and leaves for 'Rab'	10 Man days	Rs. 400/- Rs. 40/- per man day	20 Man days	Rs. 640/- Rs. 32/- per man day
2. Dried cow dung	10 cart loads Rs. 120/- per cart load	Rs. 1200/-	10 cart loads Rs. 120/-per cart load	Rs. 1200/-
3. First ploughing in June	Two days ploughing at	Rs. 240/- Rs. 120/- a day	Two days ploughing at	Rs. 240/- Rs. 120/- a day
4. Second ploughing after eight days	One day ploughing at	Rs. 120/- Rs. 120/- a day	One day ploughing at	Rs. 120/- Rs. 120/- a day
5. Nursery Preparation	8 man days	Rs. 320/- at Rs. 40/- a day	8 man days	Rs. 320/- at Rs.40/- a day
6. Ploughing for transplant after 3 weeks	One day ploughing	Rs. 60/-	One day ploughing	Rs. 60/-
7. Transplant	Ten man days at Rs 40/-a day	Rs. 400/-	12 man days at Rs. 35/- a day	Rs. 420/-
8. Weeding	Ten man days at Rs. 40/- a day	Rs. 400/-	10 man days	Rs. 360/-
9. Harvesting	Five man days	Rs. 200/-	Five man days	Rs. 180/-
10. Bundling after 8 days	Ten man days	Rs. 400/-		
11. Threshing & Winnowing	4 man days	Rs. 160/-	8 man days	Rs. 240/-
12. Cattle for threshing 8	15 cattle days	Rs. 600/-	15 cattle days	Rs. 450/-
13. Rent of the land	--	Rs. 4/-	Rent of land	Rs. 15/-
14. Seeds (3 kg)	--	Rs. 75/-	seeds 10 kg	Rs. 200/-
Total Input Cost in One Acre Cultivation of <i>Nachni</i>		Rs. 4579/-		Rs. 4385/-

A man-day is one man working for eight hours.

A cattle-day is an average bullock working in the field for eight hours.

from that of *paddy*, as the latter is grown and even transplanted in fields with 5 to 10 cm deep water where the fields are enclosed by bunds to retain water. *Nachni*, on the other hand, is grown on gentle slopes or flat land with free drainage with little chance of water logging.

The nursery, even for *nachni*, usually 1/4 to 1/6 of the area of the field, is prepared with care and for each acre of land seeds weighing 3kg are broadcast in the nursery. Harrowing or shallow ploughing of the land is done twice, once in June and once before transplant. The seedlings are removed from the nursery three weeks after the seeds were broadcast. Occasionally, delay is caused while waiting for a rainy spell for the transplant. The seedlings are uprooted from the nursery by a process of thinning leaving some of the seedlings in place, depending on the ratio of the nursery plot with the entire field of transplant. An important feature of the technique of transplant of *nachni* is the way saplings are hurled like a dart onto the harrowed or ploughed land with wet slushy earth. No effort is made to push them into the soil, as is done in case of rice. In about a week, the saplings strike roots.

Believably, *nachni* is a hundred days crop - three weeks in the nursery and 10 to 12 weeks after the transplant. No irrigation is provided and no fertiliser is applied. Lately, some farmers have started applying urea containing 45% nitrogen that, no doubt, boosts the yield.

Input in Tisali cultivation: There is no significant difference between the level of inputs in the two valleys, viz. Koyna and Mulshi, about 100 km apart. The essential

difference is in the wages and the amount of seed used. In the more isolated Koyna valley the wages are about 20% lower and the amount of seed used is roughly three times as high as in Mulshi valley. (Table V)

The Succession of Crops: The first crop grown after long fallow is invariably *nachni* (*Eleusine coracana*). The second crop usually *vari* (*Panicum miliaceum*), is grown the following year and oilseed mostly, niger seed (*Zygotia abyssinica*) is grown in the third year. This is the usual sequence. Though second year crop *vari* requires the same treatment as *nachni*, but what is paradoxical is the dilution of effort on the part of the farmers who are casual in ploughing the land, preparing the nursery, ridding and even in the use of fertilisers. The farmers on the whole, are less enthusiastic because they feel that getting a higher yield from the cultivation of *vari* is not possible. They take it for granted that the soil gets exhausted of its fertility in the first year by *nachni*, hence there is not much use in investing more energy and other inputs. *Vari* is considered inferior to *nachni*, but has greater resistance to sustain longer periods of dry spells. In fact, *vari* is not considered a primary crop, it is sown to utilise the residual fertility of the soil. The third year crop is usually niger seed, also called *karal* or *khurasani*. This is an oilseed, very resistant but with a very meagre yield.

The Yield of Crops: The yields of crops associated with *tisali* system vary not only with the crops but also their cultivation in a specific year during the sequence of three consecutive years during which the land is cul-

tivated after a long fallow. Usually, the crops grown in the first year after fallow give a higher yield as compared to the second and third year crops. This results from the exhaustion of the accumulated fertility over years of fallow. By the third year in succession, the field is completely squeezed of its fertility and has to be returned to fallow.

The yield of *nachni* is, on an average, six quintals an acre, while in case of *vari*, it is around four quintals. The third crop of niger seed gives a very poor yield and the best of fields do not give a yield of more than one quintal per acre. This most generalised assessment of yield is based on the piecemeal information collected from farmers practising the *tisali* system of cultivation. The adopted yields are comparable to those given in the Socio-economic Reviews of Satara district.

Nature of Holdings: The individual holdings in Koyna valley are not consolidated and are invariably scattered. The plots of *nachni* and *vari* are relatively small. Nowhere have the present investigators witnessed a contiguous *nachni* or *vari* field that admeasures even half an acre. This is contrary to the impression one might gather looking at the survey numbers of plots. In fact, the area of some of fields bearing a specific survey number measure as much as ten acres, but these have neither a regular geometrical shape nor the entire survey number stretches at a uniform level. A survey number in this part of the state encloses a large plot of land the two ends of which may have a level variation of as much as 100m. Starting from the river side plain, some of the survey numbers rise gently and then steeply, cutting across the lower slopes,

the upper terraces and in some cases even the forested hill tops, higher up.

The lowest parts of these large plots, often coinciding with the lower fluvial terraces are used for growing paddy, some parts of the sloping valley sides are covered with grass, some carry Government controlled forests, and some still higher up are the sites of *tisali* cultivation.

The division of the area of these hilly villages, into indiscriminate survey numbers, to say the least, is irrational. The boundary lines neither follow the contours nor the land use categories. Within the broad frame of these large survey numbers, small parcels of land are owned by farmers. They appear to lie in a circular belt at almost equal distances from the village settlement, located on higher surfaces, in the immediate vicinity of, or even surrounded by forests. So clear is the interdigitation of forest land and small patches of cultivated land under '*tisali* system' that one is tempted to infer that these small patches were once unauthorised forest clearings, subsequently enlarged and in due course attaining legal status as cultivator owned land, granted by the State Government.

II

The Economic Profile of the Villages in Koyna Valley and the Adjacent Hilly Areas:

Practically the entire area of Koyna valley and the adjacent hilly land of the Western Ghats is littered with tiny villages occupying large revenue areas. The average revenue area of a village is 300 to 400 hectares though there are villages with an area of 700 to 800 hectares. On the lower end of the

scale, a village with an area of 150 hectares is rare. The population of a village ranges from 250 to 400 persons which means 50 to 80 households. This may suggest that each family will own 4 to 5 hectares of land, but this is not the case. More than three fourths of the land in each village is either forested or uncultivable waste. Added to this is the common pasture land and the large acreage of fallow lying uncultivated for years. Even the remaining land is not equitably distributed, though landless families are rare. The area of a few villages, their population and land utilisation pattern is given below. It must be mentioned that there is considerable variation in the data as given in the District Census Handbooks, the Socio-economic

Reviews and the primary data collected from village papers from Circle Office, the last being an administrative unit above the village level which is the first level of aggregation after the village. Here, reliance is placed more on village level data. To quote an instance, it is only in the village records that the areas where grass is grown is given but this doesn't appear anywhere in printed records.

This is a random sample of 11 villages that lie in the three *talukas* that occupy the Koyna basin. (Table VI & fig. 4) As can be seen, it is only in villages closer to the river like Katroshi and Vatole that a higher percentage of land has been brought under cul-

Table VI

Landuse of some selected villages in Koyna Basin

Village	Population	Total Area of the village in (ha)	Forests (ha)	Culturable waste including fallow (ha)	Not available for cultivation (ha)	Area under cultivation	Population per ha. cultivated
Mahabaleshwar Tahsil							
Parsond	188	271.36	142.5	103.08	13.03	12.67	14.8
Hatlot	289	1,035.25	699.5	263.47	8.26	64.01	4.5
Dudhgaon	291	445.21	312.1	106.02	4.55	22.79	12.8
Jaoli Tahsil							
Kotroshi	422	521.00	100.37	90.44	120.79	209.40	2.1
Kandat	81	1,473.00	38.0	1,096.00	339.00	No cultiv.	--
Uchat	415	1,119.00	314.0	706.00	99.00	No cultiv.	--
Renoshi	323	643.00	200.0	100.16	270.84	72.00	4.48
Shindi	207	824.00	471.0	162.00	15.00	176.00	1.76
Patan Tahsil							
Vatole	1099	911.00	489.0	--	21.00	401.00	2.74
Mirgaon	242	539.00	116.0	1.00	337.00	85.00	2.84
Nawaja	798	2,135.00	1246.0	23.00	547.00	319.00	2.5

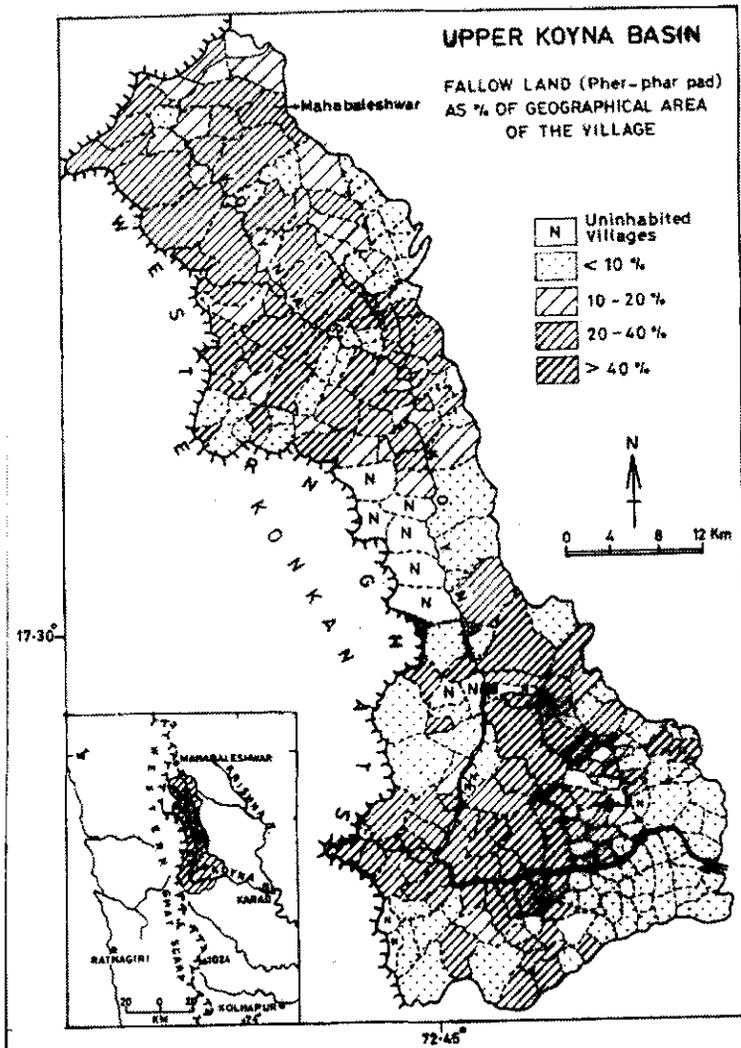


Fig. 5 Upper Koyna Basin - Fallow Land

by once-a-day bus to the district or *taluka* headquarters, involves a walk of 5 to 10 km. Over the past decades, particularly after the fifties of the last century, the population of these villages has multiplied, without there being any increase in the area of agricultural holdings. Large villages near the western edge of the plateau rendered inaccessi-

ble after the a dam was built on Koyna, no doubt, show a decline in population. The increase in yield is only marginal as most of the crops are rain fed, and only a small acreage under rice received the benefit of fertilisers, partly because of terrain conditions and more because of the poverty of the villagers.

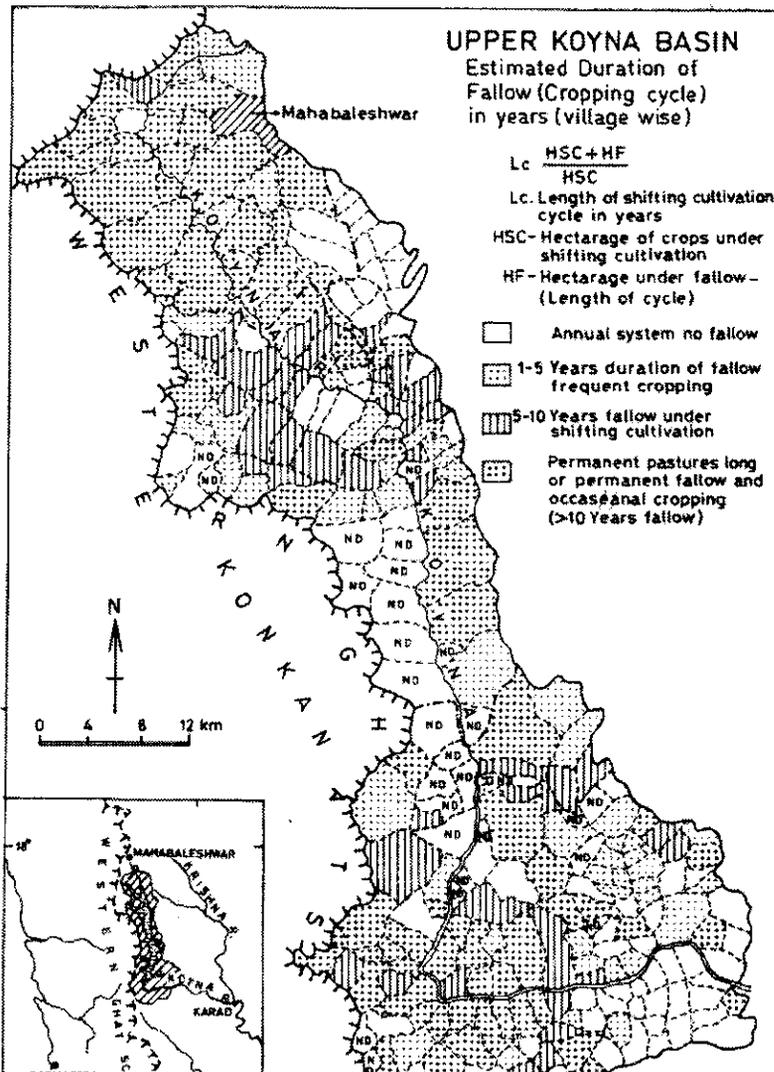


Fig. 6 Upper Koyna Basin - Estimated Duration of Fallow Cycle

Insufficiency of Food Grain Production for the Village Population: The local production of food grains, largely rice, *nachni* (*Eleusine c.*) and *rada* (fox tail millet) is, in most cases, insufficient. The agricultural production of a few villages based on the hectareage under different crops and their average yield, as communicated to the au-

thors by most farmers, is calculated to assess the level of sufficiency of the locally produced crops for a specific village. The assumed yield is 20 quintals/ha for rice, 15 quintals/ha for *nachni* and 10 quintals/ha for *vari*. To assess the food requirement, a subsistent level, minimum of 450gm/person/day is taken as the average, not accounting for

Table VII

Area of Principal Crops and The Food Grain Produced in Some Selected Villages of Koyna Basin

Village	Area of the Three Principal Crops in hectares			Total Food Grain Produced (Quint)	Population	Food Grain Required (Quint)	Surplus/ Deficit
	Rice	Nachni	Vari				
Kurnthe	31.37	5.86	2.64	743.7	509	836	-11%
Parsond	12.23	1.43	0.14	267.45	238	391	-31.5%
Dudhgaon	19.6	3.4	—	443.0	291	478	-07.3%
Hathlot	29.7	8.36	2.5	744.4	323	531	+40%
Kotroshi	52.8	29.0	1.47	1505.7	422	694	+116%
Remoshi	14.0	30.0	2.1	751.0	323	531	+ 41%
Kandat	-	-	-	-	81	130	-100%
Uchat	-	-	-	-	416	683	-100%
Navaje	13.68	22.68	-	613.8	798	1310	-53%
Mirgaon	4.44	13.13	1.28	298.5	242	397.5	-24.8%
Vatole	12.22	10.61	4.10	444.6	1099	1805.1	-75.4%

the sex-age variation. The calculation would, thus, remain an approximation, but should provide a rough idea of the nutritional level of the area's population.

The table shows that in most cases, with the exception of those located on the tributary of Koyna and with a relatively wide riverine plain, there is a deficit of 10 to 100%. In quite a few villages which are located on the edge of the Deccan plateau, overlooking the Western Ghats escarpment, the revenue areas of the villages are large ranging from 10 to 15 sq. km, and in extreme cases even 20 sq. km. Such villages have a relatively small population, declining with every passing year, and virtually no cultivation of food crops. After the building of Koyna dam and the submergence of

some areas, these villages have become inaccessible and approachable only by boat. In the rainy season, they find themselves virtually cut off, the nearest town not being less than 50 or 60 km. away. Such villages utilise their land by growing grass which requires minimal supervision and manpower and in many cases the village records show a Net Sown Area which includes a high percentage of grass varying between 25 and 100%. Given below are the villages strung along the plateau edge each having a large area, small population and a poor agricultural base

The Case of Parsond Village: This village was the scene of intensive field work for data

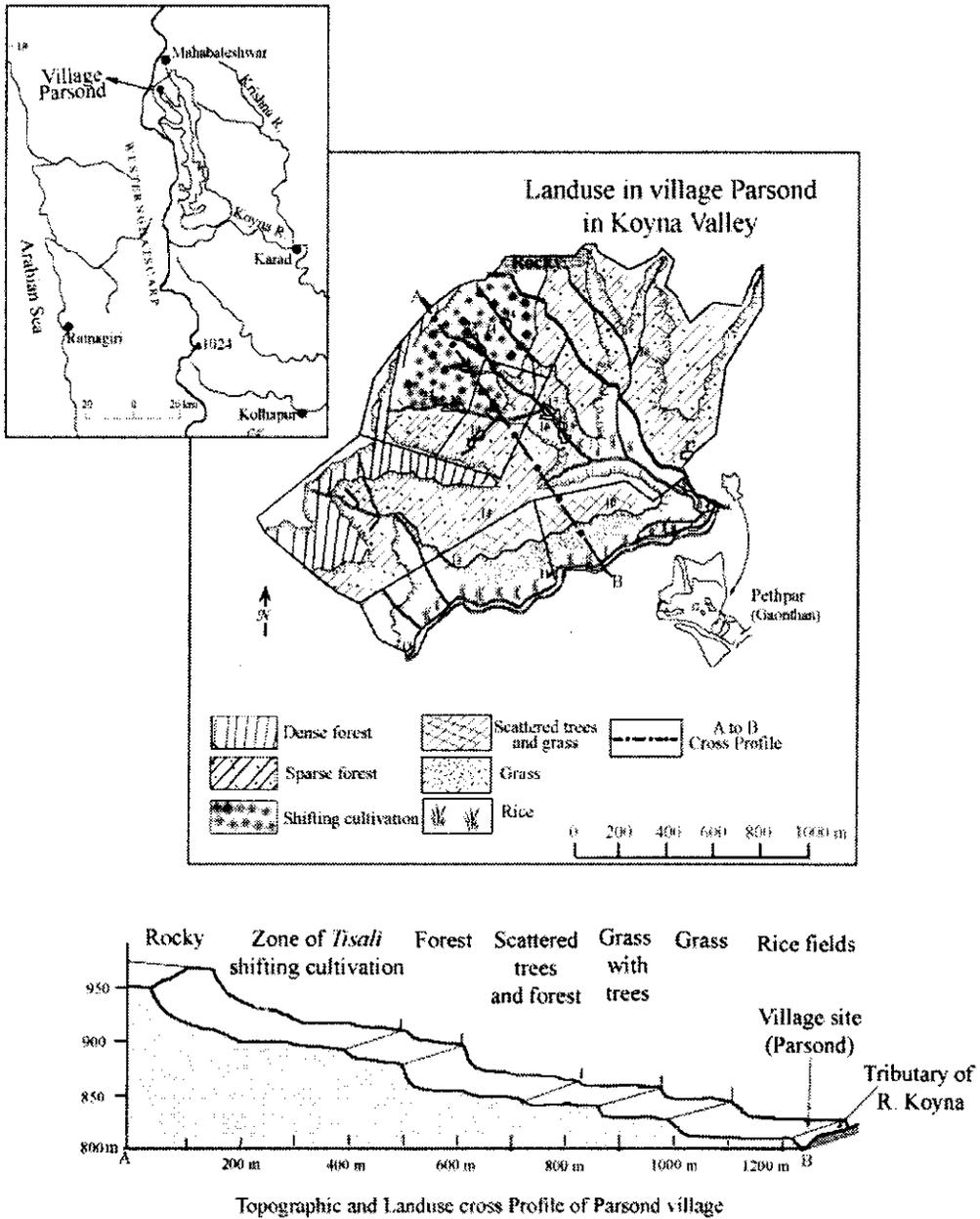


Fig. 7 Land Use in Village Parsond

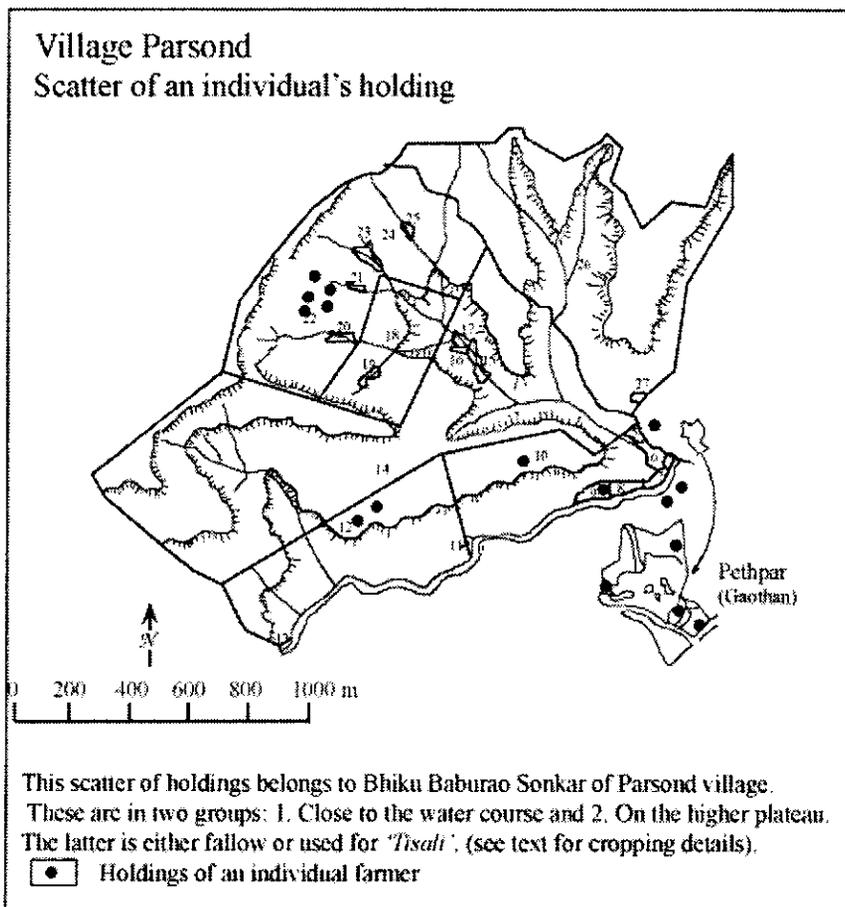


Fig. 8 Village Parsond - Scatter of an Individual's Holdings

to 238 in 1991 from 188 in 1981, the land resources of the village despite a marginal increase in agricultural productivity, is short of the requirement. The total land is used as follows:

These figures published in the District Census Hand Book of Satara don't reflect any change during the last thirty years. But the village records show greater details. According to the village papers maintained by the *talati*, the land records keeper of the village, the land use and crop distribution of

the village are as follows:

The two sets of data given above, one from the Census and other from the village records are quantitatively not different but the difference is qualitative. What is classed as culturable waste in the *taluka* or Census records is given as *Pher-Phar-chi-Pad* in the village papers. *Pher Phar* in Marathi means rotation, and *Pad* means fallow. Thus, it is a perfect Marathi translation of Rotational fallow. This fallow suggests a large hectareage left fallow every year in the *tisali* system of farming, a system we are equating with shifting cultivation.

The Scatter of Holdings and their Fragmentation: The holdings of an individual farmer in the Koyna villages as anywhere else are highly fragmented. Since the quality of land in the area, and, in fact, almost in every village, is highly variable, ranging from the flat fertile river terraces cultivated annually and giving high paddy yields to stony wastes susceptible to violent erosion and cultivated only periodically after a long fallow, every farmer likes to own part of the fertile land and, in consequence, part of the bad land as well. To quote an example, a meagre holding of 2.68 hectares of a *Khatedar*, land holder from Parsond village, is spread over 17 parcels. Named Bhiku Baburao Sonkar, his holding is spread as follows (fig.8). It has to be noted that in these holdings he has a share of only one-fourth.

What is remarkable is that rice growing patches are always small, whereas large chunks of land, some times admeasuring over 2 acres, are kept fallow. In survey no. 22 which in any case is a large number, 2.09 h. is the $\frac{1}{4}$ share of the farmer implying that the family owns over 8 hectares of land in survey no.22/5 which is only part of that survey number.

Agricultural Production of the Village: By following the method of an average yield pattern for each crop and the area under each crop, the results obtained are as follows. This is juxtaposed with the production of different crops as perceived by the village folks, learnt during the course of our interviews with villagers (Table X).

There is great discrepancy between the perception of the farmers and what was ar-

rived at from hard facts and as learnt from the records. Normally, one would believe that the farmers are more dependable, but clearly in assessing the production of the whole village, they perceived much higher figures. In fact, their estimate is nowhere near what a field worker may arrive at. Here, the assessed production of grains is taken as a basis for arriving at the food requirement of the village.

Similar overestimation is discovered also in assessing the population. The Census of India gives the population of Parsond as 238 in 1991. Allowing for a growth of even 20% over the last decade, the population of the village in 2001 should be 285, and in any case should not exceed 300, but the village headman and others from the village quoted a figure of 500 as the population of the village. One of the reasons cited was to increase the number of persons in a family to inflate the entitlement of cheap food grains from the Government sponsored ration shops.

Food Grain Deficiency and the Govt. Support: Assuming a population of 300 and a daily minimum subsistence requirement of 450gm. the village requires 492.75 quintals of food grain a year, thus falling short by over 45% of its annual need. If the food grain production figures mentioned by the villagers are to be relied, upon then the village can survive at a subsistence level. Paradoxically, the villagers declare, in the same breath, that the food grains produced in the villages is just sufficient for four months of the year. And for the remaining period, they have to depend on the public distribution systems started by the Govt for their benefit. This deficiency is met by subsidised

Table VIII

Landuse of Parsond Village

According to Village Papers

Land Use Category	Area in ha	Percent of Geographical Area
Total Area of the Village	271.36	hectares 100%
1. Forest	142.58	" 52.46
2. Net Sown Area	12.67	" 4.66
3. Culturable Waste	103.08	" 37.98
4. Area Not Available for Cultivation	13.03	" 4.8

According to Census - 1991

Land use Categories	Area in hectares	Percent of Geogr. Area
1. Forest	149.32	hectares 55.02
2. Net Sown Area	16.68 (12.67)	" 6.14
a. Rice	12.23	"
b. <i>Nachni</i>	1.43	"
c. <i>Vari</i>	0.14	"
d. <i>Rala</i>	-	
e. Grass	2.88	
3. Rotational Fallow (<i>Pher-Phar-chi-Pad</i>)	99.34	36.60
4. Land not available for cultivation	6.02	2.2

food provided by the Government through outlets that supply a specific amount of food grain per person. The system seems to operate well. The village has 800 registered units of persons, counting two units for an adult and one for a child. This is certainly an inflated figure. The Government looks at the problem in a humane way and doesn't seriously verify the actual number of persons in the village with the units of ration claimants. The Government provides 12.5 kg of food grains per adult per month, or roughly 50 quintal per month for the entire village. It is not only that the village doesn't produce enough food grain for its consumption, equally alarming is the fact that they don't have enough purchasing power to buy food grains from the open market, let alone money for other needs.

Other Assets of the Village: Besides agricultural land, the village has other assets, particularly forest and grazing land that sup-

port the village cattle and a small scale seasonal domestic dairy enterprise. These also provide fuel and periodically engage the village people in the collection of forest products. As seen earlier, the village has around 100 hectares of rotational fallow that serve as pastures, some producing grass and some left open as pastures.

The cattle wealth of the village as estimated by the village Headman is as follows: Bullocks - 80; Cows - 80; Buffaloes - 50; Calves - 40, thus bringing the total to 250 heads of cattle. This seems reasonable, as each family owning some land, even if it is half an acre, requires bullocks to plough his rice field during the season. Secondly, maintaining cattle is more an exercise in supervising and getting them back to be tethered. Fodder is not a problem in this region as the cattle thrive on grazing either in the fallow land or forests. For grazing in the forest, a

Table IX

Scatter of Individual Holding in Parsond Village

Survey No.	Area (ha)	Survey No.	Area (ha)	Survey No.	Area (ha)
12/5	0.23 R	1/4	0.18.3R	2/5	0.71R
5/12	0.37R	3/10	0.10.1R	7/1	0.4R
7/2	0.13R	9/7a	0.7.1R	10/13b	1.65F
12/4	0.34F	22/5	2.09F	22/6	1.34F
22/8	1.46F	22/13	0.06R	22/5	1.99F
29/1	0.71F	32/3	0.04R		

* R stands for rice and F stands for fallow

nominal rent has to be paid per head of cattle to the forest department. No stall feeding is necessary. Besides, the village has over 100 poultry birds. While the bullocks are used only seasonally, their dung is quite valuable as manure.

Milk Collection and Dairy Product: The normal production of milk in the village is 50 to 60 litres, about 50 % is consumed in the village and the other half is sold to the dairy plant at Mahabaleshwar. The collection is done by a milk van that visits the road side villages every day. In rainy season, the production of milk suddenly increases because of better green fodder available to the milch cattle. This has promoted a small scale local enterprise involving processing of milk by condensing it to a semi-solid state. The product locally called 'mava' is sold at a much higher price to sweet makers. Dairy, as an organised enterprise by domesticating better breeds of milch cattle is not favoured because of high rainfall which, in some years, reaches a level of 4000 mm. This has disastrous consequences for better breeds of

Table X

Area under Crops and the Amount of Food Production in Parsond Village

Crops	Hectarage Under the Crop	Average Yield Quintals /ha	Production in Quintals as Calculated	Production as Perceived by the Farmers (Quintals)
Rice	12.23	20	244.6	300
Nachni	1.43	15	21.45	150
Vari	0.14	10	1.4	60
Wheat	-	-	-	25
Total Production			267.45	535

imported milch cattle which don't survive very wet and prolonged rainy conditions. Thus, native cows and buffaloes acclimatised to the conditions of the area, though not yielding much milk, are preferred.

The annual production of milk in the village is estimated at around 15,000 litres, which even at the rate of Rs. 10/- a litre gives an income of Rs. 150,000/-. Next to agriculture, dairying, though not well organised, is the second most important source of income to the villagers. The annual production of eggs in the village is estimated at 8,000 eggs, valued at Rs. 8,000/-. The eggs, like food grains, are consumed in the village.

Other Sources of Income in Parsond: Another source of employment and income that materialises every alternate year is the collection of *shekakai* fruits from the forest on contract. The village is able to collect 200 bags of *shekakai*, each weighing 40 kg. This brings to the village, at the rate of Rs. 150/- per bag, Rs. 30,000/-. But the most important source of income is the monthly remittance by the migrant population of the vil-

lage which works in large cities like Mumbai, or Pune, as simple unskilled wage earners or even skilled and semi-skilled labour. Traditionally, the economically depressed area of Konkan and the western part of the Maharashtra upland have been depending on the earnings of their migrant labour in Mumbai. Usually referred to as 'Money-Order-Economy', this monthly remittance is a great support to these impoverished villages. Parsond receives an estimated sum of Rs. 6000/- per month remitted by roughly 40 migrants (Table X).

In an over all assessment of the economic situation of the village, the annual income from all sources is as follows: Distributed over a population of 300, the per capita income for the village comes to Rs. 1223/-, which would buy three quintals of food grains, a little more that required at the subsistence level. It is, by any standard, a pathetic economic situation.

Impact of Tisali on Environment: One of the principal reasons why the practice of shifting cultivation is decried in most parts of the world is the destruction of enormous acreage of forests year after year. The FAO believes that 'shifting cultivation is the greatest obstacle not to the immediate increase of agricultural production, but also to the conservation of the production potential for the future in the form of soils and forests' (FAO 1957). Their assessment is that 36 million sq. km of land is under shifting cultivation practised by some 200 million people. A much later estimate suggests that 'each year approximately $1.9-3.6 \times 10$ ha land of primary close forests, $3.4-4.0 \times 10$ land of secondary close forest, and $6.9-21.9 \times 10$ ha

land of secondary open forests are being lost due to shifting cultivation' (R. P. Detweiler and C. A. S. Hall 1988). This may appear an over estimate but the situation is serious in many parts of the world. And even in India a million hectares, particularly in Orissa and NE India, are under shifting cultivation causing enormous destruction of forest and inducing in the process many other evil consequences of this practice, like soil erosion, loss of biological diversity, pollution and the most visible impact the destruction of good forests. This genre of assessment is based on the global concern for the preservation of environment, increasing load of GHG in the atmosphere, conservation of forests which house vast reserves of food, medicine, fodder and fuel besides functioning as a global sink for CO₂. The concern is genuine but disregards the regional socio-economic realities reflected in the livelihood conditions of the tribal groups or other farming communities practising this system of farming.

This concern, however, doesn't strictly apply to the practitioners of *tisali* system who don't burn the forests, and collect only leaves and twigs from the forested areas, and the practice has to be seen as an economic compulsion imposed on the practitioners of this system. No group, tribal or non-tribal, practices shifting cultivation out of choice but is forced by necessity to survive. Though the economic dependence on shifting cultivation is not exclusive in most areas yet a large part of their food requirement is met by shifting cultivation. Given a substitute practice that can ensure better crop yield and access to alternative means of production and employment, the practice may finally disappear restoring the natural landscape in the areas that carry the scotched earth, following centuries of burning and destruction.

Table XI

Income from Different Sources of Parsond Village

Source	Income in Rs.
Agriculture	106,980
Dairy product	150,000
Poultry (eggs)	8,000
Shekakai collection	30,000
Remittances from migrants	72,000
Total for the year	3,66,980

Rational Decision and Persistence of Tisali System:

The persistence of *tisali* in Western India is based on a very rational decision of farmers based on the individual domestic economy of a farmer who takes into account the most rational utilisation of his holding based on variable soil fertility of different parcels of land, their location in the topographic sequence, the food requirement of the family, the crop ecology of crops that can thrive in the area as well as their yield pattern and above all the weather uncertainties, particularly the moisture stress, that may plague his crops.

A most significant point that points towards the advantage and persistence of *tisali* system is the area under crops of this system, viz. *nachni*, *vari*, *rata* and *khurasani* is twice that of area under rice. This shows a rational utilisation of the holdings of the farmers. While they grow rice in the paddy wet lands annually, the rest of the land is utilised intermittently with long fallow. There is a greater dependence of the farmers on *nachni* and *vari* than on rice. Firstly, because of a larger acreage these two crops more than compensate for the deficiency in yield. The general yield ratio of the three

crops (rice, *nachni* and *vari*) is 8:6:4, and an acre of *nachni* and an acre of *vari*, the ratio in which they seem to exist, produce more food grains than an acre of rice. Even one acre of *nachni* and half an acre of *vari* together produce as much grain as an acre of rice. By parcelling the less productive land into 80% fallow and 20% under *nachni* and *vari*, the farmers are assured of a substantial amount of food grain, despite the practice of *tisali* which is labour intensive, in particular the practice of *rab* which is an inalienable feature of the *tisali* system. The practice of *rab*, is discussed in the earlier section.

Another yet more important reason for adopting *tisali* system of shifting cultivation is a more assured return from *nachni* and *vari*. These two crops are more resistant to weather fluctuations and thrive even in semi-arid conditions. While a long dry spell spells doom for the rice crop, *nachni* can withstand moisture stress for a longer period and can thrive even if the rainfall is deficient. The *tisali* crops are an insurance against dry spells and during a lean monsoon. The crop ecology of *nachni* is more suited to uncertain weather conditions. The reason for persistence of *tisali* system is not only the need for utilisation of land, albeit with a lower return and with a long rotational fallow, but a rational system of land use in which total failure can be avoided, utilising at the same time the surplus labour of the country side, and in specific areas, large holdings of individual farmers all of which are not amenable to the annual system.

The authors of this paper are intrigued to find that burning is the only process the farmers depend on to utilise biomass as a fertilising agent. Can this biomass not be

changed into compost? The fear of the compost being washed away may appear genuine, technology can surely provide better answers. Secondly, they are inclined to think that while the agricultural scientists spend a lot of time and energy in propagating hybrid seeds of *jowar*, they don't seem to have concerned themselves with finding an optimal crop combination, or a land utilisation model for rainy and hilly terrains with a variety of slope facets. The State Government thinks of this as a peripheral issue, the main focus being occupied by irrigation, fertilisers and plant breeding and the introduction of hybrid crops.

Paying serious attention to the hill areas would also mean addressing the grievances of hill people which form a significant, though voiceless, segment of society.

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Appendix - A

Cropping Pattern and Landuse of Javli Taluka, Satara District (Maharashtra, India) during the 19th Century - as given in the Gazetteer (1888) and Settlement Survey Report (1894)

Total area of Javli taluka	108,520.60 hectares
Area of alienated villages	27,456.47 hectares
Area of taluka accounted for	81,066.13 hectares

Broad land use category	% of geographical Area accounted for	
1. Arable Land	46,692.93 ha	57.6
2. Non Arable Area	3,080.36 ha	3.8
3. Forests	26,183.71 ha	32.3
4. Village sites, roads, streams etc.	5,107.10 ha	6.3
Total	81,064.10 ha	100.0

Total Arable Land	46,692.93 ha	
Total Land under tillage	38,033.20 ha	46.91
	(a+b)	
a. Land under fallow	22,211.39 ha	27.39
b. Net sown area	15,821.86 ha	19.50
c. Area double cropped	425.00 ha	0.54
d. Gross cropped area	16,246.80 ha	20.04
	(b+c)	
e. Area under Shifting Cultivation crops	8,290.37 ha	10.22
f. Area affected by Shifting Cultivation (a+e)	30,501.75 ha	37.62
	(a+c)	

Note: Shifting cultivation crops include Nachani, Vari, Rada and Kodra

Appendix - A1

Cropping Pattern in the Late 19th Century in Jaoli Taluka

Crops	Area under the crop in hectares	% of gross cropped area	% of area under village (according to Gazetteer)	% of Area under tillage (according to Settlement Survey Report)	% of the geographical area of the taluka (accounted for)
Fallow	22211.39	—	58.4	55.0	—
<i>Bajra</i>	940.8	5.78	2.47	3.3	1.16
<i>Jowar</i>	2567.32	15.8	6.75	10.5	3.17
<i>Nachni</i>	4133.86	25.44	10.87	}	5.4
<i>Vari</i>	3689.1	22.77	9.7	}	4.55
<i>Rala</i>	440.3	2.71	1.16	}	0.54
<i>Kodra</i>	27.11	0.166	0.07	}	0.033
Rice	1253.3	7.71	3.3	3.6	1.54
Wheat	425.23	2.61	1.12	2.4	0.52
Maize	4.4	0.027	0.01		0.005
Barley	17.8	0.1	0.046		0.02
Pulses	1046.5	6.44	2.75	4.5	1.3
Oilseeds	904.8	5.57	2.37	2.07	1.11
Orchards and miscellaneous		0.9	0.9	0.2	
Double cropping	425.00	4.5			
Total Cropped Area	16246.80	99.5	41.53	roughly 45 %	20.04

Appendix - B

The Land use of Koyna Basin as represented by 349 villages in the Four Talukas of Karad, Patan, Javli and Mahabaleshwar in 1990

No.	Category of Land use	Area in hectares	% of geographical area	% of NSA
1	Total geographical area	207,720.28	100.00	
2	Net sown area including grass	67,487.54	32.48	
3	Crops typical of shifting cultivation			
	a. <i>Nachni</i>	6,273.6	3.02	9.3
	b. <i>Vari</i>	995.63	0.48	1.47
	c. <i>Satu</i>	191.26	0.092	0.28
	d. <i>Rala</i>	189.86	0.091	0.28
4	Area under shifting cultivation crops (a + b + c + d)	7,650.35	3.683	11.33
5	Rotational fallow	39,971.14	19.25	88.6
6	Other crops including grass	59,837.19	28.8	
7	Forests	58,274.72	28.05	
8	Other uses	52,640.11	25.34	
9	Total area affected by shifting cultivation (3a+3b+3c+3d+5)	47,621.49	22.92	
	Area affected by shifting cultivation		47621.49	
10	Length of fallow cycle = Area under shifting cultivation crops = 7650.35 = 6.22			

Appendix - C

Land Use of Koyna Basin as represented by 208 Selected Villages

No.	Category of Land use	Area in hectares	% of geographical area	% of NSA
1	Total geographical area of 208 selected villages	128,089.4	100.00	
2	Net Sown Area (including grass)	30,362.3	23.7	100
3	Rice	7,548.5	5.9	24.8
4	Crops typical of shifting cultivation			
	a. <i>Nachni</i>	5,169.3	4.03	17.02
	b. <i>Vari</i>	530.1	0.41	1.75
	c. <i>Rala + Satu</i>	259.7	0.2	0.85
5	Area under shifting cultivation crops (a + b + c)	5,959.1	4.65	19.62
6	Grass	7,394.4	5.7	24.35
7	Other crops	9,460.3	7.38	31.15
8	Rotational fallow	42,186.1	32.93	138.94
9	Forests	37,503.2	29.27	
10	Other uses	18,037.8	14.08	
11	Area under shifting cultivation (5+8)	48,186.1	37.58	158.56
	Area affected by shifting cultivation		48,145.2	
12	Length of fallow cycle = Area under shifting cultivation crops = 5,959.1 = 8.07			

Land Use of 26 Selected Villages from Koyna Valley

No.	Land use Category	Area in hectares	% of the Geographical Area	% of the NSA
1	Total geographical area of 26 villages	24,346.5	100.00	—
2	Net sown area	2,166.6	8.89	100.00
3	Area under Rice	736.7	3.02	34.00
4	Area under <i>Nachni</i>	713.2	2.92	32.91
5	Area under <i>Vari</i>	97.5	0.40	4.5
6	Area under <i>Rala</i>	51.8	0.212	2.39
7	Area under shifting cultivation crops (4+5+6)	862.5	3.542	39.8
8	Rotational fallow	7,936.5	32.6	
9	Area under forests	8,628.4	35.44	
10	Other uses	5,615.0	26.06	
11	Total Area under shifting cultivation (7+8)	8,799.0	36.14	406.12
12	Length of cycle(Fallow land ÷ Area under shifting cultivation) 10.2 years			

Comparative Chart of Area Under Shifting Cultivation and the Main Components of Land Use in Koyna Valley at Different Times (in hectares)

Terri- torial Units and Period	Geogra- phical area	Net sown area (including grass)	Area under shifting cultivation	Rota- tional fallow	Area affected by shifting cultivation	Forests	Other uses including unrecl- amed land
Jaoli Taluka (1885)	81,066.69	15,450.91 (19.05)	8,340.37 (10.28)	22,212.8 (27.40)	30,553.17 (37.68)	26,079.15 (32.16)	17,323.8 (21.36)
Koyna basin with all four talukas (1992)	207,720.28 (100%)	68,487.54 (32.48)	7,650.35 (3.68)	39,971.14 (19.25)	47,621.49 (22.92)	58,274.72 (28.05)	52,640.11 (25.34)
208 villages from only Patan, Jaoli & Mahabaleshwar taluka (1992)	128,089.40 (100%)	30,362.30 (23.70)	7,394.40 (5.70)	42,86.10 (32.92)	48,186.10 (37.58)	37,503.20 (29.27)	18,037.80 (14.08)
26 villages from rainy & mountainous areas (1992)	24,346.50 (100%)	2,166.60 (8.89)	862.50 (3.54)	7,936.50 (32.60)	8,799.00 (36.14)	8,628.40 (35.44)	5,615.00 (26.06)

1. The figures in brackets represent percentage of geographical area.
2. Shifting cultivation crop means the sum of area under *Nachni*, *Vari*, *Rala* and *Salu*.
3. Area affected by shifting cultivation is the sum of the area under shifting cultivation crops and the area under rotational fallow.

Appendix - F

Comparative Chart of Two Sets of Villages: Those Close to the River Koyna and those Up Closer to the Divide Line of the Mountain

Average land use of the villages close to the river				Average land use of villages at higher levels, closer to the divide			
Total of seven villages	Area in hectares	% of geographical area	% of net sown area	Area in hectares	% of geographical area	% of net sown area	
1. Geographical Area	2744.8	100 %		7113.9	100 %		
2. N. S. A.	590.4	21.5	100 %	648.7	9.1	100 %	
3. Rice	162.0	5.9	27.45	168.4	2.36	25.9	
4. <i>Nachni</i>	185.5	6.7	31.4	166.8	2.34	25.7	
5. Total cropped area under shifting cultivation	200.9	7.3	33.8	205.4	2.87	31.6	
6. Grass	193.4	7.04	32.7	270.7	3.8	41.7	
7. Rotational fallow	804.4	29.3		2279.1	32.03		
8. Forests	890.2	32.3	150 %	2743.9	38.5	423 %	
9. Other uses & not suitable for cultivation	159.8	5.8		1442.2	20.2		
10. Area affected by shifting cultivation (5+7)	1305.3	47.5		2484.5	34.9		

The villages closer to the river include Renoshi, Rule, Awalan, Ahir, Harchandi and Vanwali of Jaoli taluka and those closer to the divide include Kumthe, Birmani and Hathlot of Mahabaleshwar taluka and Kandat, Uchat, Nivali and Dobhe Mohan of Jaoli taluka.