244

WP : 244

Working Paper

INDIAN INSTITUTE OF MANAGEMENT
AHMEDABAD

CONTROL OF SHIFTING CULTIVATION: THE NEED FOR AN INTEGRATIVE APPROACH AND SYSTEMATIC APPRAISAL

by

Tirath Gupta
Shreekant Sambrani

W P No. 244
Sep. 1978

INDIAN INSTITUTE OF MANAGEMENT
AHMEDABAD

CONTROL OF SHIFTING CULTIVATION: THE NEED FOR AN INTEGRATIVE APPROACH AND SYSTEMATIC APPRAISAL*

Tirath Gupta
Shreekant Sambrani

I. Introduction

In a highly populated agrarian country such as India, land-based enterprises represent both a source of income to a large majority of people and a critical determinant of the pace of economic development. Effective use of land, therefore, becomes a major concern of planning economic activity in such countries. In much of the literature, land-based enterprises have been closely identified with settled crop cultivation. Subsequent attention has, therefore, been paid to an effective use of owned and purchased inputs to achieve desirable results.

In hill tracts inhabited by tribals, a shifting or slash-and-burn mode of cultivation has been traditionally practised. A hill slope is cleared of its natural vegetation by cutting and burning, seeds are broadcast and the crop is harvested on maturity. The slope is then left fallow for the rest of the shifting cultivation cycle. The cultivators move on to another slope.

---

* We are grateful to our colleague Professor Anand Maslekar for a discussion of the forestry-based approach.

In the hills of North-Eastern region of India, shifting cultivation, known locally as jhuming, has been the principal mode of livelihood. The seven states and union territories of the region show varying population densities, with the regional density below the national average. Arunachal Pradesh is populated at 6 persons per sq km. Assam and Tripura are relatively densely populated with 186 and 149 persons per sq km respectively. The dependence on shifting cultivation also varies from region to region and within a region. Thus, while Nagaland as a whole shows a substantial dependence of shifting cultivation, three of the Naga tribes have been practising settled terraced cultivation for some countries. Given the paucity of the land records and indeed, many other kinds of statistical data in the region, estimates of dependence on shifting cultivation or the total area under it have been understandably difficult and relatively few.[1]

The adverse physical consequences of shifting cultivation have been well-accepted. It destroys the ecological balance, results in substantial soil erosion which subsequently leads to flooding of rivers, dries up hill springs and destroys valuable forestry. As population increases, a vicious circle starts. The jhuming cycle becomes shorter and

---

[1] The National Commission on Agriculture (NCA) contented itself with the estimates made in 1956 which indicated that a total of 2.7 million people in India practised jhuming on 5,42,000 ha (India, 1976, p.148). At the same time, the NCA also referred to a study for the North-East region of India, estimating the number of families dependent on jhuming at 4,92,000 and the area affected by the system at 2.7 million ha, of which 4,55,000 ha was cultivated at any one time (Wadia, 1975). Yet another study for the region has estimated the number of jhumia families in the region at 7,00,000 and the land under the system at 2.7 million ha (Anon, 1977, pp.1 and 6).

soil fertility is not fully restored, yields decline and further areas are brought under jhuming, so that the jhum cycle is further shortened. It was reported that in parts of Tripura, jhuming cycles have been reduced to two to three years, as against the 15 to 20 year cycle that prevailed just 30 years ago (Sambrani, 1977). In the Garo Hills district of Meghalaya, the cycle is four to five years, compared to 30 to 40 years of a few decades ago (Borah, 1977, pp.11-12).

Opinion is divided on the economic and social desirability of shifting cultivation. One school of thought holds that in a situation of inadequacy of other resources for earning livelihood, jhuming represents the only source of income generation in the hill regions. It has now been deeply embedded in the social and cultural patterns of those dependent on it so that control of jhuming become a socio-cultural traumatic experience. The other school of thought holds that given the damaging consequences for the natural resources, it is a matter of time before jhuming can totally damage the social and economic fabric of life (Bhowmik, 1976; Borah, 1977; Wadia, 1975).

Most governments in the region have recognised the importance of tackling the problem of shifting cultivation. A variety of approaches have been tried. These range from relatively obvious remedies such as terraced cultivation to relatively innovative schemes such as rubber and coffee plantations. These programmes need to be examined for their ability to provide a better livelihood to the intended beneficiaries. Our basic premise is that even if the population pressure on land today is low, a

long-term remedy based upon rising population and expectations must aim at making an effective use of the available land in conjunction with other available resources. We propose to develop a set of operational criteria which will help assess schemes for their ability to satisfy the overall objective. We examine some of the existing and proposed schemes against these criteria. We then suggest a new approach which appears to have very good possibilities of satisfying these criteria. The paper is concluded with some general observations regarding such schemes.

II. An Analytical Framework for Assessment of Alternative Schemes

In a region, suppose L_o is the total availability of land for jhuming, of which L is annually cultivated. The jhuming cycle is therefore $l = L_o / L$ years. Let P_t be the number of people dependent on jhuming in the year t. Let this number increase at the rate $\dot{P}$. Let us assume that the use of inputs in jhuming is negligible and that output is a static function of land cultivated. Let us further assume that the entire income, ie. the monetary value of gross output, is spent on wage goods.

Then, total income $Y = f(L)$

or per capita income $y = Y/P_t$

Changes in per capita income are given by

$$\frac{dy}{dt} = \frac{d(Y/P_t)}{dt} = \frac{1}{P_t}\frac{dy}{dt} - \frac{Y}{P_t^2}\frac{dP_t}{dt} = -\frac{Y\dot{P}}{P_t}$$

$$\therefore \quad \dot{y} = -\dot{P} \qquad .. \qquad .. \qquad (1)$$

Hence, under static conditions, per capita income declines at the rate of increase in population dependent on jhum. If per capita income is to be kept constant,

$$\dot{L} \equiv \dot{p} \qquad .. \qquad .. \qquad (2)$$

Hence l decreases. The implication of (1) and (2) above is the vicious cycle discussed in Section I.

Let a programme be undertaken for the control of shifting cultivation, which covers L_o and benefits p_t. Let

K_t = Capital cost of the programme to the government in the year t

Z_t = Income net of maintenance generated by the programme in the year t

W_t = Wages/benefits paid to P_t in the year t

S_t = Supervisory charges in the year t

C_t = Retained surplus in the year t ; it could be negative for $t \leq n$, ie. additional subsidies/expenditure may have to be provided by the government in the early years

n = project maturity period in years

T = Pre-specified time horizon for which measurements of costs and benefits can be made with some certainty

r = Social rate of discounting

P_{gt} = Price of wage goods in the year t

G_t = Quantity of wage goods available in the year t

Then, $Z_t \equiv W_t + S_t + C_t$

For the programme to be acceptable, we must have:

$$w_t = W_t/P_t \geqslant Y/P_t = y \quad .. \text{ for all } t \quad ... \quad (3)$$

$$C_t = K_{t+1} \quad .. \text{ for all } t > n ... \quad (4)$$

$$\frac{Z_t}{L_o} \geqslant \frac{Y}{L} \quad .. \text{ for all } t > n ... \quad (5)$$

$$\sum_{t=1}^{T} \frac{Z_t - Y}{(1+r)^t} \geqslant \sum_{t=1}^{n} \frac{K_t - C_t}{(1+r)^t} \quad ... \quad (6)$$

$$W_t = P_{gt}\, G_t \quad .. \quad ... \quad (7)$$

$$\dot{P}_{gt} = 0 \quad .. \quad ... \quad (7a)$$

Relationship (3) assures that the expected per capita income under the programme is greater than that under shifting cultivation. Condition (4) assures that the programme pays for itself on maturity. Condition (5) implies that land productivity under the proposed programme is at least as great as under jhuming. Relationship (6) ensures that the internal rate of return is equal to or greater than the social rate of discount. Conditions (7) and (7a) together ensure that the real availability of wage goods <u>after</u> the programme is implemented is at least as much as before. The import of this condition is that the implementing authority will have to arrange the distribution of wage goods to the extent they are not produced as part of the programme.

All of these conditions must be satisfied if the programme is to be accepted. Therefore, they are necessary conditions. We may wish to consider some additional conditions:

$$\dot{W}_t \geqslant R \quad .. \quad ... \quad (8)$$

$$W_t = Y + B_t, \text{ where } B_t \geqslant 0 \quad .. \quad ... \quad (9)$$

$$W_t \geqslant k Z_t, \quad k \leqslant 1 \quad .. \quad ... \quad (10)$$

where R = target rate of growth of the economy or the region

B_t = pre-specified bonus

k = pre-specified constant

Condition (8) implies that the future income distribution is no skewer than the original one for P_t. By (9), P_t can be compensated for the loss of non-economic satisfaction obtained from shifting cultivation. Condition (10) ensures that a certain minimum proportion of the benefits goes to P_t. Thus, (8), (9) and (10) can be considered sufficient conditions.

While we have used less than or equal to and greater than or equal to conditions for generality, it should be obvious that for a really acceptable programme, most of the above will have to be satisfied as strict inequalities. Although the framework above has been developed with algebraic symbols, most of the quantitative data needed are generated or should be generated as necessary parts of project preparation. The framework can therefore be easily operationalised.

III. Existing and Proposed Schemes

Some tribes have traditionally nurtured skills for constructing terraces. Faultless terraces have been built with labour and minimal tools. Hill springs have been used for irrigating them. Traditional paddy grown without modern inputs in these areas has provided yields comparable to those in the plains under similar conditions.

Therefore, some states, particularly Meghalaya, have proposed terracing as an alternative to jhuming. Terraces are constructed by the soil conservation department. Fifty families were planned to be settled in a new village near the terraces, with an approach road. A 2 ha plot was to be allotted to each family. For the first three years seeds, fertilisers, pesticides, and power were to be provided free or with considerable subsidies to the farmers. A cash grant of Rs 200 per family was to be made in the first year to meet other expenses, mainly labour hire charges.

Officials indicated in discussions with us that the total cost of resettling a family over the three years would be about Rs 11,000. Terraced paddy was expected to yield a minimum of 15 quintals per ha, as against the maximum jhum yield of 6 to 7 quintals. After the withdrawal of subsidies, at least half the output was to be considered net returns. These expectations indicate, without going through elaborate calculations, that at the existing prices and estimates of the social rate of discount (8 to 10 per cent per year), the scheme meets the criteria of section II.

A recent study of Darengiri village in the Garo Hills district of Meghalaya (Borah, 1977) showed that the department had incurred a cost of Rs 5,60,000 for terracing and constructing other permanent assets. The total area of terraces was 246 ha, the investment thus being Rs 2,300 per ha. Subsidies for inputs amounted to Rs 480 per ha.

The average gross returns per ha of the terraced land in 1975-76 for a sample of 50 households were Rs 863. The net returns were Rs 260. The same families continued jhuming, gross returns from jhuming being Rs 1617 per ha. Thus, expectations regarding results of both jhuming and settled cultivation for this group of families turned out to be wrong. The official explanations was that as long as both forms of cultivation continued, diversion of resources meant for terraced cultivation, including seeds and fertilisers, to jhuming was taking place, since the cultivator was "emotionally" attached to jhuming. Thus, the "bonus" of the previous section was not high enough to prevent jhuming.

While we have not discussed resources in the aggregate in section II, such considerations will show limitations of terracing even when it is carried out as planned. There is hardly any possibility that a million ha of terraceable land or over Rs 500 crores will be available in any foreseeable future to resettle today's half a million jhumia families.

Somewhat more comprehensive programmes have also been proposed. These include a scheme planned by the North-Eastern Council to cover an area of 13,600 ha under plantations of rubber, coffee and cardamom. In

the fourteen years it will take to complete the project, Rs 17.7 crores are expected to be spent. The established plantation will be eventually transferred to individual families. By the eighth year, the project is expected to provide full employment to 18,000 workers (Anon, 1977).

While experiments with such plantation crops have met with some success in some areas of the region, their viability under all conditions has not been clearly established. The aggregate amounts of land and money for a complete dependence on this scheme for resettlement will be somewhat higher than those needed for terracing. Therefore, the same limitations as in the case of terracing apply to plantations as an alternative to jhuming as well. Further, eight years' wait for full employment and fourteen for ownership might cause such uncertainties among the beneficiaries as to render the assumptions for operationalising the framework of the previous section untenable.

Other schemes seek to cover a variety of activities at a particular project site (Wadia, 1975). A Tripura scheme includes a community orchard, a plot for family cultivation, a lake for irrigation and pisciculture, and provision of employment in state reserve forests as well as traditional handicrafts including weaving (Sambrani, 1977). While the scheme appears attractive at a first glance, unless its implementation is in an integrative fashion, both for resources and people, much of its attraction will be lost. Its viability remains to be established.

IV. An Integrative Approach Based on Forests

The first two programmes examined in the previous section appear to emphasise the individual economic identity of the jhumias and propose to absorb them in occupations similar to their current ones. Constrained availabilities of natural and financial resources seem to make their full replication impossible. Hence, alternative measures which meet the tests of economic and social viability must be sought. Such programmes must make the best use of the available natural resources.

Hills in general and jhum lands in particular tend to support forests quite well. Since bamboo areas attract the jhumias most, bamboo-growing may be accepted as a natural alternative to jhuming. Unless it is accompanied by processing industry, however, bamboo-growing by itself may not be economically attractive.

An exercise to develop bamboo forests for a 250 ton per day capacity paper mill shows that it will consume approximately 1,80,000 tons of air-dried bamboo per year. In Tripura, bamboo plantations start yielding in the fifth year and provide, on an average, 5.5 tons of air-dried bamboo per ha per year. An area of 32,000 ha will thus have to be placed under bamboo to feed the mill. Table I indicates labour requirements for planting, maintaining and harvesting the required area.

While 7,000 man-years will be needed in the fifth year on the plantation, such employment will stabilise at 1,540 man-years by the ninth year. This does not include labour for further transport or processing. Backward and forward employment linkages because of the esta-

Table I : Employment Potential of a Bamboo Plantation

Area covered: 32,000 ha under Tripura conditions (Figures in thousands)

Years	Area planted[a] (ha)	Labour required for					
		Plantation[b]	Post-plantation care[c]	Harvesting[d]	Transportation[e]	Total mandays	Total man-years[f]
1	6.4	1,280	-	-	-	1,280	4.57
2	6.4	1,280	256	-	-	1,536	5.49
3	6.4	1,280	512	-	-	1,792	6.40
4	6.4	1,280	512	-	-	1,792	6.40
5	6.4	1,280	512	176	256	2,224	6.94
6	-	-	512	176	256	944	3.37
7	-	-	256	176	256	688	2.46
8	-	-	-	176	256	432	1.54
9	-	-	-	176	256	432	1.54

Notes:

a The total area of 32,000 ha to be planted over five years

b Plantation labour requirement assumed @ 200 man-days per ha

c Post-planting care required only in the second and third years of plantation @ 40 man-days per ha. This includes labour for thinning, replacements, weeding etc.

d Harvesting labour requirements assumed @ 27.5 man-days per ha

e Transportation labour requirement assumed @ 40 man-days per ha. This includes labour for assembling the harvested materials at the loading point or the road-head (average lead of 2 km), and loading the trucks, but not further movement

f One man-year is assumed to be of 280 man-days.

blishment of the plantation and the factory could be substantial, leading to a net increase in employment many times that of the direct employment in the plantation.

The NCA estimate of planting and maintenance costs of bamboo indicate a rather low fiture of Rs 563 per ha (India, 1972, p.129). Given the requirement of 240 man-days per ha at a wage rate of Rs 5 per day and 10 per cent overheads, the costs work out to Rs 1,320 per ha or Rs 84 lakh per year for the first five years. Since the bamboo can yield almost perennially, the financial and social benefit-cost ratios of the project will be high. Further, most of the benefits of such a programme will go to the poorest people. The approach has almost unlimited geographical scope, as most of the land under jhuming is fit for the growth of bamboo and other tree crops. Financial institutions, international agencies, business houses, and the general public can be involved in mobilising the needed resources for setting up such units on commercial basis. There is a large national and international market for paper and a number of other forestry projects, leading to a conservation or enhancement of foreign exchange.

Transportation of wood and other raw forest produce out of the difficult terrain of the region to other parts of the country will be difficult because of their bulk. Therefore, processing industries must be set up close to the sources of these materials. This will result in a minimum disturbance to the social life of the local population and give them a sense of participation in the programme. It will also improve the

economic base of the region by keeping the value-added within the region. Thus, most of the sufficient conditions and some of the necessary conditions of our framework seem to be satisfied. This does not, however, obviate the need for a thorough analysis of this and other similar projects. Necessary data for this purpose can be generated.

Such programmes for the development of forests and processing industries will not necessarily be easy to implement. Their prospects, however, seem attractive enough to warrant further investigation. Conventional efforts at providing the jhumias with lands capable of supporting permanent crop cultivation may, on the other hand, benefit a few, leaving a comprehensive solution to the problem still illusive.

V. Conclusions

Even this limited analysis leads to several conclusions. Firstly, there appears to be no single remedy for the entire region. Depending upon the agro-climatic conditions, a mix of activities, such as terracing, orchard plantations, forestry and forest-based industries, will have to be tried. Secondly, some amount of jhum cultivation may have to be tolerated not merely because of emotional and socio-cultural factors but because it seems to represent the best economic opportunity in certain relatively remote and sparsely populated pockets. Nagaland, Arunachal Pradesh and Mizoram provide examples of such pockets. Thirdly, an effective use of land will necessarily call for investment in related activities.

Such investments will have to be considered as integral parts of the total programme and one must assess the projects on the basis of feasibility of the total scheme and not constituent units alone. Fourthly, the responsibility of such programmes cannot be assigned piecemeal to one or the other departments involved. Quite clearly, competences in the fields of soil conservation, agronomy, horticulture, forest management and processing are called for. If the governments are to seriously pursue these efforts it will be necessary to create a new department which, within itself, comprises all these various competences. Finally, remedies aimed at resettling individual jhumias, rather than their collectivity, will violate the basic principles of conservation of resources and their effective use. A truly integrative effort needs to look at the proper match of resources and people.

References

1 Anonymous, 1977 — Scheme for Setting up of Plantations for Rubber, Coffee and Cardamom in the North-Eastern Region, North-Eastern Council, Shillong (Mimeo).

2 Bhowmick, P.K. 1976 — "Shifting Cultivation: A Plea for New Strategies" in Shifting Cultivation in North East India, North East India Council for Social Science Research, Shillong, pp. 5-10.

3 Borah, Durgeswar 1977 — A Comparative Study of Crop Production Under Shifting and Terrace Cultivation: A Case Study of Garo Hills, Meghalaya, Agro-Economic Research Centre for North East India, Assam Agricultural University, Jorhat.

4 India, Ministry of Agriculture 1973 — Interim Report of the National Commission on Agriculture on Production Forestry: Man-Made Forests, Government Press, New Delhi.

5 _____, 1976 — Report of the National Commission on Agriculture, Part IX, Forestry, Controller of Publications, Delhi.

6 Sambrani, Shreekant 1977 — Designing Jhumiya Resettlement Programmes, Case Study of Indian Institute of Management, Ahmedabad (Mimeo).

7 Wadia, F.K. 1975 — Control of Shifting Cultivation in the North-Eastern Region, Shillong (Mimeo).

o*o o*o o*o o*o o*o