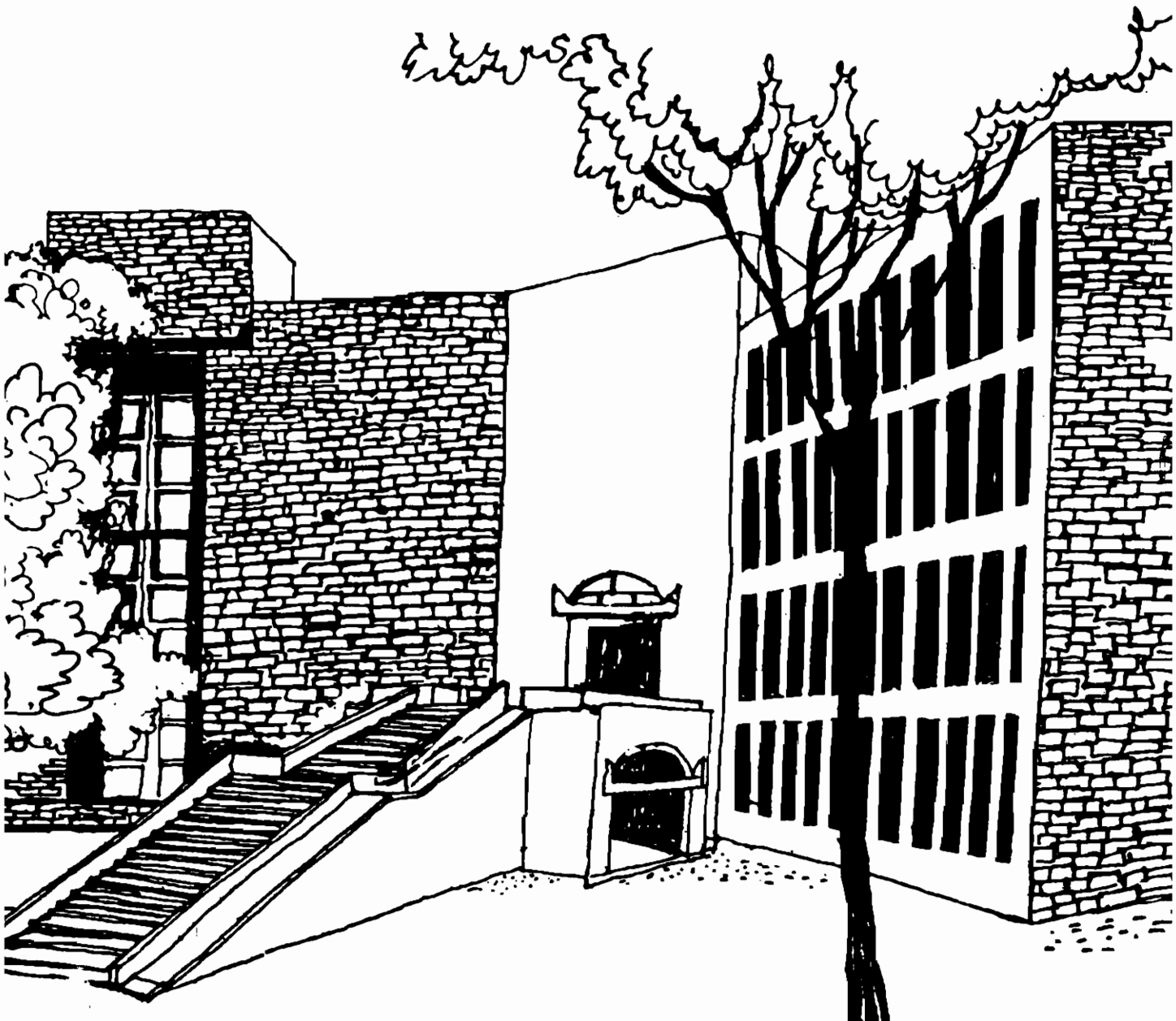




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# Working Paper



**ECONOMICS OF JOINT FOREST MANAGEMENT  
PROGRAMME: A CASE STUDY OF SOLIYA VILLAGE,  
GUJARAT, INDIA**

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**ECONOMICS OF JOINT FOREST MANAGEMENT PROGRAMME:  
A CASE STUDY OF SOLIYA VILLAGE, GUJARAT, INDIA**

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## **SUMMARY**

This paper discusses the organizational and economic issues related to the Joint Forest Management programme in India with respect to Soliya Village in Gujarat. Using the private-benefit cost analysis (PBCA), the case study suggests that it is financially feasible and bankable scheme but needs revision of sharing arrangements between Forest Department and village communities.

## **KEY WORDS**

Afforestation, Joint Forest Management, Private Benefit-Cost Analysis, Benefit-Sharing

# **ECONOMICS OF JOINT FOREST MANAGEMENT PROGRAMME: A CASE STUDY OF SOLIYA VILLAGE, GUJARAT, INDIA**

## **INTRODUCTION**

India's forest policy has come to a full circle in 1990, almost after a century. In 1894 AD, the first forest policy was initiated by the then British regime: this was basically a policy of extractivism to meet timber demand in England. The fallout of this was the control on village communities' access to forests.

The coercive power of state feared people and people in turn lost the feeling of belonging to forests hence lost interest in protecting them too. This very psychology of people towards forests as not belonging to them demotivated people and led to indiscriminate exploitation of forests surrounding village communities and forests on common lands, finally adding to degradation and deforestation. Having realized the social costs of excluding people from local management of forest resources, the Government of India in 1988 passed a new Forest Policy which states that forests should not be looked upon as a source of revenue but as a national asset to be protected and enhanced for welfare of people of the land through peoples participation. Further, in June 1990, the Government of India passed a resolution which provided more specific guidelines for involving people in forest management. Since then some 10 states including Gujarat have issued government orders (GOs) endorsing the participatory/joint forest management (JFM) programme.

The JFM aims at rejuvenation of the old community forest management systems for managing state forestry resources which surround the village communities. Under this

programme, the legal ownership of land remains with the government or Forest Department (FD) but village communities (VCs) become co-managers in the management of forest resources and are entitled to free usufruct benefits and some share in timber or other major harvests from forests.

Several benefits emanate from JFM which include a number of ecological, community related and economic benefits. The ecological benefits arise in term of improved soil and water holding capacity, reduced run-off, increase in the local biodiversity, and above all the aesthetic beauty of the village. The community-related benefits arise in due to frequent interactions among villagers for a common cause which otherwise was absent before. Frequent interaction makes people to know and understand each other well, and develops a culture of resolving conflicts through dialogue, not through confrontation. The programme fosters unity among villagers and rejuvenates the traditional leadership based on ethical values and prepares people to jointly endeavour to achieve some community objectives or to combat selfish leadership in the village.

The economic benefits comprise primarily tangible benefits in terms of nontimber and timber products. The nontimber outputs include fuelwood, fodder, gums, leaves, flowers, roots, etc.; the fodder and fuelwood are highly valued by village communities. Village communities are allowed to collect them freely without Forest Department's permission. The other benefits which villagers value much are the cash benefits from sale of timber and other marketable forest products such as bamboo, etc.<sup>1</sup> These benefits are valued very much by the community as they meet the liquidity or cash-needs of the people.

Since JFM is basically a community forestry programme, its sustenance as a viable institution depends upon continuous interest of the community in the programme which can be only achieved if the participants can be ensured gainful economic remuneration. The economic remuneration depends upon the magnitude and timings of harvest of various products from a forest crop. For example, nontimber products are available in the early years of forest crop but their magnitudes may not be very large. On the other hand, large timber benefits arise after 15 to 30 years since planting but they require a long waiting period. This is specially true wherein the JFM programme is a relatively new one.

However, people in general are impatient and are interested in getting quick returns. Hence the time preference of the village community towards returns from JFM plays important role in shaping the long run future of the programme. Several questions thus loom in the policymakers' minds as to how exactly these benefits would come, of what value they would be to people, and whether this will be a financially feasible or bankable programme.

Besides financial feasibility, the other important decisive factor in shaping the future of JFM is that how Forest Department and village communities agree to share the economic benefits, i.e., the economics of benefit-sharing. Currently the tentative understanding between the Forest Department and villagers is as follows: the usufruct benefits which are a small proportion of total benefits from the programme are fully used by the villagers while the substantial benefits coming from timber and quick growing NTFP species such as bamboo are to be shared. The sharing norms vary from state to state, ranging from 50 to 75 percent share of Forest Department in final produce. There seems a general feeling of discomfort on sharing norms. The question is that whether such an agreement would, besides its



**enforceability, be economically viable or not to sustain the interest of the village community.**

**The economic incentives to stimulate JFM activities across the Indian countryside hence depend upon two factors: (1) the financial feasibility or returning capacity of the afforestation schemes; and, (2) the economics of benefit sharing between the village community and the Forest Department. The major purpose of this study is to assess and analyze the economic incentives towards making JFM a sustainable institution, based on the case study of Soliya village in Gujarat. More specific objectives of the study are as follows:**

- (1) to study the organizational aspects of JFM programme in the Soliya village;**
- (2) to appraise the financial feasibility of afforestation under the JFM programme; and**
- (3) to study the economics of different sharing norms between the Forest Department and the village community.**

**The organizational framework of JFM in Soliya village is examined in the next section. This is followed by the discussion on factors which led Soliya villagers to protect trees under the JFM programme, financial analysis and economics of benefit sharing in subsequent sections. Major conclusions are summarized at the end.**

### **ORGANIZING JFM PROGRAMME IN SOLIYA VILLAGE**

**For achieving the said objectives, a village called Soliya, located in Dediapada Taluka of Bharuch district in Gujarat province of India was chosen for two reasons: one, the JFM**

programme in this village has been successful in raising and protecting some 250 hectares of forests; two, since this village has one of the earliest plantations and villagers have had an harvest of bamboo in 1991, thus some estimates of economic benefits are now available. The village is situated at the bank of rainfed Karjan river and is surrounded by hills and has highly undulating topography (Figure 1). There are some 320 households in the village comprising 2100 people--900 adult male, 800 adult females, and 400 children below 15 years of age. Soliya is a tribal village comprising mostly Vasava community. Total area of the village is about 814 hectares and break-up of its land-use pattern is given in Table 1. Agriculture and livestock-rearing are major occupations of people.

[Insert Figure 1 and Table 1 around here]

The physical infrastructure of the village is poor. The village is connected by rough roads to the nearest town Netrung. It has one high school. There is no effective electricity and drinking water facilities. People drink water from open wells which are beset with health hazards. Attitudes of people towards health care and education are not very positive.

In the past, different organizations have been built in the village. The real organizational work was started by Dr. Parikh, who was stationed at Soliya Primary Health Centre in the late 1980s. Dr Parikh was successful in persuading villagers to form a **Gram Vikas Samiti** or **Village Development Council**. Later in 1985, the Agha Khan Rural Support Programme (India) (AKRSP) converted this into the **Gram Vikas Mandal (GVM)** or **Village Development Board** which initiated the **Joint Forest Management Programme** in year 1986. The GVM in 1985 was a sort of informal organization and had a total of 50

members; all members were landless. The criteria of membership was based on the "principle of labour contribution." That is, one who could contribute labour towards forest protection was eligible to be a member. Later, landed people were also made members whosoever subscribed to the above principle.

GVM has become popular for its various multifarious functions it has performed. These include: (1) forest protection and marketing of forest produce, (2) banking function, (3) medical insurance function, (4) an input-supply agency function (Figure 2). Organizing protection of forests is the major objective of GVM. It organizes the schedule of protection duty and fines members those who skip their protection duties. In addition, it fines members and nonmembers who steal from forests and designs practicable punishment criteria. So it must have the sanctions of the villagers' will to execute these rules to be enforced.

GVM also functions as a bank for villagers. All those who work in the afforestation programme are paid through GVM. The individual is paid after making two types of deductions at the source: (1) GVM commission deduction (GCD); (2) individual's savings deduction (ISD). The GVM commission deduction is used for maintaining the GVM office, for buying implements like pesticides sprayers for the community, and for paying wages to watchmen during monsoon season, etc. The GVM deductions thus form the community savings. The individual's savings deductions are kept by the GVM in the individual's account with GVM. The GVM meticulously maintains these records. Members can take loan against these savings from GVM; interest rate charged by GVM is however high around 24%.

In 1992, villagers were paid Rs.29.75 per day. Out of Rs.29.75, the GVM commission deduction was Rs.1.75 while the individual savings deduction was Rs.4; the remaining Rs.24 per day was paid to the individual. The total money generated in 1992 was Rs.43,226.75 through planting of saplings and digging pits; out of this a total of Rs.34,872 was paid to individuals, Rs.5,822 went to individuals' accounts with GVM, and the rest Rs.2,541.75 went to the community's savings account (Table 2).

[Insert Figure 2 and Table 2 around here]

Out of so generated funds, the GVM lends money to members to buy agricultural inputs such as hybrid seeds, pesticides, and fertilizers. Since access to these inputs is not easy, GVM buys them from nearby markets and then retails them in the village and thus performs role of an input-supplying agency. Members find it very convenient as they get loan from GVM and the seeds or fertilizers at the right time in the village. Since timely supply of these inputs is very necessary lest yield may go down, the GVM supplies of inputs with loan facility come in handy to villagers.

But more important and the noble thing that GVM has done in Soliya is providing finance for medical help. Many people who fall sick and have no money find this facility as boon to them. In point of fact, many villagers confirmed this as the greatest service by GVM to villagers. Interesting thing is that loan facility for medical help is instant. If anyone goes to doctor or/and to buy medicines, he can instantly get loan to pay for these expenses. No other financial institution can provide such a timely help in such an efficient manner as does GVM. Having realized the importance of GVM, people are also very

sincere in making repayments. According to Mr. Shantibhai, Secretary of GVM Soliya, the recovery is rather good and they do not have as yet any problem of default at all.

With the formation of GVM, the Agha Khan Rural Support Programme (AKRSP) initiated the afforestation programme in the village. The first afforestation work in the village was done on 17 hectares of revenue wasteland in 1985 by the members of GVM. In 1986, some 85 hectares were afforested, of which 75 hectares were on Forest Department's land. As time went by, more area was brought under afforestation. By 1992, some 189 hectares were afforested and 86% of this hectarage belonged to the Forest Department. The details of yearwise afforestation until 1991 and other associated information are given in Table 3. After 1991, another 88 hectares have been afforested, thus total forest area reaching to about 247 hectares. A perusal of Table 3 reveals that from 1985 to 1991, about 449.9 thousand saplings were planted and out of which some 348.8 thousands survived till March 1991--thus overall survival percentage being 77.5%. The average height of teak in 5-6 year period was about 5.4 meters (18 feet) and girth about 32 cms. (13 inches). It is considered to be reasonable growth given the climate and soil moisture conditions in the area<sup>2</sup>.

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[Insert Table 3 around here]

The GVM of Soliya has developed a set of rules and regulations to arrange protection for afforested areas. All male members of GVM protect the forested areas as per the basic principle of labour contribution by which each member is required to supply labour towards protection of forests. Protection in Soliya is done round the clock, throughout the year.

Everyday from 6 a.m. to next day 6 a.m., six GVM members patrol the afforested area of 247 hectares. The largest strip of protected forest is on the southern side of the village while two other strips of 25 hectares each are on the Northern side. With a total of 183 members, each member gets his turn once in a month. So this does not impose too much constraint on the individual's commitments to agriculture and household works.

A member who is paid Rs.10 per day maintains the records of duties and informs members when their turns come. During the agricultural season when people are busy with their agricultural work, GVM employs two watchmen who are paid Rs.300 each per month. Protection is required to guard forests property from thefts by members and non-members in the village and persons coming from outside the village.

Villagers accept that persons from nearby villages which do not have joint forest management programme do come to steal from Soliya forests. According to Soliya people, people from villages of Roopghat, Valpar, and Chalibaug have been constantly stealing from Soliya forests. Since incidents of thefts have been very common in the past, the Soliya GVM has formed some rules for punishing offenders. Both member and non-member residents of Soliya village, and non-members from outside Soliya, have indulged in thefts. In general, thefts of bamboo sticks and branches of trees or poles are very common. A member found stealing bamboo or teak pole is charged fine at the rate of Rs.10 per bamboo stick and Rs.25 per teak pole, as opposed to market price of Rs.5 per bamboo stick, and Rs.10 per teak pole. In addition, the stolen offence material is forfeited<sup>3</sup>. For non-members, the fine rates are just doubled. The rationale for differential rates for members and non-members lies in the expected commitments towards protection.

It is interesting to note that, with the initiative of JFM in Soliya and nearby villages in Bharuch district, the illegal extractions from reserve forests have dwindled by more than 50% as revealed by local Forest Guards. Villagers of Soliya also confirm that the task of protection has become very easy and simple as now most members abide by the rules of protection. In September 1993, when this village was surveyed it was found that only two watchmen were protecting forests and people were busy with their agricultural work. These two watchmen were able to protect the large area of 247 hectares. Villagers in general subscribed to the idea that stealing would finally nail down the community efforts. Everybody seemed to understand his/her social responsibility towards protection very well.

#### **WHY DID PEOPLE PROTECT FORESTS IN SOLIYA?**

Understanding the psychology of individual households or participants and of the community as a whole is a key towards developing sustainable protection efforts. For this purpose, some 35 participants and other village opinion leaders were interviewed. Several reasons appear why people in Soliya participated in the afforestation programme.

Villagers cite several reasons for joining the JFM programme but the most important one to them is the idea of economic benefits. Three things are important here in this respect: (1) the magnitude of economic benefits; (2) timings of these benefits; (3) the expectation horizon in the people's mind. For convenience of understanding, we can classify various economic benefits into three categories: (1) benefits that are available instantly or instant benefits; (2) benefits that are available within intermediate near future or between 3 and 7 years of plantation or intermediate benefits; and (3) the distant benefits which are available beyond 10 years. Villagers give high weightage to instant benefits whatever may be their

magnitudes. As a matter of fact, availability of such benefits in terms of wage employment provided by the AKRSP was the prime attraction to villagers to join JFM programme in Soliya. This was cited as the main reason by many participants for joining JFM in Soliya. The wage rate paid by AKRSP was also better than that available in agriculture. For example, agricultural wage is about 50% of what people were paid in forestry operations<sup>4</sup>. Other lucrative thing is that wage rate in forestry work has increased rapidly over the years<sup>5</sup>.

The other instant and second most important economic benefits that people viewed as strong incentive to join JFM programme was the availability of other advantages such as availability of hybrid seeds, finance for medical expenses, etc., from the Gram Vikas Mandal (GVM). Interesting thing to note is that most participants interviewed agreed that prices charged by GVM are very reasonable and disbursement of agricultural inputs such as seeds, chemicals, and fertilizers, was very timely unlike their previous experience<sup>6</sup>.

Villagers considered the availability of NTFPs--in particular fuelwood and fodder--as the next immediate near future economic benefits. People need fuelwood and fodder directly to meet out their daily needs. In particular the women of the village felt that easy access to fodder and fuelwood from jointly managed forest would save their drudgery of walking miles together to faraway places for collection of fuelwood. This would also save time which could be employed elsewhere gainfully. It is estimated that some 20 to 30% of total grass requirement of the village is met from JFM forests. Since 10th year or so, fuelwood in the form of fallen and dead twigs becomes available. Author's estimate is that some 2 to 4 tonnes per hectare of fuelwood would be available every year since 10th year onwards.



Besides fuelwood and fodder, other intermediate benefits that people expected to materialize within 3 to 5 years of JFM plantation was the harvesting of bamboo. Bamboo crop can be harvested from the fourth year since planting, and it can meet the liquidity needs of the people at large.

Villagers expect distant future benefits in terms of timber to come after 30 to 50 years of planting. But they are uncertain about them. The biggest concern to them is the uncertainty of the so-called sharing arrangement between Forest Department and the community in general. Various economic benefits along with their expectation horizon and amount of uncertainty involved are shown in Table 4.

[Insert Table 4 around here]

Apart from economic benefits, villagers in general recognize the ecological and sociological benefits arising out of the JFM programme. People in general believe that good forest cover brings out good rainfall in the village. For example, an executive committee member Mr. Ramanbhai Vasava asserted that rainfall has increased after the commencement of JFM; as a result, water was available even during summer months. Mr Vasava also said that the agricultural yields have increased by one and half times due to good rains; and, the growth of grass around the agricultural fields have increased, adding to increased fodder supply in the village. The aforesaid statements of Mr. Vasava just reflect the perceptions that people have about the ecological benefits from the JFM. These perceptions may not necessarily confirm the cause-effect relationship between JFM and rain but they do tell at least one thing that people view JFM as contributing factor to village ecology.

## **FINANCIAL ANALYSIS AND ECONOMICS OF BENEFIT SHARING**

As mentioned earlier, two important things that need to be investigated for successful proliferation of JFM programme in Gujarat, or for that matter in India, are its financial viability and optimal sharing of financial benefits between the village community and Forest Department. In order to study the financial feasibility, the financial or private benefit-cost analysis (PBCA) was applied to the cultivation of some major tree species in Soliya, Gujarat.

Basically, forests in Soliya can be classified in two categories; (1) partially planted forests which include roughly 25% natural regeneration and 75% enrichment planing; (2) completely or 100% planted forest. Although some 30 species are grown in Soliya forest, three types of species are important: (1) teak, (2) bamboo, and (3) fuelwood and fruit species. The teak and bamboo predominate and are lucrative in terms of cash-earning prospects. Other species are generally used to meet the fuelwood and fodder requirements of villagers. Teak and bamboo are hence important ones in terms of meeting cash needs of villagers.

A survey of JFM participants indicated that they are more interested in quick and frequent cash returns. To this end, two possible strategies are possible: (1) frequent harvesting schedules can be allowed in bamboo and teak cultivation; (2) different combination of teak and bamboo can be grown to meet cash needs of the community after setting aside some area for fuelwood and fodder species for meeting fuelwood and fodder requirements. Bearing the above strategies in mind, the PBCA was applied to a set of promising scenarios (Table 5)<sup>7</sup>:

1. Scenario 1 entails complete bamboo cultivation in the designated JFM land and some seven types of bamboo management models are appraised. Each management model assumes different types of yield and harvesting schedule (B1 to B7).
2. Scenario 2 focuses on complete teak plantation, including 4 types of harvesting schedules, allowing more frequent thinning yields (T1 to T4) T4 allows more frequent thinning yields than T1.
3. Scenarios 3 to 11 assume different proportions of area under bamboo and teak along with fuelwood and fodder species. The area for fuelwood and fruit species is set aside for meeting fuelwood and fodder demand of the village.

[Insert Table 5 around here]

Cashflows were worked out for bamboo, teak, and various combinations of bamboo and teak. Cashflows for combination scenarios were worked out using the principle of proportion. That is, for example, the cashflow for scenario 7 was worked out by multiplying cash flows of bamboo and teak each by 0.4 and then summing them up to get the combination cashflows (Table 5). Having computed cash flows for each scenario, the following three measures of PBCA were computed: (1) Gross Benefit-Cost Ratio (GBCR), (2) Net Present Value (NPV), 3) Financial Internal Rate of Return (FIRR). The GBCR and NPV are given by the following formulas:

$$GBCR = \frac{\sum_{t=1}^n \frac{B_t}{(1+i)^t}}{\sum_{t=1}^n \frac{C_t}{(1+i)^t}} \quad \dots (1)$$

$$NPV = \sum_{t=1}^n \left( \frac{B_t - C_t}{(1+i)^t} \right) \quad \dots (2)$$

where

$i$  = discount rate,

$n$  = economic life of the project,

$B_t$  = total benefits in the  $t$ th year,

$C_t$  = total costs in the  $t$ th year.

The GBCR refers to the ratio of present value of total benefits to the present value of total costs; while the NVPs refer to the present worth of the net cash flows obtained over the economic life of the plantation. FIRR refers to the maximum earning capacity of the project: or it is the rate of discount which equates the present value of total costs to the present value of total benefits or in other words makes NPV equal to zero as indicated.

FIRR =  $i$  such that NPV = 0. For estimating FIRR, however, the following formula is used (Gittinger, 1972: 55-56):

$$FIRR = i_l + (i_h - i_l) \left( \frac{NPV_{i_l}}{|NPV_{i_h} - NPV_{i_l}|} \right)$$

where,

$i_l$  = lower discount rate at which NPV is positive;

$i_h$  = higher discount rate at which NPV is negative;

$NPV_h$  = net present value at higher discount rate.

$NPV_l$  = net present value at lower discount rate;

Financial analysis results of seven different bamboo management models are given in Table 6. Some important observations that are made from this table are highlighted. First, the financial internal rates of return (FIRRs) from all these projects vary from 60% to 112%; the highest one being for model B1 and the lowest one for model B7. All these projects are financially feasible even at 30% discount rate--the highest rate of interest that perhaps can be charged by any financial institution today<sup>8</sup>. The present values of net benefits at 30% discount rate totalled Rs.6,137, Rs.4,296, Rs.4,134, Rs.4,441, Rs.3,064, and Rs.2,944 respectively for B1 to B6 bamboo management models. For B7 bamboo management model, the present value of net benefit totalled some Rs.30,974. Similarly, the GBCRs are 5.68, 4.83, 4.73, 4.90, 4.06, 3.98, and 4.88 respectively for B1 through B7 models, indicating that they are financially feasible ventures.

Like bamboo management models, four different teak management models were evaluated. The results of benefit-cost analysis are given in Table 7. The FIRRs were not as high as they were in the case of bamboo; the FIRRs hover around 38 to 39% (Table 7). All projects T1 through T4 are financially feasible up to 30% discount rate. The present value of net benefits per hectare for these totalled Rs.3,320, Rs.3,023, Rs.3,206, Rs.3,815 at 30% discount rate. Other interesting result that emerge from the perusal of teak management models is that with the increased number of selective thinnings allowed the net returns per hectare increased. Model T3 and T4, which allow frequent thinnings compared

to model T1 and T2, have higher net present value of benefits. This suggests that with increased numbers of thinnings the teak can be made more attractive to villagers unlike the persisting general belief among foresters.

Since various possible combinations of teak, bamboo, and other fuelwood and fodder species can be and are being tried under JFM programme, some nine possible combination management models were also tested using the PBCA. The salient results for nine combination management models are given in Table 8. A perusal of Table 8 reveals that FIRR from all combination models, except model 5 (C5), hover between 46 to 50%. For the first four combination models, C1 through C4, the FIRR is around 50%; while for the last four models, C6 through C9, it is around 46%. FIRR for model 5 is however highest, about 80%. All combination models are feasible up to 30% discount rate and beyond, and their GBCRs are more than 2. It is suggested that combination of teak, bamboo, fuelwood and fodder species can be a financially feasible alternative. These combinations will meet both cash and kind needs of the villagers.

[Insert Table 6,7, and 8 around here]

Although the analysis suggests that all above activities are financially feasible and bankable, the crux lies in how these benefits are shared between the Forest Department and village communities or not. Thus, the economics of benefit sharing is very important in deciding whether the programme as such will be viable option to the community or not. The current understanding between the Forest Department and villagers is that the latter would reap usufruct benefits such as fodder, fuelwood, etc., without sharing with the Forest

Department, but people would be entitled to 25 to 50% share in the harvests of bamboo or timber. The bone of contention that can occur between Forest Department and GVM of Soliya is most likely would be the share in the timber related benefits. Though government policy has changed in favour of giving more share to village communities, the operationalization of the same is not yet that easy and simple. And, the Forest Department is yet in the process of adopting to new policy changes<sup>9,10</sup>.

As mentioned earlier, large numbers of villagers expressed their disappointment with 25% share allotted to villagers. Most villagers told that the 75% share of the Forest Department in timber benefits is too much. Of the 35 participants interviewed, about 57% expressed that this sharing arrangement is unsatisfactory; some 31% considered it satisfactory, and the rest were undecided. The PBCA was applied towards understanding the economics of different sharing arrangements. To this end, the four possible sharing formulas or arrangements were considered:

Option A: 25% benefits to the villagers and 75% to the Forest Department (Sharing formula No.1).

Option B: 50% benefits to the villagers and 50% to the Forest Department (Sharing formula No.2).

Option C: 75% benefits to the villagers and 25% to the Forest Department (Sharing formula No.3).

**Option D: 100% benefits to the villagers and none to the Forest Department (Sharing formula No.4).**

The current sharing arrangements conform to the Sharing Formula No.1 or 2. A comparison of GBCRs and NPVs under 4 sharing options at 30% discount rate for selected bamboo and teak management models are given in Table 9. A perusal of the first four bamboo management models reveals that under Option A the net returns to villagers are meagre, ranging from Rs.203 for B3 to Rs.552 for B1 model. And, for the intensive bamboo cultivation model B7, the returns are far negative.

The situation is worse when we examine the net returns from teak cultivation. That is, net returns from teak are negative even under the 50% sharing option (Table 9). By combining teak and bamboo and other fuelwood growing species, the net returns have improved (Table 10). But even under combination models, net returns are negative to villagers under the 25% sharing formula and turn positive certainly under 50% sharing formula, although net returns are not that large and attractive in terms of magnitudes. But villagers do get free fuelwood and fodder in ample amount which might compensate for less liquidity.

A comparison of FIRRs of different forest management models considered in this study across four types of sharing arrangements are given in Table 11, Note that, except a few bamboo management models (B1, B2, B3, ...), all models including teak and different combinations of teak with bamboo and fuelwood/ fodder species have less than 30% rate of return under the current 25% sharing arrangement. And it suggests that such arrangement



is most likely to be unpalatable to villagers when viewed entirely in terms of liquidity or cash needs of the people. Under 50% sharing formula, bamboo becomes attractive and FIRR goes up from 40 to 80%, but teak and combination models barely touch the 30 to 35% rate of return (Table 11).

Whether people will actually accept the current sharing arrangement with Forest Department or not depends upon what they value the most between liquidity and the kind needs in terms of fuelwood and fodder etc. If fodder and fuelwood needs are sufficiently large so that people do not mind the small or marginal cash benefits coming from the JFM, people's interest in the JFM can be sustained. A 50% share of villagers in forest benefits seems more reasonable and sustainable than the 25% share. This, however, requires mixing of teak with quick growing species such as bamboo. Interestingly enough, only teak growing cannot sustain community's interest even at 75% sharing option. It is hence necessary to mix bamboo or other quick growing species with teak to make JFM economically interesting to the community.

## **MAJOR CONCLUSIONS**

Major conclusions of the study are summarized as below:

Forest is integral part of people's life styles in Soliya. Development of forests and its protection in Soliya would surely improve the quality of life of its people. The joint forest management as a new institution provides an alternative to regenerate degraded forests and to afforest new areas for the fulfilment of various needs of

people such as fodder, fuelwood, liquidity, and other environmental recreational goods.

- Economic benefits from the JFM programme are estimated to be very attractive. Villagers expect a number of benefits from the JFM forests. Of these that they value most are fuelwood, fodder or grass, bamboo, and timber. In the short run, that is during the first 7 to 10 years of plantation, they harvest grass--valuable output for rearing of livestock. Some 20 to 30% of total grass requirement of the village is met from JFM; and, some 2 to 4 tonnes of fuelwood is expected to come after 10 years since afforestation. From the fourth year onwards, bamboo crop is ready for harvest and it brings quite attractive returns to villagers. Villagers prefer bamboo crop for it gives quick economic return to them. The Forest Department however prefers growing timber trees such as teak.
- The JFM programme has enhanced the organizational capabilities of the villagers and has brought forth the leadership qualities of individuals. Villagers have developed their own ways to resolve various issues of conflicts. However, the AKRSP has played parental role in developing organizational and leadership qualities among villagers. The real test of the sustainability of the JFM institution lies in the wake of withdrawal of AKRSP. Author's assessment is that the AKRSP should withdraw in phases rather than once-for-all withdrawal. This would obviate crumbling of institution and allow people to take over and manage new responsibilities.

- Financial analysis of bamboo, teak, and bamboo plus teak management models indicated that they all are financially feasible activities up to 30% discount rate. The FIRR for various bamboo management models range between 60 and 112%, indicating very high returning capacity. Similarly, FIRRs for teak management models hovered around 38%. By combining teak with bamboo, the FIRRs from combination management models can go up to 50%. This suggests that combining quick-returning crops such as bamboo with slow growing teak can meet preferences of both villagers and Forest Department.
- Economics of benefit sharing is the most decisive factor in determining the sustainability of JFM as an institution per se. Different income sharing arrangements were evaluated using the PBCA. The results indicated that net returns are more or less very small to negative under 25% sharing option. A 50% sharing option seems to be economically attractive to villagers and can ensure sustainability of JFM in the province.

## **REFERENCES**

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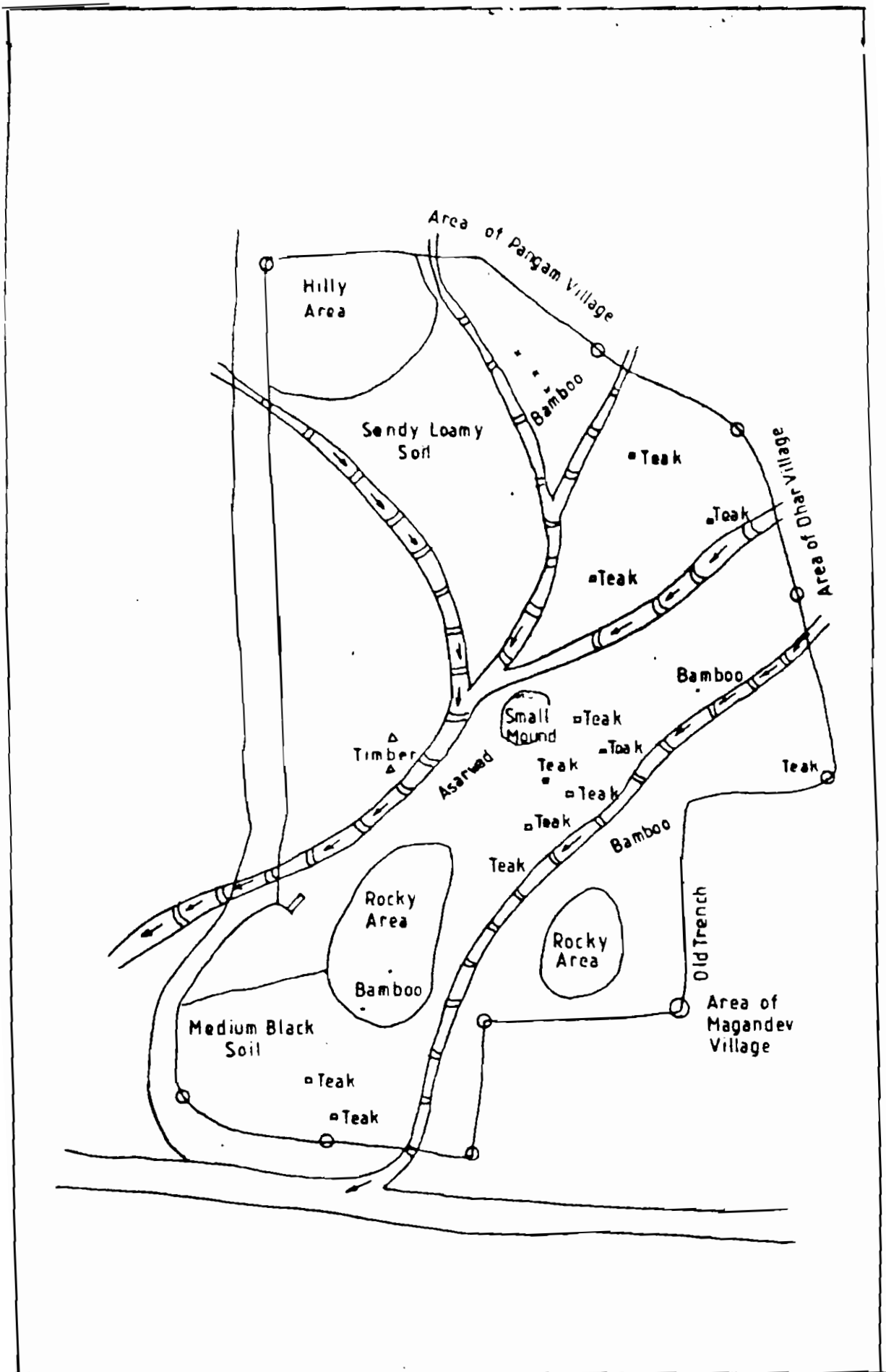


Figure 1: A Sketch Map of Soliya Village, Gujarat

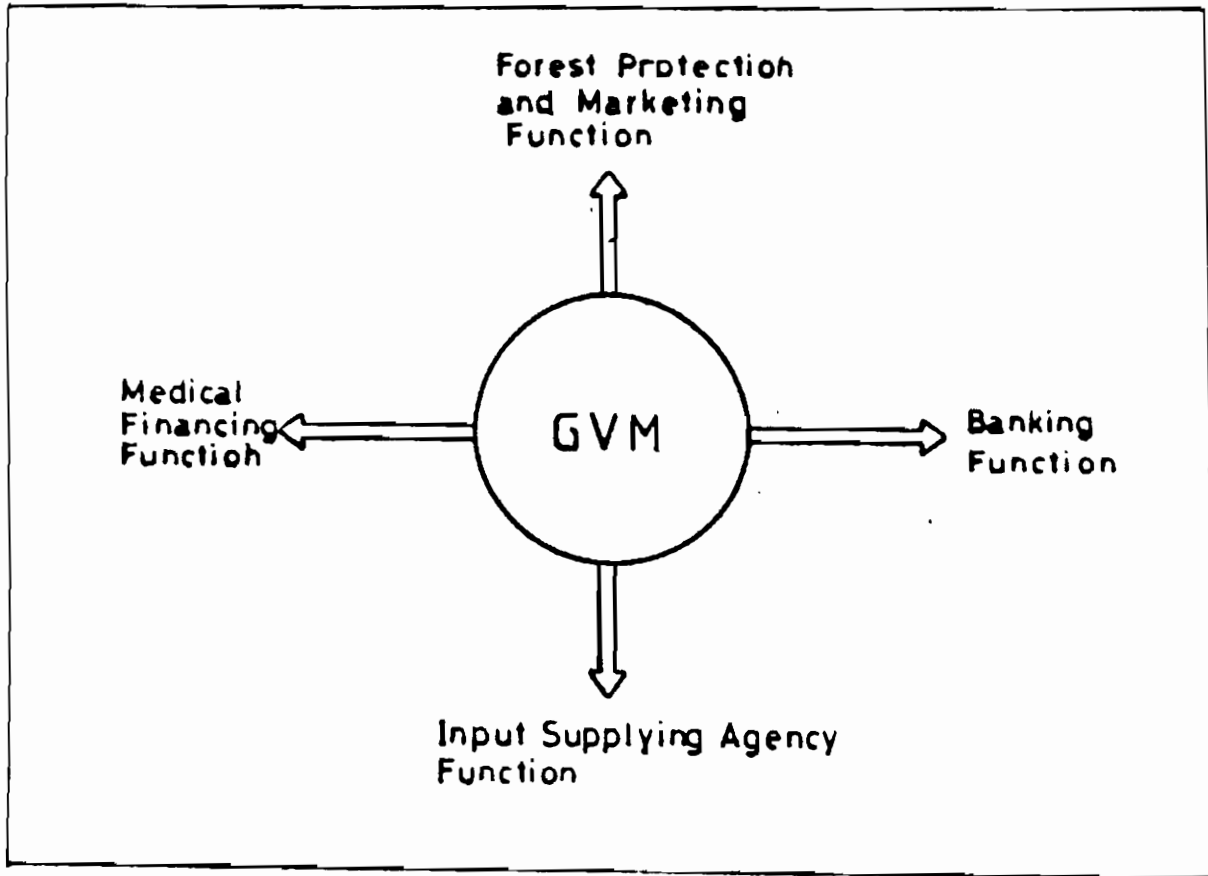


Figure 2: Functions of GVM, Soliya

Table 1: Land Use Pattern in Soliya, Gujarat

Particulars	Area (ha.)	Proportion (%)
Privately owned	379.60	46.60
Revenue wasteland	20.23	2.48
Forest Department owned land	388.10	47.71
kGauchar land	10.11	1.24
Other land	15.38	1.89
Total	813.43	100.00

Source: Taluka Development Office, Dediapada,  
1993

**Table 2: Details of Community and Individual Savings Generated by GVM, Soliya, 1992**

Particulars	Activities		Total
	Digging	Planting	
Total mandays	319	1134	1453
Total money paid to GVM by AKRSP @ Rs.29.75 per day	9,490.25	33,736.50	43,226.75
Individual savings @ Rs.4 per day	1,286.00	4,536.00	5,822.00
GVM commission reduction @ Rs.1.75 per day	557.25	1,984.50	2,541.75
Actual money paid to individuals	7,656.00	27,216.00	34,872.00

Source: Records of GVM, Soliya, 1993



Table 3: Yearwise Afforestation in Soliya under the Joint Forest Management Programme

Sl. No.	Year of Planting	Type of Land	Area Planted (ha.)	Total No. of Sapling Raised Including Causality Replacement (000)	Total No. of Saplings Planted Till 1992 (000)	Total No. of Plants Surviving March 1991 (000)	Survival Percentage etc.	Average Height (ft.)	Average Girth on Mar. '92 (cm)
1.	1985	R	17	94.5	51.00	36.00	85	18	32
2.	1986**	R	10	55.5	30.00	21.20	85	17	30
3.	1986	F	75	190.0	187.00	220.00	--	18	32
4.	1989	F	30	41.4	40.40	24.20	81	5	4
5.	1990*	F	30	28.5	28.40	18.11	64	5	4
6.	1991	F	27	40.0	39.09	29.34	75	-	-

\* Causality replacement taken up by the Forest Department.

\*\* There has been only one year of planting. The plot has quite a substantial proportion of natural plants. The survival counting has been done on the basis of quadrant model.

R - Revenue Land

F - Forest Department

Source: Data supplied by AKRSP and villagers.

Table 4: People's Expectations about Economic Benefits, Soliya, Gujarat

Particulars	Instant Benefits	Near Future Benefits	Distant Future Benefits
Type of Benefits	Wage employment  Availability of timely loan for agricultural inputs and medical needs.	Fuelwood  Fodder  Bamboo  Commercial and non-commercial NTFP <sup>a</sup>	Timber  Fuelwood
Expectation Horizon	Within 0 to 2 years of the project.	Within 3 to 7 years of the project.	Beyond 7 to 10 years
Uncertainty involved in the people's mind	Least	More	Most

<sup>a</sup> Other commercial NTFPs include timru, khakar leaves, gums, etc. Other non-commercial NTFPs such as berries, fruits, etc., used for supplementary daily diets.

Source: Based on discussion with JFM participants, Soliya

**Table 5: Scenarios for Tree Cultivation Appraised for Soliya, Gujarat**

Scenarios	Bamboo	Teak	Other Species
	.. .. . % Area/Hectare .. .. .		
1	100 (B1-B7) <sup>a</sup>	0	0
2	0	100 (M1-M4)	0
3	40 (B1) <sup>b</sup>	40 (T1)	20
4	40 (B1)	40 (T2)	20
5	40 (B1)	40 (T3)	20
6	40 (B1)	40 (T4)	20
7	40 (B2)	40 (T1)	20
8	40 (B2)	40 (T2)	20
9	40 (B2)	40 (T3)	20
10	40 (B2)	40 (T4)	20
11	30 (B2)	30 (T2)	40

<sup>a</sup> Figures in parentheses represent either number of models or the type of individual tree model used in combination with other models.

<sup>b</sup> A combination of teak and bamboo is assumed to have one life cycle of 50 years of teak and two life cycles of bamboo of 25 years each.

Source: Analysis

**Table 6: Results of Benefit-Cost Analysis for Different Bamboo Management Models (B1 to B7), Soliya, Gujarat**

Models	10%	20%	30%	40%
<b>Model 1 (B1)</b>				
NPV	33,060.40	12,892.43	6,137.37	3,262.58
GBCR	7.96	6.84	5.68	4.62
FIRR	.. .. .	.. .. .	(112.26)	.. .. .
<b>Model 2 (B2)</b>				
NPV	28,864.92	9,999.65	4,296.94	2,083.16
GBCR	7.76	6.24	4.83	3.67
FIRR	.. .. .	.. .. .	( 91.88)	.. .. .
<b>Model 3 (B3)</b>				
NPV	28,760.53	9,850.62	4,134.91	1,929.52
GBCR	7.65	6.18	4.73	3.52
FIRR	.. .. .	.. .. .	( 82.35)	.. .. .
<b>Model 4 (B4)</b>				
NPV	24,472.82	9,463.23	4,441.56	2,317.32
GBCR	7.30	6.08	4.90	3.88
FIRR	.. .. .	.. .. .	( 99.22)	.. .. .
<b>Model 5 (B5)</b>				
NPV	21,288.20	7,288.04	3,064.77	1,432.57
GBCR	6.97	5.44	4.06	3.00
FIRR	.. .. .	.. .. .	( 80.37)	.. .. .
<b>Model 6 (B6)</b>				
NPV	21,255.45	7,182.87	2,944.44	1,317.62
GBCR	6.97	5.40	3.98	2.87
FIRR	.. .. .	.. .. .	( 73.45)	.. .. .
<b>Model 7 (B7)</b>				
NPV	2,23,883.50	77,041.73	30,974.30	12,876.17
GBCR	6.92	4.88	3.34	2.27
FIRR	.. .. .	.. .. .	( 62.41)	.. .. .

**Table 6: Results of Benefit-Cost Analysis for Different Bamboo Management Models (B1 to B7), Soliya, Gujarat (contd..)**

Models	50%	60%	70%	80%
<b>Model 1 (B1)</b>				
NPV	1,849.70	1,083.26	638.43	367.59
GBCR	3.72	2.99	2.39	1.93
FIRR	.. .. .	.. .. (112.26)	.. .. .	.. .. .
<b>Model 2 (B2)</b>				
NPV	1,072.63	558.46	276.19	112.52
GBCR	2.78	2.13	1.65	1.30
FIRR	.. .. .	.. .. ( 91.88)	.. .. .	.. .. .
<b>Model 3 (B3)</b>				
NPV	935.58	439.95	175.40	27.55
GBCR	2.59	1.91	1.42	1.07
FIRR	.. .. .	.. .. ( 82.35)	.. .. .	.. .. .
<b>Model 4 (B4)</b>				
NPV	1,275.69	713.57	389.78	194.48
GBCR	3.05	2.40	1.90	1.51
FIRR	.. .. .	.. .. ( 99.22)	.. .. .	.. .. .
<b>Model 5 (B5)</b>				
NPV	692.69	319.96	118.09	3.18
GBCR	2.23	1.68	1.29	1.00
FIRR	.. .. .	.. .. ( 80.37)	.. .. .	.. .. .
<b>Model 6 (B6)</b>				
NPV	590.00	231.12	42.53	-60.52
GBCR	2.07	1.50	1.10	0.82
FIRR	.. .. .	.. .. ( 73.45)	.. .. .	.. .. .
<b>Model 7 (B7)</b>				
NPV	4,685.54	637.07	-1,472.43	-
GBCR	1.56	1.08	0.77	-
FIRR	.. .. .	.. .. ( 62.41)	.. .. .	.. .. .

**Table 6: Results of Benefit-Cost Analysis for Different Bamboo Management Models (B1 to B7), Soliya, Gujarat (contd..)**

Models	90%	100%	110%	120%
<b>Model 1 (B1)</b>				
NPV	196.69	85.95	12.81	-36.14
GBCR	1.56	1.27	1.04	0.86
FIRR	.. . . . . (112.26) .. . . . .			
<b>Model 2 (B2)</b>				
NPV	13.82	-47.30	-	-
GBCR	1.04	0.84	-	-
FIRR	.. . . . . ( 91.88) .. . . . .			
<b>Model 3 (B3)</b>				
NPV	-57.50	-	-	-
GBCR	0.82	-	-	-
FIRR	.. . . . . ( 82.35) .. . . . .			
<b>Model 4 (B4)</b>				
NPV	72.74	-4.90	-	-
GBCR	1.21	0.98	-	-
FIRR	.. . . . . ( 99.22) .. . . . .			
<b>Model 5 (B5)</b>				
NPV	-64.40	-	-	-
GBCR	0.80	-	-	-
FIRR	.. . . . . ( 80.37) .. . . . .			
<b>Model 6 (B6)</b>				
NPV	-	-	-	-
GBCR	-	-	-	-
FIRR	.. . . . . ( 73.45) .. . . . .			
<b>Model 7 (B7)</b>				
NPV	-	-	-	-
GBCR	-	-	-	-
FIRR	.. . . . . ( 62.41) .. . . . .			

Source: Estimation

**Table 7: Results of Benefit-Cost Analysis for Different Teak Management Models (T1 to T4), Soliya, Gujarat**

Models	10%	20%	30%	40%
<b>Model 1 (T1)</b>				
NPV (Rs./ha.)	1,01,806.40	17,079.79	3,320.216	-429.558
GBCR	9.19	3.70	1.71	0.89
FIRR (%)	.. . . . .	(38.12)	.. . . . .	.. . . . .
<b>Model 2 (T2)</b>				
NPV (Rs./ha.)	94,312.47	15,269.55	3,023.999	-479.454
GBCR	8.88	3.45	1.65	0.88
FIRR (%)	.. . . . .	(38.86)	.. . . . .	.. . . . .
<b>Model 3 (T3)</b>				
NPV (Rs./ha.)	86,137.40	15,021.06	3,206.979	-399.965
GBCR	8.44	3.41	1.69	0.90
FIRR (%)	.. . . . .	(38.23)	.. . . . .	.. . . . .
<b>Model 4 (T4)</b>				
NPV (Rs./ha.)	90,505.20	16,836.69	3,815.119	-182.489
GBCR	8.56	3.64	1.81	0.95
FIRR (%)	.. . . . .	(39.24)	.. . . . .	.. . . . .

Source: Estimation

Table 8: Results of Benefit-Cost Analysis for Different Teak-Bamboo Combination Management Models, Scliya, Gujarat

Combination Models	10%	20%	30%	40%	50%	60%
<b>Model 1 (C1)</b> (B1 + T1)						
NPV (Rs./ha.)	55,156.79	12,042.03	3,784.014	1,133.488	45.30856	-451.635
GBCR	8.82	4.52	2.58	1.59	1.03	0.69
FIRR (%)	..... (50.66) .....					
<b>Model 2 (C2)</b> (B1 + T2)						
NPV (Rs./ha.)	52,159.180	11,317.93	3,665.527	1,113.529	41.64038	-452.377
GBCR	8.59	4.35	2.54	1.58	1.03	0.69
FIRR (%)	..... (50.61) .....					
<b>Model 3 (C3)</b> (B1 + T3)						
NPV (Rs./ha.)	48,889.12	11,218.52	3,738.714	1,145.322	52.28725	-448.940
GBCR	8.28	4.32	2.56	1.60	1.03	0.69
FIRR (%)	..... (50.75) .....					
<b>Model 4 (C4)</b> (B1 + T4)						
NPV (Rs./ha.)	50,634.28	11,944.63	3,981.957	1,232.311	85.27334	-435.786
GBCR	8.37	4.47	2.65	1.64	1.05	0.70
FIRR (%)	..... (51.20) .....					
<b>Model 5 (C5)</b> (B2 + T1)						
NPV (Rs./ha.)	53,311.97	10,870.66	3,048.77	661.52	-265.635	-
GBCR	8.77	4.29	2.31	1.35	0.83	-
FIRR (%)	..... ( 80.37) .....					
<b>Model 6 (C6)</b> (B2 + T2)						
NPV (Rs./ha.)	50,314.37	10,146.56	2,930.28	641.560	-265.635	-
GBCR	8.53	4.11	2.26	1.34	0.83	-
FIRR (%)	..... (46.15) .....					
<b>Model 7 (C7)</b> (B2 + T3)						
NPV (Rs./ha.)	46,938.65	10,043.35	3,003.18	673.32	-258.66	-
GBCR	8.15	4.07	2.29	1.35	0.83	-
FIRR (%)	..... (46.27) .....					
<b>Model 8 (C8)</b> (B2 + T4)						
NPV (Rs./ha.)	47,702.48	10,661.73	3,232.17	758.10	-226.06	-
GBCR	8.15	4.21	2.38	1.40	0.85	-
FIRR (%)	..... (46.83) .....					
<b>Model 9 (C9)</b> (B2 + T2)						
NPV (Rs./ha.)	37,743.00	7,615.48	2,202.08	484.67	-199.13	-
GBCR	8.54	4.11	2.27	1.34	0.83	-
FIRR (%)	..... (46.12) .....					

Source: Estimation



Table 9: A Comparison of GBCRs and NPVs at 30% Discount Rate across the Four Sharing Formulas, Selected Bamboo and Teak Management Models, Soliya.

Management Models	Sharing Option (Villagers' Share)			
	25%	50%	75%	100%
<b>Bamboo</b>				
1. Model B1				
NPV (Rs./ha)	552.00	2411.79	4271.58	6137.37
GBCRs	1.42	2.84	4.27	5.68
2. Model B2				
NPV (Rs./ha.)	231.49	1586.20	2940.91	4296.94
GBCRs	1.21	2.41	3.62	4.83
3. Model B3				
NPV (Rs./ha.)	203.39	1513.90	2824.41	4134.91
GBCRs	1.19	2.37	3.55	4.73
4. Model B7				
NPV (Rs./ha.)	-2179.79	8871.58	19922.94	30974.30
GBCRs	0.84	1.67	2.51	3.34
<b>Teak</b>				
5. Model T1				
NPV (Rs./ha.)	-ve	-673.92	1323.14	3320.22
GBCR	<1	0.85	1.28	1.71
6. Model T2				
NPV (Rs./ha.)	-ve	-814.38	1104.80	3024.00
GBCR	<1	0.82	1.23	1.65
7. Model T3				
NPV (Rs./ha.)	-ve	-729.72	1238.62	3206.98
GBCR	<1	0.84	1.26	1.69
8. Model T4				
NPV (Rs./ha.)	-ve	-448.62	1683.24	3815.12
GBCR	<1	0.90	1.35	1.81

Source: Estimation

Table 10: A Comparison of GBCRs and NPVs to Villagers at 30% Discount Rate under Different Sharing Options, Combination Management Models of Teak Plus Bamboo

Management Models	Sharing Options (Villagers Share)			
	25%	50%	75%	100%
1. <u>Combination 1</u> <u>(B1 + T1)</u>				
NPV (Rs./ha.)	-847.38	696.41	2240.21	3784.01
GBCRs	0.64	1.29	1.93	2.58
2. <u>Combination 2</u> <u>(B1 + T2)</u>				
NPV (Rs./ha.)	-878.53	634.10	2152.88	3665.52
GBCRs	0.63	1.26	1.90	2.54
3. <u>Combination 3</u> <u>(B1 + T3)</u>				
NPV (Rs./ha.)	-858.22	674.26	2206.40	3738.71
GBCRs	0.64	1.28	1.92	2.56
4. <u>Combination 4</u> <u>(B1 + T4)</u>				
NPV (Rs./ha.)	-811.19	786.52	2384.29	3981.95
GBCRs	0.66	1.32	1.98	2.65
5. <u>Combination 5</u> <u>(B2 + T1)</u>				
NPV (Rs./ha.)	-995.67	365.80	1707.28	3048.77
GBCRs	0.57	1.15	1.73	2.31
6. <u>Combination 6</u> <u>(B2 + T2)</u>				
NPV (Rs./ha.)	-1000.70	309.62	1619.95	2930.28
GBCRs	0.56	1.13	1.70	2.26
7. <u>Combination 7</u> <u>(B2 + T3)</u>				
NPV (Rs./ha.)	-986.78	343.20	1673.19	3003.18
GBCRs	0.57	1.14	1.72	2.29
8. <u>Combination 8</u> <u>(B2 + T4)</u>				
NPV (Rs./ha.)	-943.05	448.67	1840.43	3232.17
GBCRs	0.59	1.19	1.78	2.38
9. <u>Combination 9</u> <u>(B2 + T2) 30%</u>				
NPV (Rs./ha.)	-746.15	236.59	1219.33	2202.08
GBCRs	0.56	1.13	1.70	2.27

Source: Estimation

Table 11: A Comparison of FIRR's under Four Sharing Formulas, for Different Management Models, Soliya, Gujarat

Management Models	25%	50%	75%	100%
<b>Bamboo</b>				
B1	46.79	78.39	97.74	112.26
B2	36.88	62.55	79.08	91.88
B3	35.78	58.60	72.39	82.35
B4	38.75	67.88	85.78	99.22
B5	30.56	53.84	68.79	80.37
B6	29.87	50.94	63.88	73.45
B7	25.32	43.38	54.32	62.41
<b>Teak</b>				
T1	19.11	27.82	33.67	38.12
T2	18.29	27.20	33.26	37.84
T3	17.98	27.46	33.64	38.23
T4	18.78	28.51	34.69	39.24
<b>Combination</b>				
C1	22.04	35.13	43.93	50.66
C2	21.28	34.88	43.84	50.61
C3	21.39	35.15	44.03	50.75
C4	22.05	35.79	45.56	51.20
C5	21.07	32.62	40.30	46.15
C6	20.44	32.32	40.15	46.06
C7	20.31	32.57	40.40	46.27
C8	20.88	33.25	41.01	46.83
C9	20.47	32.36	40.20	46.12

Source: Estimation

## NOTES

1. This is specially true in the province of Gujarat where this study was conducted.
2. Based on discussion with forest officials, Forest Department, Baroda, Gujarat.
3. On probing with villagers and local Forest Guards, it was found that one person can steal on the average 10-15 green or 20-25 dry bamboos sticks or 2-3 teak poles at a time.
4. Farm wage is Rs.10 per day plus the lunch.
5. For example, in 1986, wage rate paid by the AKRSP was Rs.14.20 per manday; it was revised upward to Rs.17.20 in 1989 and Rs.32.15 in 1993.
6. For example, before 1986, there existed a Dairy Cooperative Society which took lots of time in sanctioning and disbursement of loan and as a result it ceased to exist in the long run.
7. Detailed assumptions of each scenario are given in Tewari (1994) and are not produced here for conservation of space.
8. In a rural environment, where uncertainty abounds with respect to yield and institutional responses, a 30% discount rate seems justified; as commercial banks are already charging 16 to 21% to their customers.
9. For example, the AKRSP initiated discussion on the sharing arrangement with the Forest Department in 1990, after the Government of India circular. The GVM of Soliya submitted an application on January 1991 to the Forest Department seeking permission to harvest first bamboo crop. However, the Forest Department took almost one and half year to grant the permission.
10. Lately they have revised the sharing norm in the 50:50 ratio.

