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Tree plantations for restoration of degraded lands and greening of India: a case study of tree growers' cooperatives

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Abstract

India has over 100 m ha (million hectares) of village common lands. *De jure*, these lands are owned by the state but, *de facto*, they are used in common by villagers. Most of the village commons are degraded and denuded and are almost non-productive. Several attempts have been made in the recent past to restore them through planting of trees by governmental and non-governmental organizations. Tree Growers' Co-operative Societies (TGCS), as an organisational innovation of relatively recent origin, have proved to be more cost-effective than other forms of organisations engaged in greening the village commons in India. This paper attempts to assess the financial viability of tree plantations carried out by three selected TGCS and to distil lessons of their experience useful for policy purposes. The study revealed that plantations founded by the sample TGCS were financially viable, and that the plantations had transformed the desolate village commons into 'green wealth'. The authors conclude that the TGCS have a high potential as an instrument for promoting the afforestation of India's degraded village common lands and thereby improving village economy and the quality of the environment. © 2001 United Nations. Published by Elsevier Science Ltd. All rights reserved.

Keywords: Benefit-cost analysis; Common pool resources; Financial viability; Greening of village commons; Sustainability; Tree growers' co-operative societies

1. Introduction

India has over 100 m ha of village common lands, or village commons. *De jure*, the revenue departments and the forest departments of state governments own these lands but, *de facto*, they are used in common by villagers, and hence they are common pool resources (CPRs). Being CPRs, these lands are prone to over-grazing, erosion by water and wind, and encroachment by villagers. In fact, most of the village commons in India are degraded and denuded and are almost non-productive. India, being a poor country, can hardly afford to continue to have such a vast chunk of its land resources lying unproductive. Duly recognising the need for restoration of village commons and putting them to productive uses, the Government of India, the state governments, national and international donors, non-governmental organisations (NGOs), and tree growers' co-operative societies (TGCS) have, over the last two decades or so, attempted to rehabilitate the degraded village commons and private lands through tree plantations all over India. In fact, an investment of 64,900 m

Indian Rupees (Rs)¹ had been made in tree plantations, and 18.9 m ha of land had been planted under various social forestry projects from 1974–1994 in India (Indian Council of Forestry Research and Education (ICFRE), 1995). However, the lack of financial resources is one of the main limiting factors in greening the village commons in India (Vohra, 1989; Kapoor, 1992; Kadekodi, 1995; National Wastelands Development Board (NWDB), 1995).

The existence of an appropriate institutional and organisational set up, the availability of production inputs, managerial and technical know-how, marketing facilities and funds play a crucial role in ensuring the success of the tree planting efforts on village commons. Several types of organisations are currently engaged in afforestation of village commons in India. Of them, the TGCS is an organisational innovation of relatively recent origin that seems to hold great potential for replication all over the country. TGCSs provide production inputs and technical

¹ 1 US\$ = Rs 31.4 in 1994–95.

know-how to their members, and help them in marketing the resulting produce. However, they are constrained by the inadequate availability of institutional finance for plantation purposes. The budgetary allocations of the government and bank credit are not sufficient to meet the need. In a study undertaken by Balooni and Singh (1994), it was found that the disbursements of credit by the National Bank for Agriculture and Rural Development (NABARD)² to the forestry sector from 1985–1990, amounted to only Rs 661.3 m. This was only 2.7% of the government's contribution to afforestation of wastelands during the same period (ICFRE, 1995). Given the paucity of funds available for greening of village commons and in view of the possibility of replication of the TGCS model in the country, it became imperative to determine the financial feasibility of the model. Moreover, such a study would also help in exploring the possibility of financing the plantation projects through institutional credit.

Most of the studies of financial feasibility of tree plantations are confined to the farm forestry plantations carried out by tree growers on their own private lands,³ and plantations on village commons⁴ carried out by the various governmental agencies and non-governmental organisations (NGOs). However, not many studies⁵ have been carried out to find out the financial feasibility of plantations established on village commons by the TGCS. This may be partly because the TGCS are a recent development.⁶ This paper attempts to assess the financial viability of tree plantations carried out by three selected TGCS in Kheda district of Gujarat state in India and distills lessons of their experience useful for policy purposes.

Given this context, an attempt has been made in this paper to determine the financial feasibility of tree plantations as an instrument of restoring degraded village commons and thereby improving the quality of the environment. The major limitation of the present study is that, because of the paucity of data, the financial analysis is based on a set of assumptions.

² NABARD is an important development bank in India. It was set up in 1982 to support and promote agriculture and rural development. It provides several lines of production and investment credit to agriculture, small-scale industries, handicrafts and other allied economic activities through the banking institutions and financial system in India.

³ For example, Gupta and Deepinder (1982); Jain (1988); Singh (1988); Aziz (1995); Sharma et al. (1995); Balooni and Singh (1999).

⁴ For example, Puri and Khybri (1975); Tewari and Singh (1984); Nadkarni et al. (1992); Singh and Bhattacharjee (1995).

⁵ While, there may have been more such studies on TGCS, the authors have come across only two studies conducted by Mishra (1993) and Saxena (1996) on financial feasibility of TGCS during the course of the literature review.

⁶ According to Saxena (1996), various models of TGCS such as the Anand model promoted by National Tree Growers' Co-operative Federation, and the IFFCO model promoted by the Indian Farmers' Fertilizers Co-operative exist in India today, and all of them originated during the 1980s.

2. The research process

Three tree growers' co-operative societies (TGCS), namely, those in Vatra, Sarnal and Navagambara Villages, in Kheda District of Gujarat State located in western India were selected for this study. These three TGCSs were among the first established in Gujarat as well as in five other states of India under the auspices of the National Tree Growers' Co-operative Federation (NTGCF).⁷ The authors used the case study method of research, with primary data collected through direct personal and group interviews with selected members and officials of the sample TGCS, and secondary data compiled from TGCS and NTGCF official records.

To determine the financial feasibility of plantations on village commons, the project evaluation techniques of net present value (NPV), benefit cost ratio (BCR) and financial internal rate of return (FIRR) were used (for details of these techniques, see Gittinger, 1982; Chandra, 1993). The financial feasibility analysis for the sample TGCS was carried out for a period of 16 years, 1987–88⁸ to 2002–03.

A profile of TGCS and village plantations is presented in Table 1. Before the tree plantations were put up by the TGCS, the village commons were highly degraded and suffered from what Garrett Hardin called 'the tragedy of commons' (Hardin, 1968).

3. Major findings and discussion

As the data on cash flows were available only for the first five years of plantation (1987–88 to 1991–92), the following assumptions were made to determine the financial viability of the selected co-operative societies:

1. Two tree rotations of eight years each were assumed for the plantations, Rotation I at the end of 1994–95 and Rotation II at the end of 2002–03; the underlying reason was that the majority of trees surviving after five years of plantation in the sample TGCS belonged to the species *Prosopis juliflora* (see Table 1 for details) which has a short rotation.
2. Only 10% of the trees would be harvested (in a sustainable manner) after completion of Rotation I and after Rotation II. The management system assumed here is a

⁷ The NTGCF was established in 1988 under the auspices of the National Dairy Development Board (NDDB) of India. However as part of the pilot project of NDDB, the formation of TGCS for rehabilitation of degraded Village commons started in August 1986. By the end of year 1999, NTGCF had organized TGCS and supported village institutions in 633 villages involving 49,618 members and had afforested 10,910 ha of village commons. For details about the governance structure and functioning of TGCS, and achievements of NTGCF in the formation of TGCS in India, refer to Singh and Balooni (1997) and the NTGCF website: www.ntgcf.org.

⁸ The fiscal year used by the TGCS runs from 1 April to 31 March of the following year (e.g., 1 April 1987 to 31 March 1988).

Table 1
A profile of the sampled tree growers' co-operative societies (TGCS) used in this study^a

	Vatra	Sarnal	Navagambara
Formation of TGCS	April 1987	March 1987	November 1987
Registration as a TGCS	August 1987	July 1987	January 1988
Number of households in the village	566	300	95
Membership of TGCS:			
— Landless	311	188	80
— Marginal farmers	190	—	20
— Small farmers	59	—	—
— Large farmers	—	32	—
Total	560 ^b	220 ^b	100 ^b
Area under plantation (in hectares)	40 ^c	35	80 ^d
Status of land before plantation	Barren with small ravines. Sandy loam soil. Overgrazed by cattle	Barren, ravinous with highly eroded gullies with scant vegetation. Sandy to sandy loam soil. Overgrazed by cattle	Highly saline land without vegetation. Land affected by sea winds and tidal water. No grazing or any other use
Number of trees planted	121,475	80,510	205,544
Number of surviving trees as of October, 1993 (survival %)	108,106 (89%)	64,270 (80%)	96,018 (47%)
Surviving tree species ^e (with more than 100 trees; arranged in descending order)	<i>Prosopis juliflora</i> ^f (around 70%), <i>Acacia nilotica</i> , <i>Azadirachta indica</i> , <i>Zizyphus jujuba</i> , <i>Prosopis cineraria</i> , <i>Salvadora persica</i> , <i>Balanitis aegyptica</i> , <i>Leucaena leucocephala</i> , <i>Dendrocalamus strictus</i> , <i>Dalbergia sissoo</i> , <i>Dichrostachys</i> sp., <i>Pongamia pinnata</i> , <i>Comifera whittii</i> , <i>Cassia siamea</i>	<i>Prosopis juliflora</i> (around 40%), <i>Acacia nilotica</i> , <i>Azadirachta indica</i> , <i>Acacia senegal</i> , <i>Dalbergia sissoo</i> , <i>Pongamia pinnata</i> , <i>Prosopis cineraria</i> , <i>Cassia siamea</i> , <i>Dendrocalamus strictus</i> , <i>Ailanthus excelsa</i> , <i>Leucaena leucocephala</i> , <i>Dichrostachys</i> sp., <i>Parkinsonia</i> sp.	<i>Prosopis juliflora</i> (around 90%), <i>Acacia nilotica</i>
Number of nurseries raised to meet the requirement of saplings for plantation	68	66	55

^a Source NTGCF, Anand.

^b In Vatra and Sarnal villages, the number of TGCS members (including members belonging to the same household) was less than the total number of households TGCS as all of them were not members of the TGCS in the initial years. In Navagambara Village, some households have more than one TGCS member. Realizing that village commons cannot be effectively managed by a membership based organisation, now NTGCF encourages the TGCS to enroll all adults in the village as members, i.e. universal membership.

^c Includes 2 hectares of land kept aside for growing fodder.

^d The effective plantation carried out by the Navagambara TGCS was 60 ha, as 20 ha of the planted area was submerged during the monsoons, resulting in high mortality of the saplings.

^e There were few trees (less than 100) belonging to other species (Vatra TGCS—11; Sarnal TGCS—15; Navagambara TGCS—1) that survived after initial years of plantation.

^f Coppice vigorously, i.e. the new crop originates mainly from coppice shoots arising from the adventitious buds on the stumps of the felled trees.

- modified version of the conversion to a selection system or the coppice with standards system, with a certain proportion of the trees being harvested at each rotation.
3. The future stream of tangible benefits from the planted areas of the co-operative societies was based on the number of surviving trees and the composition of tree species (see Table 1 for details).
4. The land cleared after the first harvest would be replanted. However, after the second harvest, no re-planting would be done, assuming that the new crop will originate from stool coppice (coppice system) and that regeneration from seed (high forest system) will take place.
5. No substantial land development activities would be taken up after completion of five years of plantation, assuming that over time the plantation will have a good forest canopy, which would promote soil and water conservation. This assumption along with previous assumptions conveys that the cash outflow will be different for Rotation II (see Tables 2–4).
6. All cost estimates, except harvesting cost incurred on the plantation after the year 1991–92 were based on the averages of actual costs incurred in the first five years.
7. Harvesting cost was based on a case study of farm forestry in the village of Shankerpura in the Panchmahals District in Gujarat (Balooni and Singh, 1999).

Cash flows of Vata Tree Growers' Co-operative Society during the period under analysis^a (constant Rs)^b

Year	1987-88	1988-	1989-	1990-	1991-	1992-	1993-	1994-95 ^c	1995-	1996-	1997-	1998-	1999-	2000-	2001-	2002-03 ^d
Cash outflow																
Land development ^e	74,889	39,038	7705	17,895	12,128	10,848	7583	8407	9052	9628	10,093	10,790	11,188	11,748	12,394	13,138
Plantation and after care	10,516	12,962	83,511	29,525	47,602	8263	5523	51,028	6593	7012	7351	7859	8149	8556	9027	79,746
Salary of TGCS staff	4875	5400	6185	6305	6810	1,710	5915	6557	7061	7510	7873	8417	8727	9164	9668	10,248
Equipment records and rent	2750	1,391	622	1,218	3020	900	975	1,081	1,164	1,238	1,298	1,387	1,439	1,511	1,594	1,689
Harvesting operations	500	2149	2308	3817	4341	9556	10,354	179,759	14,325	15,236	15,972	17,075	177,076	18,591	19,613	280,927
Total cash outflow	93,530	60,940	100,331	58,760	73,901	31,277	30,350	246,832	38,195	40,624	42,587	45,528	47,209	49,570	52,296	385,748
Cash inflow																
Fodder	2562	1,014	2134	4705	8233	8000	8668	9609	10,347	11,005	11,537	12,334	12,789	13,429	14,167	15,017
Fuelwood	0	0	10,874 ^f	10,874 ^f	10,874 ^f	13,000	14,086	599,198	16,815	17,884	18,748	20,044	20,783	21,823	23,023	936,424
Timber	0	0	0	0	0	18,000	19,503	4,793,586	23,282	24,762	25,958	27,752	28,776	30,215	31,877	7,491,389
Non-timber forest produce	0	0	0	0	6747	9000	9752	10,811	11,641	12,382	12,980	13,877	14,389	15,108	15,939	16,895
Total cash inflow	2562	1,014	13,008	15,579	25,854	48,000	52,009	5,413,204	62,085	66,033	69,223	74,007	76,737	80,575	85,006	8,459,725
Net cash inflow	-90,968	-59,926	-87,323	-43,181	-48,047	16,723	21,569	5,166,372	23,890	25,409	26,636	28,479	29,528	31,005	32,710	8,073,977

^a Source Vatra TGCS: Actual cash flows: 1987-88 to 1991-92 except cost of harvesting operations, projected cash flows: 1992-93 to 2002-03.

^b US\$1.00 = Rs 13 in 1987-88 average.

^c Cash flow at the end of Rotation I.

^d Cash flow at the end of Rotation II.

^e Includes soil and water conservation.

^f Rs 32,623 divided equally amongst 3 years as disaggregated data were not available.

Table 3

Cash flows of Sarnal Tree Growers' Co-operative Society during the period of analysis^a (constant Rs)^b

Year	1987-88	1988-	1989-	1990-	1991-	1992-	1993-	1994-95 ^c	1995-	1996-	1997-	1998-	1999-	2000-	2001-	2002-03 ^d
Cash outflow																
Land development ^e	56,677	58,317	11,371	11,624	5703	4785	7185	7965	8577	9123	9563	10,224	10,601	11,131	11,744	12,448
Plantation and after care	6268	13,872	40,936	7186	2168	285	4226	19,519	5045	5366	5625	6013	6235	6547	6907	30,504
Salary of TGCS staff	4350	7000	7450	6480	6810	2200	6418	7115	7661	8149	8542	9133	9470	9943	10,490	11,119
Equipment records and rent	1931	1897	1696	1499	2083	910	986	1093	1177	1252	1312	1403	1455	1528	1612	1708
Harvesting operations	0	537	577	2545	2894	3185	6400	106,875	7640	8126	8518	9107	9443	9915	10,460	167,023
Total cash outflow	69,226	8123	62,030	29,334	19,658	11,365	25,215	142,567	30,100	32,016	33,560	35,880	37,204	39,064	41,213	222,802
Cash inflow																
Fodder	0	985	3818	1665	1182	2000	5000	5543	5969	6348	6655	7115	7377	7746	8172	8663
Fuelwood	0	0	0	0	264	500	10,000	356,249	11,937	12,697	13,310	14,230	14,755	15,492	1634	556,743
Timber	0	0	0	0	0	0	15,000	2,849,989	17,906	19,045	19,965	21,344	22,132	23,239	24,517	4,453,946
Non-timber forest produce	0	0	0	2169	2548	4000	6000	6652	7162	7618	7986	8538	8853	9295	9807	10,395
Total cash inflow	0	985	3818	3834	3994	6500	36,000	3,218,433	42,974	45,708	47,916	51,227	53,117	55,772	58,840	2,903,150
Net cash inflow	-69,226	-80,638	-58,212	-25,500	-15,664	-4865	10,785	3,075,866	12,874	13,692	14,356	15,347	15,913	16,708	17,627	2,680,348

^a Source Sarnal TGCS: Actual cash flows 1987-88 to 1991-92 except cost of harvesting operations, projected cash flows: 1992-93 to 2002-03.

^b US\$1.00 = Rs 13 in 1987-88 average.

^c Cash flow at the end of Rotation I.

^d Cash flow at the end of Rotation II.

^e Includes soil and water conservation.

The estimates of indicators of financial viability of the tree plantations arrived at using the above-mentioned assumptions are rather conservative. The actual benefits must have been much greater than those estimated here, as no intangible benefits were considered. The financial analysis was done for two periods, 1987-88 to 1994-95 (after Rotation I) and 1987-88 to 2002-03 (after Rotation II).

3.1. Cash outflow, cash inflow and net cash inflow

The year-by-year and item-by-item actual (1987-88 to 1991-92) and expected (1992-93 to 2002-03) cash outflow, cash inflow and net cash inflow in real terms,

i.e. in constant Rs accruing from the plantations of the sample TGCS, are presented in Tables 2-4.

As the inflation rate per annum varied over the period under analysis (see Table 5), for the purpose of financial analysis, all cash flows were first expressed in real terms and then discounted with real interest rates per annum prevailing during the period, 1988-89 to 2002-03, i.e. all the cash flows were expressed at the common 1987-88 prices (at current prices). The cash flows accruing during the year, 1987-88, were not discounted as it was zero year for the purpose of the financial analysis. Two different sets of interest rates were used for discounting the cash flows. Table 5 describes in detail the methodology used for computing two sets of interest rates.

Table 4
Cash flows of Navagambara Tree Growers' Co-operative Society during the period under analysis^a (constant Rs)^b

Year	1987–88	1988–	1989–	1990–	1991–	1992–	1993–	1994–95 ^c	1995–	1996–	1997–	1998–	1999–	2000–	2001–	2002–03 ^d
Cash outflow																
Land development ^e	0	51,387	53,202	3508	1173	19,739	9927	11,005	11,850	12,604	13,213	14,126	14,647	15,379	16,225	17,199
Plantation and after care	350	19,964	112,464	56,014	57,235	6381	7997	68,186	8811	9371	9824	10,503	10,890	11,435	12,064	106,560
Salary of TGCS staff	0	3835	5675	5700	6415	4240	4325	4795	5163	5491	5757	6154	6381	6700	7069	7493
Equipment records	414	5077	1298	249	327	735	796	815	877	933	978	1046	1084	1139	1201	1273
Harvesting operations	0	0	115	127	0	6250	6772	159,655	7162	7618	7986	8538	8853	9295	9807	249,508
Total cash outflow	764	80,263	172,754	65,598	65,150	38,345	29,817	244,456	33,863	36,017	37,758	40,367	41,855	43,948	46,366	382,033
Cash inflow																
Fodder	0	0	960	1800	0	3500	3792	3800	4178	4444	4658	4980	5164	5422	5721	6064
Fuelwood	0	0	0	0	0	11,000	11,919	532,183	13,131	13,966	14,641	15,653	16,230	17,042	17,979	831,693
Timber	0	0	0	0	0	17,000	18,420	4,257,467	20,294	21,584	22,627	24,190	25,083	26,337	27,786	6,653,545
Non-timber forest produce	0	0	0	0	0	4000	4334	4434	4775	5079	5324	5692	5902	6197	6538	6930
Total cash inflow	0	0	960	1800	0	35,500	38,465	4,797,884	42,378	45,073	47,250	50,515	52,379	54,948	58,024	7,498,232
Net cash inflow	-764	-80,263	-171,794	-63,798	-65,150	-2845	8648	4,553,428	8515	9056	9492	10,148	10,524	11,050	11,658	7,116,199

^a Source Navagambara TGCS: Actual cash flows: 1987–88 to 1991–92 except cost of harvesting operations, estimated cash flows: 1992–93 to 2002–03.

^b US\$1.00 = Rs 13 in 1987–88 average.

^c Cash flow at the end of Rotation I.

^d Cash flow at the end of Rotation II.

^e Includes soil and water conservation.

In Table 5, the interest rate per annum on long-term loans (of more than three years duration and in amounts greater than Rs 0.2 m) for forestry and wasteland development projects is the interest rate actually charged from the ultimate borrowers, i.e. the users. These long-term loans are offered by scheduled commercial banks, regional rural banks, state co-operative banks and state land development banks in India, which in turn are refinanced by NABARD (see also footnote 2).

The following sections (3.2 and 3.3) briefly describe actual costs incurred and benefits accrued from the plantations and discuss some of the associated management issues.

3.2. Cost of plantations

Table 6 shows the item-by-item breakdown of all expenditures incurred on the co-operative plantations undertaken by the TGCSs during the first five years. The National Tree Growers' Co-operative Federation (NTGCF) provided, on average, a grant of Rs 0.26 m to each co-operative society for planting about 40 ha of degraded land (NTGCF, 1997). NDDDB funded the sample TGCS as a part of a pilot project implemented from 1986 to 1991. Afterwards NTGCF received considerable financial assistance from international donor agencies⁹ to form TGCSs to rehabilitate degraded village commons.

The overhead expenses of NTGCF in providing extension services, such as the formation of TGCS, provision of technical expertise for plantations, and maintenance of accounts

⁹ As of March 1997, the NTGCF had received a total of Rs 400 m from the Canadian International Development Agency (CIDA) since 1993, and Rs 245 m from the Swedish International Development Authority (now the Swedish International Development Cooperation Agency) (SIDA) since 1991 for the formation of TGCS (NTGCF, 1997).

was not included in the present analysis, as NTGCF did not keep records of these expenses. NTGCF considered these costs as a part of the work of their staff in providing support to the TGCSs, which is included in the NTGCF's accounts. All the plantation-related activities were carried out under the supervision of management committees (MC)¹⁰ of the TGCS concerned.

On the whole, more than 80% of the expenditure was incurred on land development, soil and water conservation work, establishment of plantations and after-care operations (Table 6). The expenditure incurred on the salary of the TGCS staff¹¹ varied across the three TGCS. Its proportion was highest in Sarnal TGCS, being 12.6% of the total expenditure (Table 6). This was due to the higher number of watchmen employed by the MC for protecting the planted area. The high policing cost was mainly due to lack of participation by households in TGCS activities in the initial years. However, policing costs gradually decreased as the inconsistency between the number of TGCS members and households in the village (Table 1, footnote b) decreased.

The expenditure pattern of plantations in these co-operative societies suggests that more emphasis was given to providing employment opportunities to the villagers. The overall proportion of the labour cost (including expenditure on land development and soil and water conservation) and salary of TGCS staff was found to be 85% of the total expenditure in these

¹⁰ The MC, headed by a chairperson, is responsible for implementing the policies determined by the general body of the TGCS comprising all its members. It looks into the overall administration and management of the society.

¹¹ The staff employed by each TGCS included a secretary, appointed by the MC, to look after the day-to-day affairs of the society and two or more watchmen employed for protecting the planted area.

Table 5

Interest rates during the period under analysis used for discounting cash flows for the financial analysis of plantations (% p.a.)

Year	(Nominal) Interest rates on			(Real) Interest rates (used for discounting cash flows) based on	
	Long-term loans for wasteland development projects ^a	Central Government dated securities ^b	Inflation rate ^c	Long-term loans for wasteland development projects 5 = 2 - 4	Central Government dated securities 6 = 3 - 4
1	2	3	4		
1987-88	10.0	11.25	8.21	1.79	3.04
1988-89	10.0	11.40	7.45	2.55	3.95
1989-90	10.0	11.49	7.39	2.61	4.10
1990-91	16.0	11.41	10.26	5.74	1.15
1991-92	15.0	11.78	13.74	1.26	-1.96
1992-93	15.0	12.46	10.06	4.94	2.40
1993-94	14.0	12.63	8.35	5.65	4.28
1994-95	14.0	11.91	10.86	3.14	1.05
1995-96	13.5	13.75	7.68	5.82	6.07
1996-97	13.0	13.69	6.36	6.64	7.33
1997-98	12.0	12.01	4.83	7.17	7.18
1998-99	11.5	11.86	6.91	4.59	4.95
1999-2000	11.0	9.82	3.69	7.31	6.13
2000-01	10.5	9.13	6.40	4.10	2.73
2001-02	10.5 ^d	10.09	6.00 ^d	4.50	4.09
2002-03	10.5 ^d	10.20	6.00 ^d	4.50	4.20
Average ^e	12.3	11.6	7.7	4.7	3.8

^a From 1995-96 onwards, interest rates have become unstructured and flexible. Figures from 1995-96 represent the refinance rate charged by NABARD from the financial institutions on such loans. Source: (a) Reserve Bank of India: Report on Currency and Finance, various years (b) NABARD: Annual Report, various years.

^b Interest rates (weighted average) on dated securities of Central Government, India (Source: Economic and Political Weekly April 8, 2000, p.1324). For the years 1999-2000 to 2002-03, the figures are based on secondary market outright transaction (average of minimum and maximum) as on April 28, 2000 (Source: Reserve Bank of India: Bulletin, March 2000, S-252).

^c Inflation rates (average of weeks) based on index numbers of wholesale prices (1981-82 = 100) (Source: Economic Survey 1999-2000, Economic Division, Ministry of Finance, Government of India p. S-63). The figure is provisional (for the month of December) for the year 1999-2000, and weekly average (April 1- July 22, 2000) for the year 2000-01 based on index numbers of wholesale prices (1993-94 = 100).

^d Projected.

^e Average for the period 1988-89 to 2002-03 as 1987-88 was zero year for the purpose of financial analysis.

TGCS. Plantation cost varied across the three TGCSs, depending on the differences in topography, soil characteristics, and the extent of land degradation prior to plantation.

3.3. Benefits from plantations

Tree plantations produce a variety of tangible and non-tangible benefits, both to tree growers and to society at large. Below, we present two broad categories with the estimates of actual tangible benefits achieved from 1987-88 to 1991-92 in the tree plantations established by the sample TGCSs and distribution mechanism of these benefits amongst the members.

3.3.1. Income generation

All plantations had not yet begun to yield monetary benefits at the time of data collection as they were only five to six years old then. The trees had, however, attained considerable growth that could be harvested to meet the recurring costs of plantations and which yielded intermedi-

ate benefits to the TGCS members. Tables 2-4 show that benefits had already started to accrue in the form of fodder, fuelwood, and non-timber forest products (NTFPs). But in view of the extremely degraded condition of the land prior to plantations, and to prevent further deterioration, harvesting was not recommended by the technical staff of the National Tree Growers' Co-operative Federation (NTGCF). However, villagers were allowed to cut grass and collect fallen and dry twigs, branches lopped by pruning operations, babul pods (*Leucaena leucocephala*) and other NTFPs. All three TGCSs had harvested some or all of these benefits from their tree plantations. NTFPs were available to the TGCS members of Vatra and Sarnal villages in substantial quantities. But the Navagambara TGCS was not in a position to allow its members to harvest these benefits, as the land had been entirely barren prior to plantation due to its high salinity. Here, improvement in soil fertility took much longer; it was achieved through the addition of organic material from planted trees.

The Vatra Village TGCS obtained the most substantial benefits from fodder, as 2 ha of the village

Table 6

Expenditure^a incurred by the sample tree growers' co-operative societies on various plantation operations in the first five years (1987–88 to 1991–92) (constant Rs)^b

Expenditure head	TGCS		
	Vatra	Sarnal	Navagambara
Land development/soil and water conservation	151,655 (40.4) ^c	143,692 (56.2)	109,270 (28.5)
Plantation and after care	184,116 (49.2)	70,430 (27.6)	246,027 (64)
Equipment	5488 (1.5)	4406 (1.7)	6127 (1.6)
Salary of TGCS staff	29,575 (7.9)	32,090 (12.6)	21,625 (5.6)
Records (stationery)	2163 (0.6)	1950 (0.8)	1238 (0.3)
Rent of TGCS office	1350 (0.4)	2750 (1.1)	–
Total	374,347 ^d	255,318	384,287
Planted area (in hectares)	40	35	60
Average plantation cost per hectare	9359	7295	6405

^a Actual figures (Source NTGCF, Anand).

^b \$US1.00 = Rs 13 on average 1987–88.

^c Figures in parentheses are the percentage of the total of their respective columns.

^d Including expenditure incurred on raising 2 ha of land for fodder cultivation.

common had been allocated exclusively for cultivation of fodder crops.

3.3.2. Distribution mechanism

All tree products and other biomass accruing from the planted area were sold by the co-operative societies to villagers at nominal prices. However, after meeting the demand of their own village, surplus production was sold to neighbouring villages and/or to the NTGCF. For example, fodder and grasses growing naturally in the plantation area were sold to local people only. The Vatra TGCS collected fuelwood worth over Rs 32,000 from pruning operations during 1989–90 to 1991–92, of which Rs 9000 worth of fuelwood was sold to people in Vatra Village and Rs 23,700 worth to other villages. The NTGCF, acting as a middleman sold these products to other TGCSs, that were facing scarcity or were not growing those particular products.

In the case of certain products, value added processing was also undertaken by the NTGCF. For example, babul pods (used as supplementary cattle feed) were collected from the plantation areas at Vatra and Sarnal. The co-operative societies in these two villages sold babul pods to the NTGCF, which in turn crushed them into powder form and resold the product. TGCSs also buy tree products originating from farmers' fields.

From the above discussion, it is clear that the villagers appreciated the value of tree products, despite the fact that TGCS charged them only nominal prices for those products. The decision of TGCS to meet the needs for tree products of the villagers first was a step in the right direction of making the village self-sufficient and sustainable.

The by-laws of a typical TGCS stipulate the manner in which profits earned from the sale of fodder, timber and other tree products must be used. For example, 25% of the

profit is transferred to the TGCS reserve fund, and a sum not exceeding 12% of the paid up share capital is earmarked for payment of dividends to the shareholders. Part of the profit is also set aside for purposes such as: community development work; soil, water and energy conservation; wasteland development; education; and public relations. A certain amount is distributed as a bonus to members according to the value of trees/grass and other products sold.

A study undertaken by Balooni and Ballabh (1998) on the management issues confronted by six TGCSs in Gujarat revealed that distribution of benefits from the final harvest of the village plantation was one of the major issues facing the societies and their promoter, NTGCF. The NTGCF tried to evolve a distribution mechanism, whereby a member of a TGCS would be given a fixed share from the total value of the final harvest, depending on years of membership in the TGCS. Thus, the early birds were getting a higher share than the latecomers (Table 1, footnote b).

3.4. Results of financial feasibility analysis

Table 7 presents the estimates (in 1987–88 prices) of the total discounted cash outflows and cash inflows, net present value (NPV), benefit cost ratio (BCR) and financial internal rate of return (FIRR) of the plantations raised by the sample TGCS.

Financial analysis reveals that the plantations founded by the three co-operative societies on degraded village commons were all financially viable in terms of both NPV and BCR criteria. There was a marginal difference in the estimates of NPV and BCR using two different sets of interest rates for discounting cash flows over the analysis period (see Tables 5 and 7). The average interest rate for the analysis period based on long-term loans for wasteland

Table 7

Financial analysis of plantations raised by the sample tree growers' co-operative societies over a period of 16 years, 1987-88 to 2002-03 (Rs)^a

TGCS (Planted area in hectares)	Discount rates (real interest rates during analysis period) ^b	Discounted total cash outflow	Discounted total cash inflow	Net present value	Benefit cost ratio	Financial internal rate of return (%)
1	2	3	4	5 = 4 - 3	6 = 4/3	7
Vatra (40)	Based on interest on term loans for wasteland development projects (IWDP)	After rotation I (1987-88 to 1994-95)				
		609,039 (15,226) ^c	4,336,689 (108,417)	3,727,650 (93,191)	7.1	62.1
	Based on interest on government dated securities (IGDS)	635,537 (15,888)	4,817,856 (120,446)	4,182,320 (104,558)	7.6	
		After Rotation II (1987-88 to 2002-03)				
Sarnal (35)	IWDP	996,019 (24,900)	8,903,719 (222,643)	7,909,700 (197,742)	9	63.1
	IGDS	1,070,021 (26,751)	9,991,017 (249,775)	8,920,996 (223,025)	9.3	
	After Rotation I					
	IWDP	392,035 (11,201)	2,543,965 (72,685)	2,151,930 (61,484)	6.5	53
	IGDS	405,658 (11,590)	2,828,507 (80,814)	2,422,849 (69,224)	7	
	After Rotation II					
	IWDP	656,160 (18,747)	5,291,112 (151,175)	4,634,952 (132,427)	8.1	54.4
	IGDS	701,758 (20,050)	5,938,262 (169,665)	5,236,505 (149,614)	8.5	
Navagambara (60)	After Rotation I					
	IWDP	606,027 (10,100)	3,787,347 (63,122)	3,181,320 (53,022)	6.2	65.3
	IGDS	630,294 (10,505)	4,211,912 (70,199)	3,581,618 (59,694)	6.7	
	After Rotation II					
	IWDP	969,259 (16,154)	7,773,176 (129,553)	6,803,917 (113,399)	8	66.3
	IGDS	1,038,336 (17,306)	8,726,070 (145,434)	7,687,734 (128,129)	8.4	

^a As at the beginning of the plantations undertaken by the TGCS in the year 1987-88 (US\$1.00 = Rs 13 on average 1987-88).^b For details see Table 5.^c Figures in parentheses are values per hectare for the respective columns.

development and government securities was found to be 4.7% and 3.8%, respectively (Table 5).

There was a marginal difference in the financial internal rate of return for two different scenarios, i.e. after Rotation I (1987–88 to 1994–95) and Rotation II (1987–88 to 2002–03). However, there was a large difference in the NPV and BCR for these two different scenarios for all three co-operative societies. The presence of a high proportion of trees with coppicing potential in planted areas, which reduced the establishment costs after Rotation I, was one of the reasons for high values of NPV and BCR after Rotation II, as compared to the values for Rotation I.

The financial internal rate of return for all the three co-operative societies was found to be substantially higher than the minimum required¹² (Table 7). The highest rate was obtained by the Navagambara TGCS (66.3% after Rotation II), while the Vatra TGCS had the highest BCR rate (9.3 after Rotation II).

An attempt was made to compare the results of the present financial analysis with plantation projects undertaken on ravines in other parts of India. Babu et al. (1984) estimated the FIRR of mixed plantations in the deep ravines in the state of Uttar Pradesh. The FIRR for the Rotation I having *Acacia catechu* (60%), *Prosopis juliflora* (20%) and miscellaneous species (20%) was found to be 16.2%. The FIRR for Rotation II having *Prosopis juliflora* (78%) and other miscellaneous species (22%) was 27%. One of the tree species, *Prosopis juliflora* in this case, was also the major tree species grown on village commons by the sample TGCS. Shah (1984) estimated the FIRR of a wastelands development project undertaken on a 200 ha piece of wasteland in Manipur village in Mehsana district in Gujarat to be 33.7%. A review of two other studies on financial analysis of plantations on ravines revealed that the FIRR was 15% (Kishore et al. 1982) and 20% (Goswami and Singh, 1981).

The financial internal rate of return, as estimated by the authors, is quite high as compared to that worked out in the above-mentioned four studies. Similarly, the benefit cost ratio (BCR) was also found to be high for the sample TGCSs. The authors estimate that a better survival rate of planted trees (Table 1) and exclusion of the overhead expenses of NTGCF (as discussed in Section 3.2) in the present financial analysis may be one of the reasons for the high values of BCR and FIRR. Other reasons for better financial returns from the plantations undertaken by TGCS could be: a robust organisation (TGCS) managing the plantations; technically sound establishment and management of plantations; better marketing of forest produce under the auspices of NTGCF; and effective participation by local

people in the management of plantations. These characteristics make the TGCS plantation model more effective as compared to other plantation models used in India.

3.5. Methodological issues

Quite a few methodological issues arose while estimating the financial viability of the tree plantations of the sample TGCS. Three of these issues are discussed below.

3.5.1. The handling of opportunity costs of land, labour and capital

One of the limitations of the present analysis is that the opportunity costs of village commons, labour and capital employed in the plantation activities were not factored into the financial analysis. The reasons for this were the following:

In the case of the Vatra and Sarnal TGCSs, due to the lack of other vegetation for grazing, village common land was used for this purpose to a certain extent (see status of land before plantation in Table 1). A small proportion of households, belonging to the *rabaris* community (grazers by profession) in Vatra Village were deprived of their rights to let their animals graze on the land. To compensate them for this loss, which is rooted in the traditional property rights regime, an area of 2 ha (out of total area of 40 ha leased by the TGCS from the Revenue Department) was reserved for fodder production. As regards the issue of opportunity cost of labour, it was very low, almost negligible as the workers who obtained paid employment on the plantations in all the sample TGCSs were mostly landless labourers. As such, the labourers had few alternative opportunities for employment. In fact, they also constituted the majority of the TGCS members (see Table 1). The source of capital (as discussed in Section 3.2) employed on the plantations did have a high opportunity cost as it could have been employed elsewhere in alternative productive effort giving high returns.

3.5.2. Uncertainties and risks

The returns from the investment expenditure on plantations raised by the sample TGCSs as discussed above are subject to uncertainties and risks associated with market forces and natural vagaries such as drought, fire, floods, disease, and pest attack. An additional source of risk in our case was the insecurity of tenure, as the TGCS had taken the village common land on lease from the revenue department of the state government, who is the *de jure* owner of these lands. These lands are generally given on lease to TGCS for a short period of 15–30 years. The officials of NTGCF expect that this institutional arrangement will be renewed after the expiration of the present arrangement.

3.5.3. Employment generation

Our study reveals that the various plantation activities have generated considerable paid employment for the

¹² It is financially desirable to invest money in the plantations raised by a TGCS so long as the rate of interest on loans (see nominal interest rate per annum on long term loans for wastelands development for various years in Table 5) is equal to or less than FIRR.

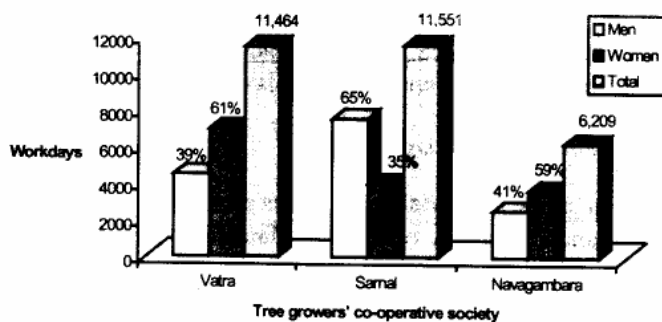


Fig. 1. Employment generated from plantation activities and nurseries raised during 1987–88 to 1992–93 by the sample tree growers' co-operative societies.

people of the three villages (Fig. 1). Theoretically speaking, employment from the plantations should not be considered as an additional benefit distinct from the benefits in the form of produce of the plantations, as the cost of wages, and the benefits captured in the form of plantation produce, had already been factored into the cost estimates. However, from the social equity point of view, mention of employment effects of plantations seems necessary.

The plantations were established gradually on small plots of land every year over the period 1987–88 to 1992–93, so as to provide regular employment to the people of the sample villages by engaging them in various plantation activities.¹³ All the plantation operations were managed by the TGCS, and villagers from the sample villages were given preference over the people from the nearby villages for employment in the plantations. In addition, each TGCS also provided direct employment to a few persons, such as the secretary, watchmen and nursery workers. In the first year of the plantation programme, the Forest Department provided saplings to the TGCSs. However, from 1988 onwards, the saplings were provided from the nurseries tended by women in the villages. A substantial number of nurseries were established in the villages (Table 1) under the supervision of the TGCS, resulting in gainful employment.

It is noteworthy that the tree planting activities generated considerable employment for women (Fig. 1). This is further evidence of the important real participation of women in the planting projects carried out by TGCS. In the village of Sarnal, women's participation in the TGCS was lower than in other locations. This may be partly due to the fact that most households in Sarnal Village belong to the *Darbar*, a very conservative community, in which women are not allowed to move around freely. This may have resulted in the lower participation of women in the tree planting activities.

¹³ The people of all the three villages were also encouraged by the TGCS to raise saplings on their private lands.

4. Lessons learned and implications

This study clearly demonstrates that TGCS could help in rejuvenating degraded village commons and improving the quality of the environment. The involvement of external agents, such as government, donor agencies and NGOs, in the management of common pool resources is often criticised on the grounds that such agents tend to interfere in the internal affairs of the local organisations. Moreover, it is also commonly believed that external aid agencies put more emphasis on physical facilities than on social capital (Ostrom, 1994). However, the present study has shown that the role of external agents is crucial to managing scarce resources that are on the verge of extinction, or in situations where local people cannot through their own initiative prevent the degradation of a common pool or open access resource. The present study has demonstrated that degraded village commons that had *de facto* become an open access resource could be restored and put to an eco-friendly use through organisational innovation, i.e. a tree growers' co-operative society. The commons in the sample villages, which once were devoid of vegetation, have now become green. Besides, the plantations have improved the quality of the microclimate in terms of moderation of temperature and humidity.

Financial institutions, including NABARD, in collaboration with various government departments can play an important role in promoting TGCS by providing finance at prevailing bank rates. The financial feasibility analysis done in this paper clearly shows the role of organisational, technical and financial support provided by the NTGCF to TGCS as an instrument of improving the financial benefits of plantations undertaken by TGCS.

This study shows that collective efforts using the TGCS model of NTGCF, if replicated on a large scale, has the capacity to improve the socio-economic conditions of rural people, particularly the very poor, and to improve the quality of the environment. The biomass produced from tree plantations could support a variety of processing and manufacturing enterprises and thereby create additional income and employment opportunities in rural areas. Tree plantations on a massive scale would reduce soil erosion and enhance the recharge of groundwater aquifers. The community plantations established under the auspices of the NTGCF have become a model for stabilising forest ecosystems and have a great demonstration effect. The model could, if adopted throughout India, lead to another Green Revolution.

The financial viability of community plantations raised by the sample TGCS increases the prospects of realising the goal of setting aside one-third of the total geographical area of the country for forests, as envisaged in the national forest policies of 1952 and 1988. This approach would be not only economical but also eco-friendly. India has around 100 m ha of

wastelands owned by state revenue departments and other government departments. Most of these wastelands fall in the category of village commons. The conversion of these wastelands into forests, through collective action by rural people, can help reduce poverty as it creates many backward and forward linkages.

5. Concluding remarks

The present study has revealed that tree plantations hold high promise as a cost-effective means of restoring India's degraded village commons. They thereby create 'green wealth' while at the same time improving the quality of the environment. In addition, tree plantations also generate substantial employment, thereby improving socio-economic conditions in rural areas. The financial feasibility analysis of plantations raised by the sample TGCSs shows that they were financially viable. Financial institutions have an important role to play in financing the formation of TGCSs in different parts of India where villages are endowed with substantial areas of common wastelands but may lack the financial resources needed for establishing plantations. Projections of benefits from plantations established by the TGCS suggest that the villages establishing tree plantations on their common lands could attain self-sufficiency in terms of timber, fodder, fuelwood and other forest products. It is, therefore, high time that India and other developing countries consider innovative models of local community participation in managing common pool resources.

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