Building on indigenous knowledge in watershed management

Agragamee, Orissa

The lives of the people of Mankadamundi used to be grey. Grey, because of the dark clouds that gather over the steep hills of the Eastern Ghats each monsoon season. The clouds brought with them heavy rain – 1300 mm a year – but nearly all in intense storms during three months of the year. Four-fifths of the rain gathered into rivulets and streams, rushed down the narrow valleys, and was lost – carrying with it tons of precious topsoil.

Grey, because the rains sometimes failed at a critical time during the wet season – the two or three weeks when the rice plants were flowering. Without any water for irrigation, the seed heads would be empty, and there would be nothing to harvest.

Grey, because after the rain came the sun. In the first week of September, the sun reappeared, and the remaining nine months of the year were parched. Short of money and unable to grow anything in the bone-dry soil, the village men left for the towns in search of work. They would come back next June to plant the crops.

Despite the heavy rains, the people of this village could grow only one crop of upland rice, millet or maize a year. If only they could trap some of the extra water and use it to irrigate their rice. Or keep it until the dry season! Then they could grow another crop after the main one.

The farmers of Mankadamundi thought it might be possible. But how could they make it reality?

From grey to green

The farmers' lives have now turned from grey to green, as a result of the villagers' work with Agragamee ("pioneer" or "marching forward" in Oriya, the local language), an NGO that has been working in remote tribal areas of Orissa for 20 years.

Agragamee has an office near the village of Mankadamundi. The village leaders approached the NGO and asked for help. Agragamee staff checked the conditions in the village and decided to see what could be done. The staff held many discussions with groups of villagers. Together, the villagers and Agragamee conducted a participatory appraisal to identify the village's problems, map its natural resources, and identify opportunities for improving the situation. As a result, they designed a 5-year project, which ran from 1999 to 2004.

One of the things that emerged from the participatory appraisal was the wealth of local knowledge about managing water to grow crops. For example, villagers designed their wet-land rice fields in the valley bottomland so they would capture runoff from the hillsides. To

Box 17 Mankadamundi at a glance

Location	Dasamantpur block, Koraput District, Orissa
Area	228 ha
Arable land	85 ha (80% upland)
Non-arable land	193 ha
Altitude	900–1050 m
Population	32 families, mainly tribal
Average family size	5

prevent the wetland fields from washing out during heavy storms, they diverted the water in channels along the edges of the fields – where it could easily be tapped during a dry spell. However, less than 10% of the cultivated land was irrigated in this way.

Agragamee suggested applying this principle to a much bigger area. By harvesting rainwater on the upper and middle slopes, it would be possible to supply water to a larger area of

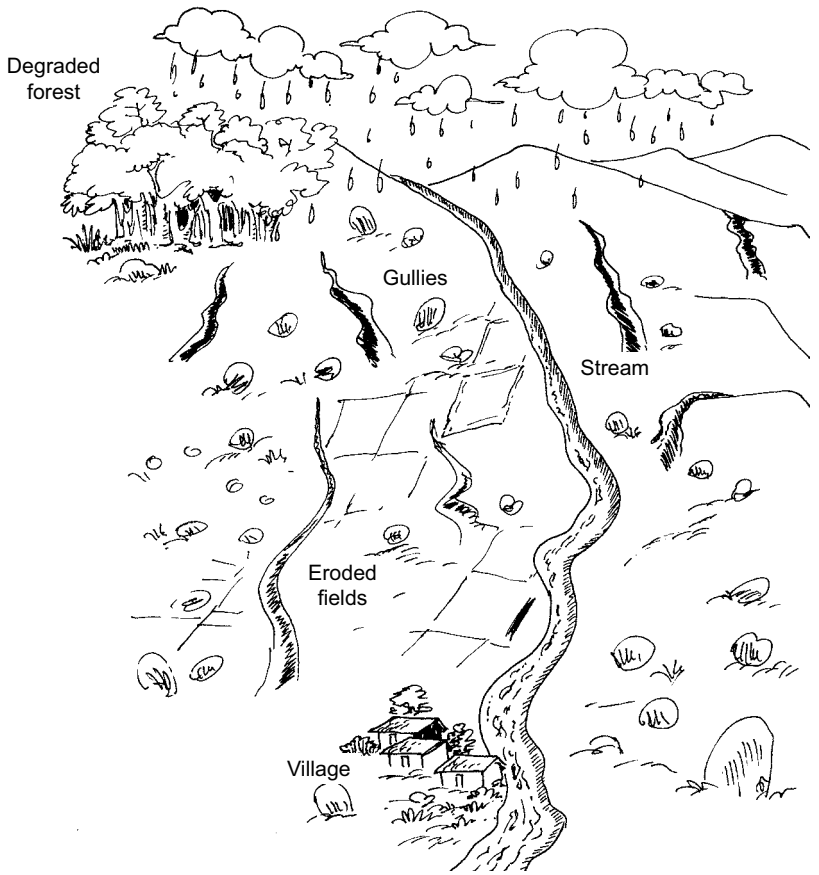


Figure 7 Before the project: gullying and erosion on the slopes

fields. By the end of the project, this approach indeed enabled the local farmers to use an extra 63 ha to grow upland rice, millets and vegetables (in medium lands) with protective *kharif* (July–October) irrigation.

They did this by applying various techniques. They built stone bunds and dug staggered trenches along the contours to harvest water on the steep slopes. Between the bunds they planted cashew and *jafra* (*Bixa orellana*, a shrub that produces a natural dye) to conserve the soil and produce extra output. They also sometimes planted pigeonpeas (*arhar*, *Cajanus cajan*) between the bunds.

The villagers also built a checkdam across the stream to slow down the water and to harvest some of it to use it to grow crops. The stream is nearly 10 m lower than the land to be irrigated, so they use a diesel pump to lift the water to the highest point of the fields. A gently sloping channel then carries it from field to field. Because of this long flow path, much of the water percolates into the ground, increasing the amount of moisture in the soil and recharging wells and ponds in the lower ground.

The farmers regulate the distribution of water using planks. If there is too much water, they let it flow down to the stream again.

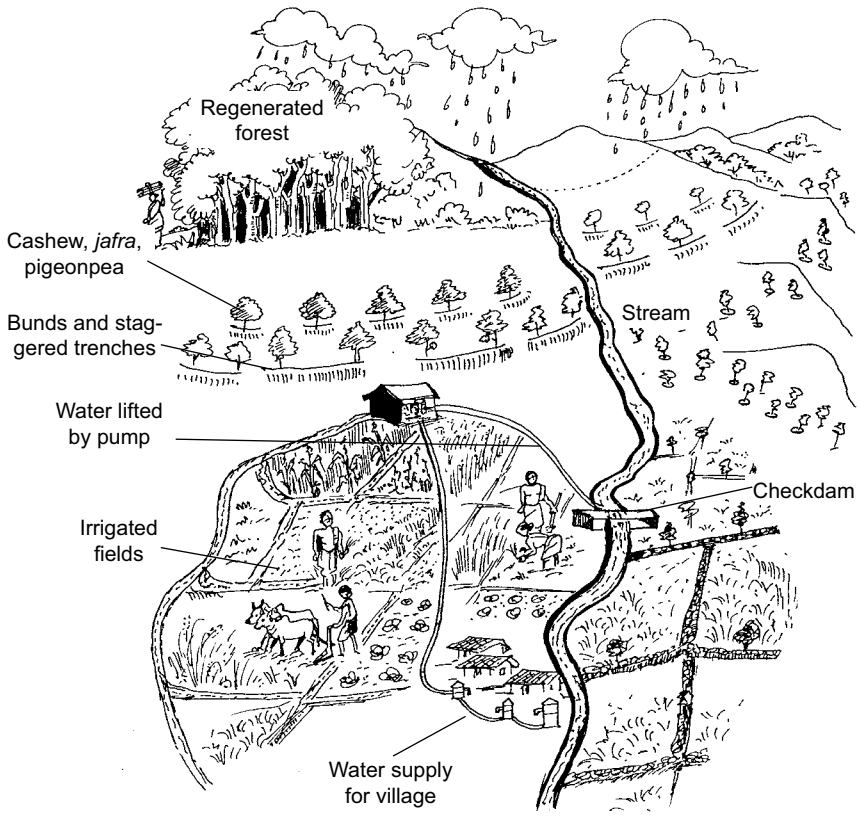


Figure 8 After the project: checkdams on the river, with a pump to lift water to the fields

The Watershed Users' Society

One of the first things that Agragamee did was to encourage the villagers to form a Watershed Users' Society to govern the watershed development activities. The villagers accepted the idea of forming such a body because it is based on the local social structure and culture. The Society is self-governing and is registered with the government. It collects dues from people who benefit from using the pump and the water. This money goes into a maintenance fund. The amount collected depends upon the crop: Rs 400–500 for a hectare of rice, and Rs 100 for a hectare of millet.

The Society controls the irrigation water, and repairs and maintains the dam and pump. Agragamee trained barefoot engineers from the village. They maintain the pump and canals voluntarily because they benefit from them. If a complex repair is needed, the Society pays an outside mechanic using money from the fund.

Part of the proceeds from the sale of *jafra* and cashew also goes into the maintenance fund. On land given by the government, the villagers run a tree nursery to raise seedlings of mango, litchi, papaya and drumstick tree.

The Society has a training centre in the village. It is used for training courses for Society members, women and barefoot engineers, to hold meetings of the Society and the community at large, and to teach children. The centre was built by Agragamee and handed over to the community after the end of the project.

The Society has a bank account with a balance of around Rs 60,000. It used some of its savings to pay for a drinking water project in 2004 in collaboration with the district government. The Society also used funds from the account to pay the villagers' share of the cost of bringing electricity to the village in 2005.

Project impacts

Table 5 summarizes the project impacts. In 1999, before the project started, the food security situation in Mankadamundi was serious. Only 30% of residents got enough to eat all year round. Another 40% managed to get enough for six months a year, while the remaining 30% had enough for only four months. There were few jobs for labourers: only for about 50

Table 5 Before and after the project in Mankadamundi

Benefits	Before (1999)	After (2004)
Availability of irrigation in *rabi* (winter) and summer	2 ha	15 ha
Yield of upland rice	0.75 t/ha	2 t/ha
Number of families growing *rabi* crops	9	32
Winter and summer season net income per family (8 months)	Rs 2000–3000	Rs 10,000–15,000
Vegetable consumption	Very little	Perceptible
Summer rice (dry season)	None	3 ha

days a year. Soil erosion was severe on at least 60% of the land, and crops that were grown there were subject to severe water stress. Wells dried up during the summer, forcing people to depend on the nearby streams for drinking water.

Things were very different by the end of the project in 2004: 70% of the families had food all year round; the remaining 30% had enough to eat for at least 7 months. Labourers could find work 200 days in a year. The villagers formed a grain bank as a buffer against food shortages. Only 20% of the land was still subject to erosion and water stress. And the water table had risen, so drinking water was available in the wells during the summer months.

Before the project, only 20% of the water that fell as rain stayed on the land. This figure is now 40%. The crops and trees stay green for longer.

The higher crop production has improved the residents' nutrition, especially for the children. Farmers can now grow vegetables such as onion, chilli, cauliflower and tomato in both rainy and winter seasons. They eat part of their produce and sell the rest.

The villagers' dependence on the forest has been reduced because of their rising incomes from farming. Before the project, 30% of the families in the village were engaged in shifting cultivation. This was the traditional practice, but was no longer sustainable in the area because of the very short fallow periods. Some 40% of the villagers depended on (unauthorized) felling of trees for timber and firewood. The project made it possible to increase the intensity of cultivation, so people no longer had to rely on clearing new land to grow enough to eat. Only 5% of the families in the village now do so. That means the remaining forest is able to regenerate.

Farmers who own a lot of land rent out part of it to landless people for sharecropping. This is the traditional arrangement among the tribal population. Before the project, they did not rent any land out – it was not worth doing so: with low soil moisture and without irrigation, productivity was low. Farmers can now irrigate their fields, and they now feel it is worthwhile taking care of their land. They rent out fields they cannot cultivate themselves to landless farmers, arranged through the Watershed Users' Society. In this way, six landless people now have the chance to earn a living in the village; they no longer have to leave in search of work elsewhere.

The higher incomes can be seen from people's belongings. They have started building houses from stone rather than the traditional mud. They have bought bicycles, radios, clothing (now they can buy winter clothes) and cooking utensils. They have money to deal with heath problems. They visit the market more often because they have more to sell, and more money to buy things with. These visits open them to more news and information from outside.

Cost effectiveness

The Mankadamundi project proved highly cost-effective. A total of Rs 358,000 was invested in the irrigation scheme to provide water to 63 ha of land. That works out at Rs 5,700 per hectare – a lot less than the typical minor irrigation schemes of the state government. The Mankadamundi scheme was cheap because the technique is simple. Many irrigation schemes, large and small, implemented by the government are very expensive – over Rs 100,000 per hectare.

Many indigenous technologies like the one used in Mankadamundi have potential for scaling up. But they have to be documented, validated and fine-tuned so they fulfil local people's needs, and to ensure that they are both cheap and effective.

Such small-scale schemes have major potential for hilly areas all across India. Agragamee has so far implemented similar projects in three watersheds in different parts of Orissa; all are working well.

More information: Omprakash Rautaraya, Agragamee, omprakash1972@rediffmail.com , www.agragamee.org

The work of Agragamee, is supported by German Agro Action.

www.welthungerhilfe.de

Forest home gardens in Raigad District

Rural Communes, Maharashtra

If you visit Aba, as Krishnaji Narsing More is affectionately known, he will invite you to sit down and wait while he goes into his "forest homegarden" behind his house. Ten minutes later, the old man is back with a freshly cut papaya. As you bite into the pieces of sweet, juicy fruit, you probably wonder where he got it. And what does he mean by "forest homegarden"?

Aba will be pleased to take you out and show you. It turns out that his forest homegarden looks quite a lot like the forests that used to cover almost all of India. The trees produce fruit, timber, fuel and other products. Below them, Aba has planted a dense patchwork of shrubs, climbers and shade-tolerant herbs that produce vegetables, herbal medicines and spices. In the first few years before the trees were fully grown, he grew crops between the saplings.

The green forest homegarden is like a small oasis in the otherwise bare landscape around the villages of Wawoshi and Shedashi. Like many areas of India, the monsoon from June to September brings heavy rain to western Maharashtra. Here in Raigad District, on the border of Khalapur and Pen *talukas*, the rainfall is high – around 2500 mm a year. The weather is humid most of the year, but the summers are hot and dry. Inappropriate farming practices,

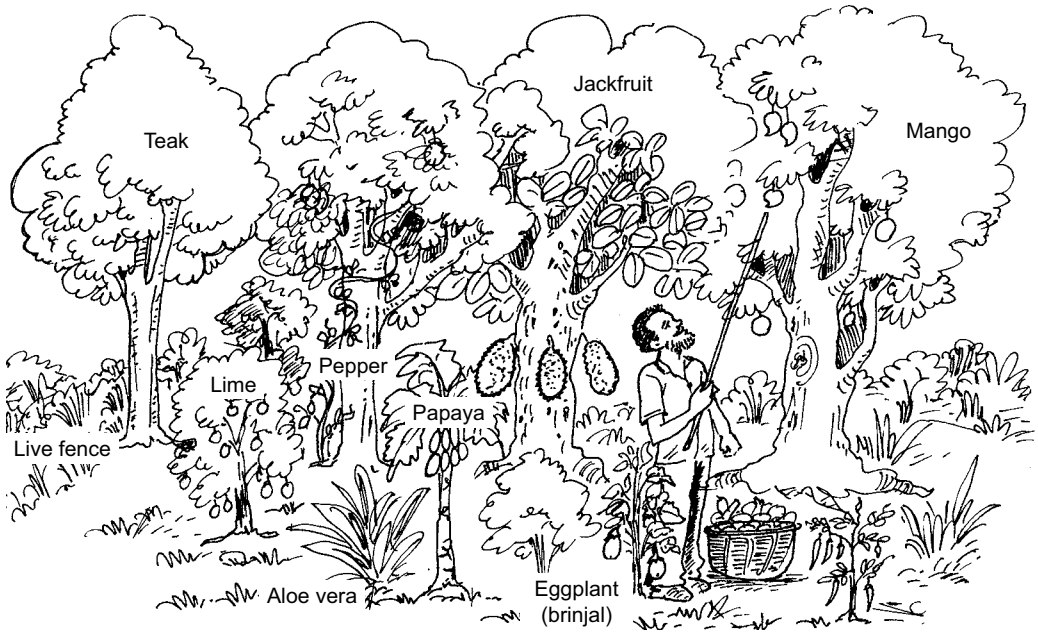


Figure 9 Aba's garden produces a wide range of fruit, vegetables, spices and wood

coupled with fires and overgrazing, have denuded the area of most of the vegetation. Many people have given up hope of growing enough from their small plots of land. They are poor and often do not have enough to eat. Many migrate to the cities in search of work.

But Aba's forest homegarden is showing them a different vision of the future. If the old man can produce such an oasis, say local people, why can't they all? They have begun to learn what he has done and copy his techniques. Gradually, forest homegardens have started growing throughout the two villages.

Comprehensive watershed development

The forest homegardens are part of a comprehensive watershed development programme implemented by Rural Communes, an NGO working in Maharashtra. Comprehensive watershed development is much more than just soil and water conservation. It also looks at issues such as social economy, basic health, livestock management, environmental sustainability and ecology. It attempts to conserve biodiversity by making the most of traditional crop varieties and livestock breeds, using approaches such as live gene banks, seed banks and networks. The approach ensures that women take active part in discussions. It relies heavily on community members' commitment: the community makes decisions on what activities to pursue, collects contributions (known as *shramadaan*) to help pay for initiatives, and ensures that everyone follows the rules (such as controlled grazing and a ban on burning).

Such an approach is able to address many different needs in the community: reduce land degradation, improve productivity, generate jobs, improve people's nutrition, improve their socio-economic status, as well as encourage their participation in the society.

An opportunity for change

Rural Communes started implementing the comprehensive watershed development programme in Wawoshi and Shedashi in 1994. The project lasted until 1999, and was funded by the German KfW Development Bank and the Indian National Bank for Agriculture and Rural Development Indo-German (NABARD).

In 1994, the Wawoshi–Shedashi watershed was open, barren and degraded. But there was an opportunity: much of the land in the watershed was not cultivated. The idea formed to use this land to help residents in the village to become self-sufficient.

Rural Communes began with a programme to build awareness and rapport among the local people. The NGO has been training village-level activists since 1982. These activists live and work in the NGO's project villages during their one-year training. The networks of trust they build up among local people enables them to play an important role in developing and supporting project work in the villages.

A watershed committee was formed with representatives of different tribal and non-tribal communities from different hamlets in the Wawoshi–Shedashi area. With the joint guidance of this committee and staff of Rural Communes, the villagers started conservation work in the watershed. They began work at the top of the ridge, and then gradually moved down into the valley. They first built plugs on gullies and *nallas* (seasonal streams) to slow down the

water flowing along these drainage lines. They then dug staggered trenches and continuous contour trenches to stop water from washing down the slopes. They planted multipurpose trees and fodder crops on the common grazing land.

Once they had finished work on the upper slopes, they moved to the lower slopes. They built checkdams along the stream using gabions (wire cages filled with stones), earth and cement. They built or improved terraces and bunds on the cropland to boost its productivity.

Starting forest homegardens

The next step was to plant mixed forests on land owned by the state, the community and by individuals. Rural Communes felt the climate and soil were favourable for forest growth, so the area had tremendous potential for regeneration. They helped farmers like Aba to start small oases of forest, hoping that they would begin to look at their land in a different way and give them more reason to care for it, plan for the long-term, and reap the benefits.

In 1996, the NGO staff held a discussion with local people about the poor food security in the villages. Everyone felt that something needed to be done about the problem – especially to provide more fresh fruit and vegetables, which they saw as important for nutrition and health. The NGO and village watershed committee members did a participatory survey, and found that the villagers had land and a small amount of water. With proper management, it should be possible to grow fruits and fresh vegetables for their own use. From this emerged the first outline plan of the forest home gardens.

The villagers faced four major challenges in developing forest homegardens:

- The gardens have to be properly protected from cattle and goats. Doing so was not easy: most people preferred to let their animals graze freely.
- The gardens have to be protected from fire. That was also difficult in an area where farmers burned stubble and weeds to prepare seed beds for the new crop every year.
- The gardens must be constantly protected from theft and wanton damage.
- Starting a garden requires a long-term perspective. It takes at least five years before the garden starts yielding substantial returns. Many people did not think they could wait that long.

Ten farmers in the two villages said they were interested enough in the possibility to try out the forest homegarden idea. Aba was one of them. He chose an acre (0.4 ha) of land near his house for this garden. He marked out the plot, and planted *Carissa*, thorny shrubs such as *Euphorbia* and trees such as teak, and *Thespesia* as live fences around it. Then he dug pits in the future garden and planted mango, cashew and coconut. Next came other fruit trees: lemons, sweet lime, guava, *chiku* (sapota), papaya, jackfruit, drumstick, along with climbers, spices and medicinal plants. He also planted a lot of vegetables, chosen because they were hardy, resilient, and grew well under local conditions.

Light, fertilizer, water

Because this was a new initiative, Rural Communes provided Aba and the other nine farmers with seeds and saplings. The farmers had to choose the location of each plant to suit the soil depth, moisture, nutrients and sunlight that each needed. The idea was to arrange the trees, climbers, shrubs and herbs to use all the sunlight and to provide shade to those plants that preferred it. Aba found he was able to use almost every inch of available land.

Apart from sunlight, the newly planted trees and crops needed fertilizer and water. Aba used slurry from the biogas plant behind his house as fertilizer. He applied mulch of cut weeds and grass around the young trees. He did not have enough, so in a few spots he piled soil and rocks around the base of the trees in summer to protect the soil surface and cut down evaporation.

Initially Aba had a difficult time providing water to the various different trees that he had planted. The lemons, sweet limes and coconuts needed more water than other trees, so Aba had to water them at least once a week in the dry season. He used waste water from his kitchen and bathroom on crops such as banana and *Colocasia* that needed watering every day. Despite his efforts, some trees were short of water in the first few years. But soon most of the fruit trees had got established, and the dense vegetation in the garden minimized evaporation losses.

As the watershed development work progressed, the water table rose. There was more water in the village well, and it was better quality. Aba pays a fee to the *gram panchayat* (village council) so he can use this water.

Aba is lucky he has this water available. But irrigation is not necessary everywhere, and plants should be chosen to match the amount of water that is on hand. Providing the right species are chosen, a proper forest home garden can be established even without irrigation. With irrigation, though, farmers can grow a wider diversity of plants.

Irrigation is also where land and watershed management really comes into play. For example, some gardens can be irrigated from pools in the riverbed. If there are no pumps or pipes, farmers can carry the water in cans or using a bullock cart. The amount and frequency of watering depends on what plants are grown and how much water is available.

Benefits

In 2005, six years after the Rural Communes watershed project was completed, Aba's garden is getting more productive each year. It provides his family with a whole range of produce: fruit, fresh vegetables, spices and condiments, medicines, and even flowers for religious ceremonies.

The basic economic viability of the garden revolves around home consumption. Farmers get the maximum benefits if they grow and cultivate crops they need for their own use. They can then harvest what they need in the kitchen each day. If there is a surplus, of course they can sell it.

Aba's two sons and their families live with him and his wife. There are nine mouths to feed. His 0.4 ha garden produces fresh fruit, vegetables and a range of other produce – enough

Table 6 Value of produce from Aba's forest garden

	Rs/year
Fresh vegetables (Rs 30/day for at least 200 days/year)	6,000
Coconuts	2,800
Other fruits (mango, lemon, sapota, guava, papaya, sweet lime, etc.)	15,000
Produce given to friends, relatives and neighbours	5,000
Spices (pepper, chillies, turmeric, curry leaf, cinnamon)	2,000
Small timber and bamboo	1,500
Fuelwood	2,200
Total	**34,500**

for them all, plus quite a lot he can give away. He has worked out that the garden yields at least Rs 34,500 worth of produce a year (Table 6).

For poor farmers in Raigad District, that's a lot of money saved. And quite apart from the economic benefits, their families get good-quality fresh fruits, vegetables and spices every day – produce that they might not be able to buy in the area even if they had the money.

A properly planned and managed garden can provide a whole range of other products: edible oil from trees like *moha* (*Maduca longifolia*), and herbal medicines for common ailments. Plants like *nirgudi* (*Vitex negundo*) and lemongrass are used to repel mosquitoes and other pests. There are soap substitutes. There are plants used in religious ceremonies, like *bel* (*Aegle marmelos*) and *tulsi* (holy basil), as well as flowers like jasmine for ornaments and decoration. Many plants can be fed to cattle. Bamboo can be woven into baskets.

Wood is a valuable product from the gardens. Small timber can be uses as poles. Branches and twigs make excellent fuel. That means that women (who have the task of gathering fuel) no longer have to go into the forest as often to collect wood.

Timber trees such as teak are an investment for the future. When they are big enough, they can be cut and used for building, or sold. At Rs 1200 a cubic foot, a single 30-year-old teak tree fetches an average of Rs 30,000. The teak trees around Aba's garden are now about 18 feet tall and growing steadily.

There are other benefits too. The area around Aba's house is cooler, less dusty and more pleasant, especially during the hot summer months. Aba says that spending 2 hours every day in the garden is what keeps his entire family fit. It is much more pleasant than working in the hot sun. Although this project wasn't vital for Aba, it increased his quality of life considerably. He lives in more pleasant surroundings, enjoys the pleasure of eating his own crops, and his grandchildren can play in a healthy environment.

When more people adopt the gardens, one of the indirect benefits will be the management of livestock. At the moment, a herder supervises the gazing cattle during the monsoon months from June to November. Everyone benefits from this system: the herder prevents the animals from damaging the standing crops. Once enough people have started gardens, it

is expected they will set up a similar system for managing cattle during the rest of the year, when the animals are now allowed to roam freely. Controlling grazing will benefit the forest, and there is much more scope for regeneration.

Another indirect benefit is better awareness about forest fires. This can already be seen: there are fewer fires now because people know they may spread into the valuable garden areas.

Scaling up

As the trees grew in the gardens of the ten farmers, their neighbours began to take interest. Aba and the other nine pioneer farmers in Wawoshi and Shedashi now have the technical expertise and can provide inputs such as saplings. They are sharing their knowledge and ideas with the other farmers in their villages. More than 25 farmers have also established forest home gardens in these and other villages nearby.

Forest home gardens can be established on individually owned land, community land, or land that the Forestry Department has allotted to tribal people for cultivation. Starting gardens next to each other cuts down the amount of fencing needed, and produces a larger area with a cooler, more humid microclimate. Fencing, labour and planting material cost about Rs 20,000 per acre (Rs 50,000/ha). Self-help groups or women's groups can grow the planting material and saplings, reducing costs and keeping the village economy alive.

The gardens give farmers a concrete, practical reason to increase the vegetation cover in the watershed. The dream of Aba and his friends is to gradually increase the area of these gardens in Wawoshi and Shedashi.

Building on its work in Wawoshi and Shedashi, Rural Communes has started implementing forest home gardens in the Chavni comprehensive watershed area, which is nearby. Thirty-seven farmers there are in the process of developing forest home gardens on a total of 22 ha. Work is now in its third year, and farmers are already able to harvest papaya, guava and some medicinal herbs from their plots.

There is a tremendous amount of uncultivated hilly land in the western Maharashtra. Wherever the climate and rainfall is favourable for rapid tree growth, some of this land can be used to set up forest home gardens.

Lessons

Forest home gardens regenerate the land and produce valuable products. Setting up a garden is not difficult – but it does take time and plenty of patience. Outside investment is required for weaker groups in the community: to help them get them over their initial hesitation to put effort and resources into an activity that will give substantial returns only after 5 years. The wait is worth it: the farmer gets interest on the investment since the value, quality and diversity of produce from the garden increases over the years.

Forest home gardens are a good example of using nature in a sustainable way and making optimum use of biodiversity. They optimize the land fertility and productivity, while using minimal inputs from outside.

The gardens are also a good example of using traditional knowledge for a common good.

Aba continues to teach and inspire all those who visit him. He is remarkable for his vision, direction and persistence. In these changing times, the watershed movement in India needs more people like Aba.

More information: Vivek Gour-Broome or Dilip Akhade, Rural Communes
ruralcommunes@gmail.com, ruralcommunes@vsnl.net

The work of Rural Communes is supported by Misereor.

www.misereor.org

Community-based watershed development in Bhipur

Cecoedecon, Rajasthan

The farmers of Bhipur village were worried. Many of them had taken loans from the bank in nearby Malpura so they could buy seed. But the rains had failed yet again, and there would be no crop this year – just like last year. They would have to go to another village to find work. Their cows had no fodder or water, and they had no money to buy feed. They might have to sell their animals before they died, sell their land and go to work as labourers on someone else's farm. Some of the older farmers were particularly concerned because they had pain in their knees and were finding it difficult to walk.

That was three years ago. Now, all the farmers manage to grow a decent crop on their land, and their animals have enough to eat, even though there has still not been much rain. The older farmers say that their knee pain seems to be disappearing too.

What has made the difference?

Three years ago, a Rajasthan-based NGO called Cecoedecon helped the villagers of Bhipur form a village development committee composed of about a dozen men and women. Cecoedecon asked the committee to identify the village's problems, and the NGO then brought in specialists to discuss possible solutions with the local people. The committee decided to focus on water harvesting, controlling erosion, plant protection, grain storage and animal breed improvement.

Some immediate relief was essential to help the people tide over the drought. Cecoedecon used its special drought-relief fund to provide immediate relief – mostly in the form of cash-for-work.

But to solve the problem in the long term it was necessary to conserve water and increase crop and fodder production on a sustainable basis. This was possible only by making better use of the rainwater in the whole watershed, which included Bhipur and the other two villages.

Increasing water availability

The lack of drinking water was the most urgent problem. The villagers deepened the wells and Cecoedecon paid half the wages of the labourers. The villagers collected the rest of the money from the whole community.

But deepening the wells was not a permanent solution. Without adequate recharge, the wells would quickly dry up again in the next drought. It was necessary to find ways to increase the amount of water that sinks into the soil, in order to raise the groundwater level and keep the wells filled.

The village development committee decided, with the help of a Cecoedecon engineer, to start work to conserve rainfall. During the heavy monsoon rains, most of the water rushed off downslope, forming gullies and washing away crops and valuable topsoil. Groups of villagers dug feeder channels to collect water and divert it into the village pond. The pond was large enough to hold the extra water – in fact, it had never filled up completely, and used to dry out during the summer.

Since the feeder channels were built, the pond has had water all year round, and can be used to keep fish and to grow water chestnuts. The village committee raises money from selling fish and water chestnuts, and uses the money to maintain the pond.

Although the area has fairly gentle slopes, erosion was a problem. The villagers built gully plugs – 16 of them – to slow down the flow of water in the gullies and prevent further erosion. Most of the fields used to be surrounded by a ditch and a thorny fence to keep animals out. This did not help control erosion or keep water on the land. Cecoedecon advised the farmers to build bunds along the field boundaries instead to keep water and topsoil in the fields. The NGO supported the farmers to treat nearly 100 ha of land in this way. When other farmers saw the benefits, they started building bunds around their own land.

These measures have raised the amount of water in the soil. Previously barren land can now be cultivated. There is enough water in the pond and wells to use for irrigation. The wells have water all year round.

One farmer found that water accumulated behind the gully plug on his land. He was able to dig out a deep pond behind the gully plug. He now allows all the villagers to let their animals drink from this pond.

Increasing food and fodder

Conserving water automatically increased the crop yields. Cecoedecon introduced various ways of improving the soil fertility and boosting productivity further. These included green manuring, mulching, composting, using farmyard manure, and crop rotation of green gram and mustard.

The farmers have been keen to adopt some of these practices. The use of manure and vermicompost is increasing, and the area of mustard and green gram has gone up. Farmers have started rotating mustard and green gram. Green gram is a legume that fixes nitrogen in the soil, so improves the soil fertility. It takes only 2.5 months to mature, so farmers can plant a crop of drought-resistant mustard using the remaining moisture in the soil. Both these crops need little labour, and have a ready market.

Only a few farmers have taken up green manuring, mulching and composting. Composting requires water, so may be difficult to introduce. Intercropping and mixed cropping have actually gone down: farmers who hire a tractor find it difficult to have more than one crop in the field. Farmers who use bullock ploughs still practise intercropping. Farmers also say it is hard to harvest if there is more than one crop in the field. Cecoedecon aims to promote these techniques more in the future.

The increased water availability also means there is enough fodder available all year round. The farmers get fodder from various sources: specially grown fodder crops, grazing on the common land, and crop residues.

Fighting fluoride

The cause of the knee problem was easy to find. Cecoedecon knew from its work elsewhere in Rajasthan that too much fluoride in well water causes problems in the knees and other joints, as well as yellowing of the teeth and in the worst cases, deformed bones. Plus, people in Bhipur complained that the water had become salty over the previous ten years.

Cecoedecon tested all the wells and hand-pumps in the village and found that only half had acceptable fluoride levels. They painted the contaminated wells red and safe wells green, and arranged a campaign to advise people not to use water from the contaminated wells for drinking. They deepened the wells to reduce the concentration of fluoride and salt in the water. They also taught people how to remove the fluoride using cheap, easily available activated alumina powder. They taught children not to drink the contaminated water and to eat lots of green vegetables – which helps reduce the effects of fluoride.

There is more water in the wells because the water table is higher. That means lower fluoride and salt concentrations in the water – making it safer to drink. Recent tests show that immediately after the rains, the wells are below 1 part per million of fluoride, the World Health Organization's permissible limit.

Other activities

Cecoedecon also helped the villagers solve other problems they had identified.

- **Grain storage** It held a demonstration on how to keep pests out of stored grain using a metal storage tank, using neem to prevent insect attacks, and drying the grain every few months to preserve it.
- **Livestock** A training programme covered animal health, and Cecoedecon provided a bull and rams of an improved breed for breeding purposes.
- **Plant protection** The villagers visited a farmer in a village nearby to see how he managed pests on his crop. They learned that improving the nutrient management would keep the crop healthier, so make pesticides unnecessary. They are increasingly using well-decomposed manure as a fertilizer, though they have not given up chemical pesticides.
- **Education** Cecoedecon started a "Sarthak" school in the village for school dropouts, mainly girls, where students can complete their primary education. As a result of the NGO's awareness-raising work, enrolment in the government primary school has also risen. All the children in the village now go to school.

Training and capacity building

Training and capacity building have been a vital part of the project. At the start of the intervention, Cecoedecon arranged for the village development committee to visit another village where watershed development activities had been carried out. The committee members could see erosion control and water harvesting structures for themselves. They asked their hosts about the cost, benefits, operation and maintenance of these structures.

Cecoedecon also trained committee members in social engineering and leadership. Members learned how to organize themselves, identify problems, choose among technical alternatives, and implement solutions.

The villagers decided among themselves who would participate in various project activities. Some were interested in learning organic farming, others in doing crop demonstrations, plant protection, grain storage and animal improvement work. Cecoedecon arranged for specialists from various local government departments to provide training in the village.

The committee and the villagers as a whole follow up the progress of these initiatives and maintain records. A Cecoedecon staff member works with the villagers to do this. The committee also monitors the water levels in the wells, and collects money to maintain the pond and erosion control structures.

Cecoedecon's work does not stop at watershed management. For example, as it started to address health issues, it found that most of the village women were suffering from leucorrhoea, a vaginal disease caused by poor hygiene. So Cecoedecon started a programme to educate women on how to improve their hygiene and on reproductive health issues.

The NGO calls on specialists from local government agencies and other organizations for assistance. The aim is to build linkages between the village and these service providers – linkages that still function after the end of the project.

The rights-based approach is key to Cecoedecon's work. It encourages the local people to monitor services such as health and education they receive from the government, and write to the concerned agency if the service is inadequate – for example, if the nurse does not visit the village on schedule, or if teachers are often absent. After a complaint to the local authority does not produce results, the villagers now know to complain to the next level up in the government. On a road project, for example, the village women found that the supervisor was cheating, so they complained to the district official, and then to the Chief Minister of Rajasthan. As a result, a woman from the village now manages the project. The government has now extended this approach to other villages: local women now supervise work in their own areas.

People in the villages where Cecoedecon works now are much more able to press for their rights. They have participated in demonstrations on irregularities in the government price-support programme, and have given recommendations on the groundwater policy and drought relief activities.

Impacts

Crop production Yields of the main crops (wheat, mustard and millet) have gone up have risen as a result of the improved water availability (Table 7). The land area cultivated has also risen.

Drought resilience The improved water availability has made the villagers more drought-resilient. There is now water in the wells throughout the dry season, and it is less salty than before. There is enough fodder for the animals and enough water in the pond for them to drink. There is enough soil moisture to support a crop even during low-rainfall years.

Table 7 Yields of key crops in Bhipur, 1997 and 2004 (t/ha)

Crop	1997	2004
Wheat	1.4	2.6
Mustard	0.9	1.3
Gram	1.9	0.8*
Millets	2.0	2.5
Green gram	0.6	0.6*

* Low yield because of termite attack

Employment and migration Overall prosperity in the village has increased. Far fewer people have to migrate in search of work (migration has fallen to one-tenth of its previous level) because there is enough food and work in the village itself. Landless people have been able to find work on the farms of other villagers. Cecoedecon has helped the villagers (and especially landless people) form self-help groups to start kitchen gardens and to save money and provide loans.

Food types and availability The village can now produce enough food for its own needs, and the villagers can earn enough money by selling the surplus to buy things they cannot produce themselves. That means the range of food has gone up: for example, people are now able to buy different types of vegetables from the market, such as *lauki* and *turai* gourds, spinach, ladyfinger, cluster beans, peas, carrots, eggplant and cauliflower. People can now afford to buy tea and buy *masoor daal* (a type of dry pulse used to make a nutritious broth).

Health and education Cecoedecon's work was not confined to agriculture: it also included health, education and organizing components. Overall health and hygiene levels have improved through education and because more water is available. As a result of the education work, all the village children now attend school.

Women's issues Half of the members of the village committee are women, and women now participate along with men in village meetings. Over half of the beneficiaries of the drought-relief work were women. Women's health issues such as reproductive health and hygiene have been addressed. The women have formed a self-help group to collect savings and provide loans to its members.

Organization The strength of the committee and other organizations in the village means that they can now pressure the government to provide services and ensure that their rights are respected.

Negative impacts Increasing income has negative impacts, too. Alcohol consumption has gone up (the number of men who consume alcohol has risen from 30% to 70%). Disturbingly, cigarette smoking and *gutka* (betel) chewing has gone up: before the project in 2000, only 30% of men and no women smoked; in 2004, 90% of the men and 75% of the women did so.

Challenges

- The project has not yet been able to address all the problems in the village. For example, it is necessary to put more effort into increasing the use of compost, or reducing pesticide use.
- Rising incomes bring with them new problems, such as increased alcohol and tobacco consumption. They also mean that people may switch to less sustainable farm production. For example, increasing the use of tractors leads to less intercropping.
- Many of the erosion control structures were built with Cecoedecon's support and were designed by the NGO's engineer. It is essential to build the capacity of local people to build and maintain such structures after the NGO withdraws.

Lessons

Range of interventions The introduction of soil and water conservation technologies is not an end in itself. Rather, it is a means to an end: improving the level of prosperity in the village. For this, a range of other interventions was also necessary, covering water, health, education, community organizing, and so on.

Entry point The most appropriate entry point depends on the individual situation. In the case of Bhipur, it was necessary to start with relief work to overcome the immediate problem of drought. This led to longer-term soil-and-water conservation work to solve the underlying problem of water availability, as well as to interventions in other areas.

Organizational strengthening It is vital to build strong community organizations. These must be active and democratic, and not dominated by a particular group or faction within the community. It may be necessary to include a variety of activities – in crop production, livestock, health, etc., to cater to the needs of different sections of the community and to ensure their interest and involvement.

Networking Networking at district and state level is an important tool for sustaining the interventions. The community should be aware of its rights and should be able to lobby and advocate for them. A vibrant working relationship should be developed between community leaders and the government apparatus and elected representatives. Only a blending of all these elements can ensure sustainability of the project.

More information: P.M. Paul, pmpaul_2002@yahoo.co.in, or Alka Awasthi,
dralkaawasthi@yahoo.com , www.cecoedecon.org

The work of Cecoedecon is supported by Misereor and ICCO.

www.misereor.org

www.icco.nl

Landshaping for better livelihood for the Sundarbans

Ramakrishna Mission Ashrama, West Bengal

Lakshman and Kamala Das farm 5 *bighas* (about two-thirds of a hectare) of land on Chandipur Island in the Sundarbans – the Ganges Delta of West Bengal. They used to grow rice and vegetables, but it was not enough to feed their three children, and there was nothing left to sell. Their land in the village of Manmathanagar is flooded for half the year by rainwater, and in the dry season it dries out and becomes very salty. Nothing will grow.

Kamala used to try to earn some money by dragging a net through the crocodile-infested river, but the catch was small: a few fish and small prawns, which she would sell in the local market. She managed to earn perhaps Rs 1000 a year – not nearly enough to send their children to school properly.

That was five years ago. Today, the Das family has enough to eat, and even a surplus to sell. The children are at school, and they can afford to go to the doctor when one of them falls ill.

The Das family's life changed when Lakshman heard about a new technology called "landshaping". This meant digging a pond on his land, and using the soil to make raised beds where he and his wife could grow rice, fruit trees and vegetables, and build a chicken house. They could use the pond for fish and to keep ducks.

Lakshman learned about this new approach from Ramakrishna Mission Ashrama (RKM), a development organization based in Narendrapur, West Bengal. He attended a farmers' training course, where an RKM staff member described the approach. The participants had a chance to visit a farmer's plot in a nearby village. After the course, Lakshman asked RKM to help him and his neighbours introduce the approach on their own land.

RKM organized another training course for Lakshman and his friends in Manmathanagar. It would be too much work for a single farmer to do all the digging alone, so the group agreed to help each other. Over a period of 2 months, the group dug ponds and built raised beds on everyone's land. Now all they had to do was to plant trees, build a chicken house, and sow their crops.

Lakshman is very happy with the results of all this work. "My daughter has finished class 10 standard, and my sons will finish it very soon", he says. "Almost every day we have either eggs or fish to eat. My wife no longer has to go for risky work, and has enough time for rest. She is now an active member of her self-help group, is respected by all."

The Das family's story is by no means unusual in this isolated area of eastern India. More than 2000 families have used the landshaping approach to improve their lives. This approach was

Box 18 The Sundarbans

The Sundarbans, in the southernmost part of West Bengal, is the largest mangrove forest in the world. It is home to the rare Royal Bengal Tiger, as well as crocodiles that used to menace Kamala Das when she fished in the river.

More than 100 islands are scattered among a maze of rivers, rivulets and creeks, which merge almost imperceptibly into the Bay of Bengal. The area is rich in biodiversity, and shields the city of Kolkata from the power of cyclones that hit the area. But the mangroves and wildlife are threatened by humans: over half the islands have been deforested and settled during last 150 years, as people move in from West Bengal, one of most densely populated states in India.

The Sundarbans are only 80 km from Kolkata, but the roads are so poor that it takes more than 5 hours to reach even the nearest island. The area is subject to frequent cyclones and flooding. The soil and water are salty, and the land is below the high tide level. Inhabited islands are protected by a dyke at least 5 m high.

developed by RKM, which serves more than 500 villages in West Bengal. The technique resulted from a farming systems research project funded by the Ford Foundation, which tested the use of raised beds and ponds in the swamplands of the Sundarbans. During the 1990s, RKM conducted further trials in cooperation with German Agro Action and with the close participation of local farmers. The technique was refined several times to solve problems before RKM and the farmers were convinced that it would work.

Shaping the land

The landshaping technology (Box 19) takes a lot of work – about 50 person-days for 0.2 ha of land. For a group of 10 farmers, it takes 5–7 days to shape one farmer's land. They can then move on to the next farmer in the group.

RKM encourages the farmers to adopt the technology by paying them to work on others' farms. It does not cover the whole cost – in order to avoid a dependency mentality. Instead, it pays the farmers about Rs 1000 to excavate 1000 cubic feet of soil. RKM also arranges training on the landshaping technology, the farming system approach, duck-keeping, poultry keeping, fish-raising, vegetable cultivation, nursery management, and other technologies that the farmers are not familiar with. The NGO also provides chicks, lime to disinfect the pond, oilcake (used as fish feed), vegetable and tree seeds, to start them off with the new farming methods. It also advises the farmers during the first two years to help them learn the new skills and solve problems as they arise.

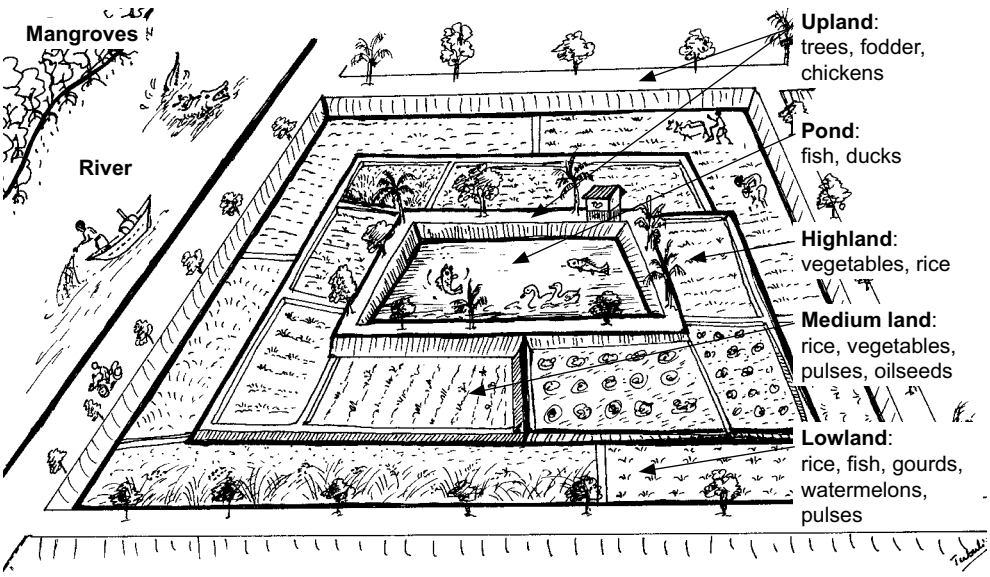
How much does this cost? For 0.2 ha, the cost is about Rs 15,000, of which about two-thirds is for labour, and the rest for inputs and training.

RKM has also introduced other technologies to help the farmers improve their yields and incomes. These include vermicomposting (making compost using earthworms), integrated pest management, green manuring, mulching, and the use of botanical pesticides instead of chemical ones.

Box 19 Landshaping: the technology

Landshaping involves creating a pond and a series of raised beds at various heights. The top 15 cm of fertile topsoil from the pond and areas that will form the raised beds is scraped off and piled up to one side. The subsoil from the pond is used to build the raised beds. The topsoil is then spread over the surface of the newly formed beds.

- **The pond** covers about 20% of the land area, in the centre of the plot. It is about 2.5 m deep – not too deep, or it will get salty. The pond catches rainwater, which is vital for domestic use and irrigation during the dry winter and summer seasons. It is used to keep fish and ducks throughout the year.
- The **"upland"** beds are about 75 cm high. They cover 5–8% of the land, and are built around the pond and around the plot borders. They are used to grow fruit trees such as coconut, guava, mango, and papaya, ladies' finger and other rainy season vegetables, fodder crops such as leucaena (*subabul*). The chicken house and timber trees such as teak are also put here.



- The **"highland"** beds are about 60 cm high, and are located wherever is convenient. They cover about 30–35% of the plot. They are used for vegetables in the rainy season and winter, and quick-maturing high-yielding rice varieties.
- The **"medium land"** is about 30 cm high. It is also in broader beds in convenient locations, covering another 30–35% of the plot. It is generally used for medium-duration, high-yielding varieties, winter vegetables, pulses and oilseeds.
- The **"lowland"** covers the remaining 10% of the land, and is left as it is. It is used for long-duration traditional rice varieties, rice–fish culture, and (in the summer) gourds, sunflower watermelons and quick-growing pulses.

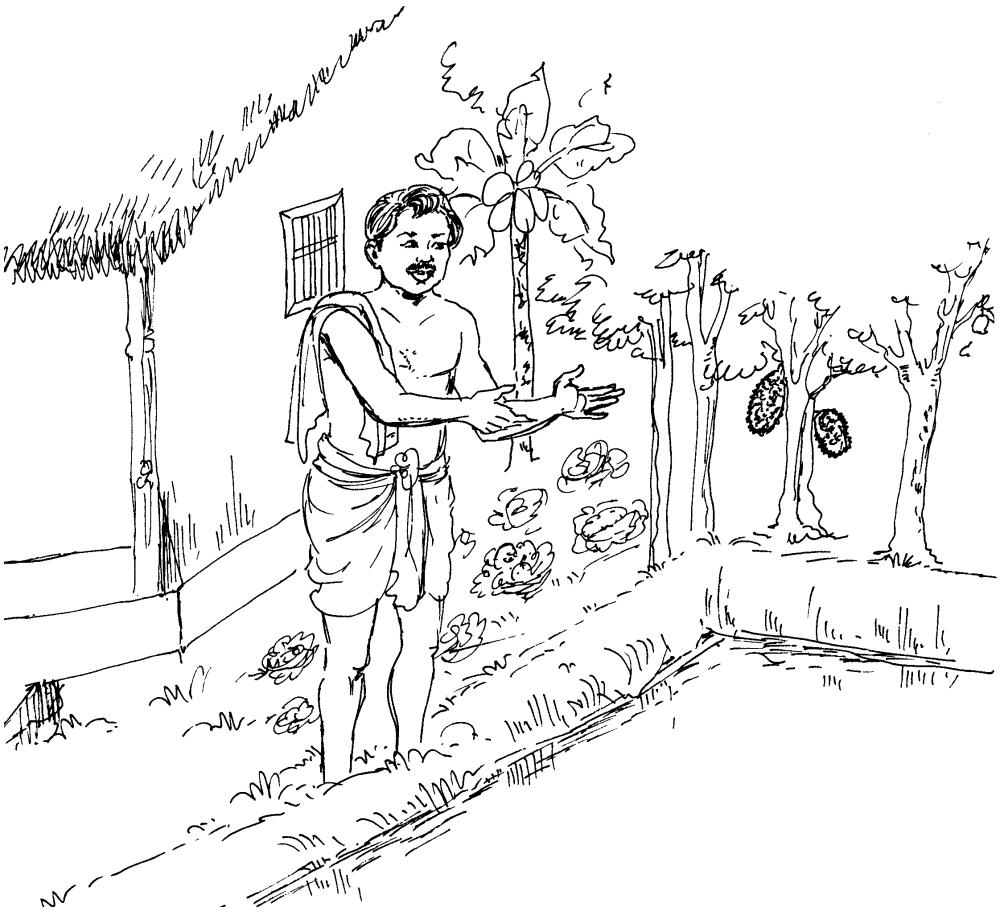


Figure 10 Lakshman Das can harvest a range of crops as well as fish from his landshaped farm

Impacts

Landshaping is having a major impact in the Sundarbans (Table 8).

- The agricultural production of the landshaped area has risen by 40–50%. The number of crops a year has gone up, farmers are planting a wider range of crops, and families have more and better food to eat throughout the year. They even have a surplus they can sell.
- Families now have water throughout the year that they can use for washing and cooking, as well as for irrigation, fish-raising and watering animals.
- The farmers have formed groups to market their crop surplus. They can buy inputs such as seed and fertilizer as a group, and they organize training so they can learn new skills.
- Crocodile attacks on women have fallen dramatically as very few women now drag the riverbed for fish.
- The environment has benefited too: the farmers can use leucaena branches and rice

Table 8 Changes to a typical farm after landshaping

	Before landshaping	After landshaping
Crops grown	Long duration tradition rice, some vegetables. Low yields (eg, 1000 kg/ha of rice)	High-yielding rice, traditional rice, rainy season vegetables, winter vegetables, summer vegetables, fruit trees, timber trees, pulses, oilseeds. Higher yields (e.g., 2500 kg/ha of rice)
Cows	2	3–4
Chickens	3–4 local chickens, free range	15–20 Rhode Island Red etc. birds (small poultry house)
Ducks	None	10–15 ducks
Fish	Fish from river	Fish from pond throughout year
Irrigation water	From roadside ditch	From pond throughout year
Compost	Very little	Vermicompost pit
Farm income (0.2 ha)	Rs 9000 per (€180) year	Rs 39,000 (€780) per year

straw as fuel, so no longer have to go into the forest to collect wood. They also do not need to hunt animals in the forest because they have plenty of eggs and fish. The river ecosystem has recovered because the women no longer trawl it for tiny fish and other aquatic species.

- People now do not have to migrate to the cities in the dry season in search of work. They can earn enough from their land the whole year round, and can even start to employ other people to some extent.

Scaling up

Landshaping is a simple technique, based mainly on local inputs. The main investment is labour – which is ample in this area of high population and high unemployment. Farmers who have seen the benefits of landshaping are beginning to adopt it spontaneously: they either start digging a pond by themselves, or they approach NGOs working in the area for assistance. In addition, RKM is now trying to upscale the approach to almost all feasible villages of the Sundarbans.

Initially RKM demonstrated the landshaping technique in five villages. It has since spread to more than 2000 farm families in more than 40 villages. Other major NGOs have also started using landshaping in their work.

RKM lobbied with the state government to introduce landshaping on a wider scale. RKM staff sit on the Sundarbans Development Board, a state-level agency. The Minister for Sundarbans Development and Board members have visited several sites supported by RKM and other NGOs, and came away impressed. They decided to initiate a government landshaping programme to sponsor 1000 farmers in over 120 villages throughout the Sundarbans to

introduce landshaping in the first year. This is still a small percentage of the nearly 600,000 families living in the area, but is a start. If it is successful, the programme may be extended further.

Community landshaping

Landshaping is a good technique to increase production in individually owned plots in these difficult areas. But it cannot touch 70% of the population in the Sundarbans: these people own too little land, or none at all. What can be done to help them?

RKM has started adapting the technique to land that is owned by the community rather than by individuals. This involves shaping a larger area of land, and negotiating with tribal and other weaker communities rather than with individuals or small groups. This brings in a host of complications: shaping a larger area may mean problems with seepage of saline water from a nearby river. It also risks involving local politics, which can be very complex. People are not used to using and managing community ponds, so there are cultural and social issues too. Patience and a long-term view will be needed to adapt this approach successfully to such areas.

More information: Manas Ghosh, RKM, rkmlpndp@cal.vsnl.net.in

The work of Ramakrishna Mission Ashrama is supported by German Agro Action.

www.welthungerhilfe.de

Working across levels in watershed management

Indo-German Bilateral Project

NO COUNTRY INVESTS MORE money in soil and water conservation programmes than India. But the results have not met expectations. Why not? Problems have included unrealistic goals, centrally determined guidelines, corruption, bureaucracy, lack of efficient land use plans to avoid overgrazing, insufficient participation by local people, poor maintenance, and the fact that projects often favoured relatively well-off farmers rather than the poorest.

The Indo-German Bilateral Project (IGBP) was designed to overcome these problems. It ran from 1985 to 2005, and aimed to promote sustainable watershed management and rainfed agriculture by helping a wide range of institutions to assist local communities to develop and manage small watersheds. These institutions included local governments, state authorities, NGOs and other civil institutions. The project also aimed to feed experiences into the national policy debate and development guidelines.

More than 65% of all households living in such watersheds subsist below the poverty line, with women representing a clear majority of the project beneficiaries. The nine IGBP project watersheds were selected as representative of all India, so the solutions that emerged would be applicable throughout the country.

IGBP worked at three levels:

- **Local** The project worked in nine small watersheds in four states in India: Uttaranchal, Uttar Pradesh, Rajasthan and Andhra Pradesh. It developed innovative models for technical and socio-economic implementation, as well as simple, replicable ways to monitor impact in a participatory way.
- **State** State government agriculture and forestry departments and 13 NGOs were responsible for technical implementation. Vikasa (page 108) was one of the NGOs involved in implementation.
- **National** The project provided policy consultancy services to the national government and helped transfer the experiences into the policy making process. The executing and financing agency was the Natural Resource Management Division of the Ministry of Agriculture.

The project was financed and supported by GTZ and KfW from Germany (about €50 million) and by the Indian Government (about €3 million). This translates into an investment of about Rs 7,000–10,000 per hectare in the watersheds.

Traditional watershed management covers natural resource management and livelihood improvement. IGBP went beyond this: it added participatory impact monitoring, capacity building and institutional development and diversification.

Box 20 Indicators of success in the IGBP project

Four targets were chosen to evaluate the success of the IGBP project:

- **Revised guidelines** for watershed management programmes, including diversified implementation strategies and a renewed impact evaluation system in at least two districts.
- A 30% increase in **vegetative cover** in the rehabilitated watersheds compared to neighbouring districts.
- A 20% increase in the availability of certain **consumer goods** in the project areas.
- A 25% rise of the **groundwater level** in the rehabilitated watersheds compared to neighbouring watersheds.

Like other projects, the project promoted the sustainable development of watersheds and sustainable agriculture to overcome food insecurity. It supported water harvesting, soil and water conservation, and biodiversity maintenance. It advanced economic development by generating employment opportunities and aimed to upgrade marginalized communities.

IGBP also strongly promoted the management and administration of watershed programmes by the communities affected. Local NGOs and communal authorities cooperated in the work, but often lacked the ability to manage watershed programmes. The project helped build the capacity of these institutions to do so. It paid special attention to gender issues and women's empowerment.

The project also developed and tested ways to monitor impacts in a participatory way, diversified the range of institutions involved in watershed work, and transferred responsibility for implementation to local committees. It contributed to a toolbox of such approaches that other programmes can apply elsewhere.

The project created a platform to exchange experiences and broaden the knowledge base of the executing agencies. All results were made available to the communities and decision-making bodies. This created awareness of the potential of watershed management and sustainable agriculture, facilitated the replication and scaling-up of good practices elsewhere, and helped achieve the Millennium Development Goals.

Activities

IGBP embraced a wide range of services:

- Consultancies at different levels
- Training and capacity building to enable partners to work in efficient, transparent, technically correct, participatory and innovative ways
- Financial support and provision of equipment to strengthen self-help groups and implement specific measures and practices.

The project provided these services at three different levels: local, state and national.

Local initiatives

The project tested and implemented participatory development measures in small watersheds. It supported self-help groups financially and through technical advice, facilitation and equipment provided by partner organizations. The project developed simple ways to monitor impact, build capacity and strengthen self-help groups, and to implement income-generating measures and pilot farming activities, conservation activities and reforestation.

Conservation measures included building retention structures in drainage lines, dams to reduce silting in waterways and reservoirs, farm ponds, percolation tanks, vegetative stabilization, and measures to reduce surface runoff. Digital equipment to monitor siltation was installed; they were less expensive and more likely to be taken over by the local governments than remote sensing-based systems. Other natural resource management measures included the introduction of smokeless stoves and solar cookers.

The project helped farmers increase their output by applying good agricultural practices and introducing new vegetable, fruit and medicinal crops. It introduced farmers to bunding along contour lines, the use of small biogas plants, and vermiculture (compost made with earthworms). It encouraged farmers to grow more fodder and to stall-feed animals to reduce overgrazing of pastures. It assisted communities to develop an integrated land management plan and put it into practice, and to create agribusinesses to improve access to markets.

The state government organizations and NGOs who worked with the communities used a range of participatory methods, including individual farm and project planning, stakeholder and problem analysis, and village-level counselling. The project fostered the formation of 150 self-regulating community groups to maintain the conservation activities and other measures.

The indicators chosen to measure the ecological and socio-economic impact of watershed management were soil loss, groundwater levels, children's height for age, possession of selected consumer durables, school attendance, use and maintenance of construction, outsiders' perception and social capital.

State-level initiatives

At the state level, IGBP stimulated the diversification of implementing institutions and agencies. Government institutions were responsible mainly for providing infrastructure and other structural measures; they worked mainly on government-owned forest land. NGOs were concerned with social mobilization and the initiation and support of self-help groups; they worked on private and common land. This collaboration enabled the government agencies' technical know-how and skills to be combined with the NGOs' competence in promoting self-help activities. Both institutions had the opportunity to introduce innovative activities that went beyond normal watershed issues and created livelihood opportunities for the local population.

The government institutions and NGOs met regularly to discuss and monitor project activities. IGBP evolved a set of "guiding principles" that enabled the government units and NGOs to relate their work to the results expected, and to work out an annual plan of action.

Earlier soil and water conservation treatments of the state government departments have been implemented only in forest areas and without the involvement of the local population. IGBP provided an opportunity to broaden the scope of those activities. For example, it facilitated the government units to implement other innovative measures that could not be attempted before due to the limited list of activities and the fixed cost norms of the government.

National initiatives

At the national level, the project's results were channelled into government regulations and development guidelines to make them available to a wide range of national programmes. This made it possible to scale up aspects of the work throughout the country. The Indian government's "common guidelines" draw on IGBP's experience and place special emphasis on the development of participatory methods for impact monitoring.

Impacts

Surveys revealed significant improvements in residents' livelihoods in all nine watersheds supported by IGBP. The degradation of natural resources in all watersheds was reduced or even halted. The use of participatory approaches throughout the project was a strong factor supporting the involvement and contribution of local people in the project activities. Local groups gained a sense of ownership for the conservation measures implemented, and continue to do so on their own initiative.

Socio-economic

The IGBP project helped stabilize crop yields and food security in the nine watersheds. It also increased the availability of irrigation and drinking water. Water retention capacity rose by 20% to 30%, while surface runoff decreased by the same amount. Up to 80% of the rain falling in the watersheds can now be captured and used.

As a result, farmers were able to increase the amount of land they irrigate; they can now grow a second crop, and they are less vulnerable to drought. They raised their cropping intensity and productivity per unit by about 20%. The workload of women declined because drinking water is cleaner and more accessible.

The project helped local people form self-help groups to stimulate the non-agricultural economy. By raising local participation in watershed activities, it contributed to decentralization and strengthened local administration.

Reclaiming degraded land increased the area of farmland and food output. Farmers began using low-cost, low-input production methods recommended by the project. Growing fodder reduced the problem of overgrazing. Better management of water, soil and crops significantly increased the land productivity: production of cereals, especially wheat and rice, increased fourfold in some places, and farm incomes rose accordingly. In addition, new income sources included new crops such as fruits, vegetables, medicinal plants and high-yielding rice varieties. Farmers are now more self-sufficient: small-scale farmers can feed their families for 6 months

of the year (up from 2 months); medium-scale farmers produce enough for 10–12 months (up from 6). This is much higher than in the neighbouring control watersheds.

Increasing off-farm employment and new opportunities to earn money cut migration away from the villages.

Women organized themselves into self-help groups. They took part in literacy courses and used small loans to take up economic activity. Small businesses also took out loans to expand their activities. In 24 villages, 40 self-help groups took out loans totalling Rs 700,000 (about €17,000). Some 550 women were members of such groups. Employment in the rehabilitated watersheds rose from 8,000 to 30,000 person-days a year. School attendance by children also rose.

Socio-cultural

The project encouraged local people, especially women, to get organized and to help themselves. Women were heavily involved in income generating activities, took advantage of loans and other financial services, and participated more in social life.

The project raised environmental awareness among local people. They now have greater understanding of the long-term effects of exploiting natural resources and of the superiority of sustainable agriculture over extractive cultivation methods.

Training and group activities motivated people to develop their own prospects for improvement. The villagers developed their ability to solve problems in cooperation, discussed the conflicting interests of different groups, and sought win–win solutions that were satisfactory for all involved.

Technical

On the technical side, the project developed a set of impact monitoring tools and locally defined impact indicators. These include ways to detect change in vegetative cover over time based on remote sensing data, identify variations in groundwater levels using simple devices, and using school registration as an indicator for family wellbeing. These tools and indicators are easy to apply and can be adopted in other watershed schemes.

Technologies such as conservation measures and composting resulted in a visible yield increase. Many farmers in areas neighbouring the pilot watershed areas spontaneously copied these methods.

Ecological

The project had a positive overall ecological impact. In all the pilot watersheds, the availability of surface water increased, soil erosion was cut, and biodiversity rose. The area covered with permanent vegetation rose by 60%, while it was still falling in neighbouring regions. The silting of lowland areas and reservoirs was reduced.

Institutional

The IGBP project played an important role in developing and testing innovative implementation methods. It was a national leader in the areas of impact monitoring, diversification and multiplication of locally implementing groups and institutions. It contributed to a process of reforming the watershed development sector, and demonstrated how the agencies involved can increase their efficiency while staying within budgetary constraints. The combination of governmental and non-government institutions in the local projects and the division of labour between different actors was trend-setting. Governmental institutions and NGOs used a platform created by the project to communicate and exchange experiences and information on a regular basis.

Due to the scope of the project and the application of innovative technology, considerable need for training and capacity building existed, and still exists. This is being addressed under a new scheme.

Helping and hindering factors

Factors that supported the project include the following.

- **Participatory monitoring** Abandoning the traditional technical monitoring practices in favour of participatory methods was one of the main factors fostering the IGBP project's success. Participatory management of the watersheds, which connected local NGOs and self-help groups to administrative bodies, was essential to accomplish the maintenance of the conservation structures. All social levels of the beneficiary group were represented on the implementing committees. Putting the target group itself in charge and giving them responsibility for project success ensured sustainable management.
- **Information exchange** IGBP worked closely with other donors and watershed management projects. Together they formed a platform to exchange information and experiences, so creating synergies which had a positive influence on all partners. Working together, the institutions involved in watershed management were able to increase their influence on the policymaking process and on the economic framework. The fact that the project was assigned to the Ministry of Agriculture provided the opportunity to influence policymakers in a way which ensured long-term success.
- **Government–NGO collaboration** The division of labour between governmental and non-government actors also fostered success. The government units provided financial capacity and technological know-how, while the NGOs brought social knowledge and ability to organize self-help groups. Each concentrated on its own field of expertise, but constantly exchanged experience. To be most effective, the NGO should begin its work ahead of the government units so it has time to explain the project's objectives and prepare the community for participating in the project. The IGBP selected smaller NGOs to work with: larger NGOs have their own agenda and may not be as willing to implement the work as required under their contract with the project. IGBP is not the only watershed management project in India to have worked successfully with local government and NGOs on a collaborative basis; another is the Indo-German Watershed Development Programme in Maharashtra.

- **Local people's openness to new ideas** Another factor contributing to the success of the IGBP was the acceptance of new crops, practices and measures among the beneficiary group.

Factors hampering success included the following.

- **Local social and power structures** Social structures of power and caste affiliation obstructed the goal of poverty alleviation. Though watershed programmes can contribute to reduce rural poverty, it is beyond their scope to overcome traditional social barriers between land owners and the landless. The main beneficiaries of a watershed management project are the land owners. People with fertile land in the valleys or with access to wells benefit more than people living in the upper watershed. The former are still small-scale farmers, and they usually do not meet their own subsistence requirements. But they are not the "poorest of the poor". IGBP's focus on water harvesting and drainage line treatment increased these inequalities.
- **Relative importance of farming** Since families that have land earn half their income from off-farm labour, it is unclear how far the project's agricultural measures affected household incomes. One might expect that watershed management measures alone would have a limited impact.
- **Need for alternative employment** More off-farm employment opportunities have to be created. The project realized this, and promoted self-help groups to address it. But many obstacles remained: indebtedness, a lack of investment capital, little access to credit, dependency on middlemen, and difficulties in identifying viable business opportunities. The self-help groups depended on the help and advice of NGOs, which in turn were unacquainted with the markets and lacked business development skills.
- **Interaction with other government agencies** Interaction with government agencies other than the Ministry of Agriculture was limited. Although the project had considerable influence on the national debate and the formulation of common guidelines, the potential to scale up the approach has not yet been fully exploited.
- **Local political interference** On a local level, political and interest groups interfered with the project. Implementing institutions sometimes competed with each other for influence in the project and the pilot regions. In rare cases, the implementing agencies encountered a lack of interest among the intended beneficiaries.

Lessons and recommendations

In view of the project's aim to feed its experiences into the policy debate and into national development guidelines, it was an advantage to be located at the Government of India level. The experience with contribution to the policy debate was largely positive.

However, being involved in a centrally sponsored scheme reduced the project's flexibility and independence. Good experience was made with the division of responsibilities between NGOs and government institutions, and with the involvement of beneficiaries at different stages of the project cycle. The project confirmed that a participatory approach is the most promising strategy to ensure long-term sustainability.

The project contributed to the Millennium Development Goals of reducing poverty (MDG 1), providing equal opportunities for men and women (MDG 2) and protecting the environment (MDG 7). It showed that it is possible to reduce soil erosion and maintain fertility, increase water availability and food security purely by means of good agricultural practices. It demonstrated the potential of low-external-input agriculture and the ability to achieve maximum outputs by minimum interference simply through conservation practices. Improved rural livelihoods and positive effects on the environment showed the viability and potential of these technologies and approaches.

IGBP helped alleviate poverty by developing innovative approaches and feeding them into mainstream watershed management and policy making. The project developed good relations with institutions and major players at national, regional and local levels. It demonstrated that watershed projects are best implemented through a multi-stakeholder approach: a cooperation involving governments, NGOs and communities. This approach offers excellent potential for scaling up and replication.

The project created awareness of the effectiveness of participatory methods, and its experiences have been incorporated into the Indian government's "common guidelines". It developed several monitoring techniques that can be used in other projects: ways to measure technical effectiveness (e.g., groundwater levels in shallow wells), ecological effectiveness (e.g., development of vegetative cover), and social effectiveness (e.g., nutritional standards, education, access to consumer goods).

More information: www.watershedindia.50megs.com

The work of the Indo-German Bilateral Project was supported by Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) and the KfW Development Bank.

www.gtz.de

www.kfw-entwicklungsbank.de

Government–NGO collaboration in the Kinchumanda watershed

Vikasa, Andhra Pradesh

The Kinchumanda watershed is hard to find on a map. Nestling in the Eastern Ghats, in Dumbriguda Revenue Mandal in Visakhapatnam District, a few miles from the Orissa–Andhra Pradesh border, it's a remote place. It's heavily eroded, too. The hills have been denuded of their trees, allowing rainstorms to wash precious topsoil down the slopes. The declining soil fertility lowers the crop yields, and the loss of trees means that people find it harder to collect enough of the forest produce they used to rely on for much of their livelihood.

The Kinchumanda watershed is achieving national prominence, though. Chosen by the Indo-German Bilateral Project (page 100) for attention because of its severe erosion and strategic location in the Sileru/Machkund river catchment, the watershed was focus of a joint effort by the government and Vikasa, an NGO based in Visakhapatnam District, to control erosion, enhance the soil fertility and help local people improve their lives.

The watershed covers 1033 hectares at altitudes of 1300–1680 m. It is home to 766 people, or 155 households, belonging to five indigenous tribal communities known as the Nookadora, Khotiya, Konda Kammari, Bhagata and Valmiki. They follow their traditional customs diligently and are proud of their festivals. The households own an average 1.55 hectares of farmland each, but much of the land is poor – it is stony, or on steep slopes.

Twenty-eight of the families have no land, but in a unique tribal practice, families that have land traditionally let landless families cultivate it for no financial remuneration. This means that people are not forced to migrate away in search of a job elsewhere.

Local people used to practise shifting cultivation in the watershed. They would leave land fallow for many years before clearing fields and growing crops for a few seasons. They would grow sorghum, rice, millets, red gram, cowpea, kidney beans, niger and other beans. They then moved on to clear a new patch of forest, allowing the soil in the old fields time to regenerate. They also went into the forest to collect items to use, eat or sell: wood, leaves (used to make plates), tamarind, nuts, medicinal herbs, and so on.

But recently, people have started cultivating the same fields permanently. They still grow the same crops, keep sheep, cows and chickens, and go into the forest to gather what they can find. But more intensive cultivation has brought with it the problems of erosion, declining soil fertility and over-exploitation of the forest.

Some of the land in the watershed area is owned by the people who live there; the rest is classified as forest land, and is managed by the State Forest Department. This department has the mandate to protect the forest, but had no power to prevent local people trying to make ends meet from cutting trees.

Box 21 About Vikasa

Vikasa has worked in 4 *mandals* (blocks) of Visakhapatnam District, Andhra Pradesh, since 1988. It is involved in community-based watershed, agroforestry, micro-watershed, and community forest management programmes.

Vikasa has received accolades from the central and state governments and civil society for its efforts to green wastelands and develop agroforestry. In 1997, it was given the Rajiv Gandhi Patri Bhumi Mitra Award constituted by the Ministry of Rural Development, New Delhi, for its contribution to wasteland development.

NGO–government coordination

A key aspect of the Indo-German Bilateral Project was collaboration between NGOs and governments. As part of this larger project, Vikasa shared responsibility for activities in the Kinchumanda watershed with two Andhra Pradesh government departments: forestry and soil conservation. It was necessary for these various institutions to agree on a framework for activities, so first they met without the villagers present so they could determine who would be responsible for what aspect of the work. The government departments agreed to focus on areas in the watershed officially classified as forest lands – where they would reforest the hills, build masonry structures to manage runoff, and work to control gullies. Meanwhile Vikasa, with its strong community organizing skills, would work on privately owned land, organize local people to take part in the conservation works, and coordinate the implementation of activities in the villagers' fields.

At first, the government departments decided what to plant on the forest lands without consulting the villagers. When Vikasa started its work a little later, it made sure to keep the villagers informed about the government's work, and more involved in it. As a result, relations and cooperation between the government staff and the community improved. After the forest had recovered somewhat, local people were permitted to cut some branches for fuelwood. They were not allowed to cut trees.

Vikasa and the government departments operated a combined monitoring system and held regular monthly meetings and quarterly field visits to monitor activities in the community. The IGBP and the Ministry of Agriculture held joint review meetings at national level twice a year involving all partner state government departments and NGOs participating in the project. IGBP provided technical inputs to both the NGOs and the Forest Department. This enabled the IGBP to act as a catalyst to improve coordination between Vikasa and the government.

Just after the Vikasa–government project began, a separate programme on joint forest management, funded by the World Bank and the Forest Department, started in the same watershed. This programme established forest protection committees in the communities, and granted local people the right to all of the produce from the forest. The committees also took charge of monitoring and maintenance activities. It was a coincidence that this programme started almost at the same time as the Vikasa project. By the time it got under way, Vikasa was well involved in its community work in the villages, and was able to help organize local people to become involved in the programme.

Planning and training

Vikasa had not worked in this community before, so the first task was to get to know local people and to build rapport with them. Vikasa organized regular meetings with the community and started discussing the concept of a watershed approach with them. It used participatory appraisal and village-level planning methods to enable the villagers to decide what should be done.

The NGO also organized a range of activities to raise residents' awareness and knowledge of watershed issues. These included cultural programmes, community meetings, street plays, and exposure visits for local people to various organizations working on natural resource management, vegetable cultivation, wasteland development, etc. Vikasa also arranged training sessions on composting, cultivation of different kinds of vegetables, joint forest management, watershed structures, as well as on capacity building, leadership, accounting and bookkeeping.

Promoting good practices

In consultation with the communities, Vikasa introduced a range of improved practices to improve agricultural production in the watershed.

Soil and moisture conservation works These included graded bunds, staggered trenches and contour stone bunds, land levelling and loose-boulder structures. The gullies were treated with rock-fill dams, check dams and spillways, reducing erosion. Over a period of 4 years, all the villagers' farmland was treated. The work started out with trials in a couple of villages, but there was so much interest that it was later possible to involve all the farmers across the eight villages in the watershed.

Compost Traditionally the farmers would take cow dung out to their fields in baskets, then spread it on the soil in a haphazard way. But heavy rains would wash away the dung before any seed could be sown. The project introduced composting as an alternative. It supported 60 families to dig compost pits, and another 30 families did so after seeing the benefits.

Soak pits Stagnant water around the village allows malaria-carrying mosquitoes to breed. Every year the malaria season starts with the monsoon rains; people are too ill to work on their farms, so cannot grow as much food. To address this problem, Vikasa encouraged local people to dig soak pits to allow the stagnant water to seep into the ground. Forty pits were dug for the use of 70 families.

Tapping spring water Local people used dirty water from ponds and streams for drinking, washing, watering animals, and so on. Vikasa encouraged them to build walls to protect the springs, so ensuring the water is uncontaminated. Animals were allowed to drink lower down the stream. Five springs were protected in this way, benefiting five of the eight villages. In the other three, the government dug wells to provide drinking water.

Vegetable cultivation The farmers used to grow only grains and pulses, which can be dried and stored easily. They did not grow vegetables, which are perishable, so their diets were limited. The project introduced vegetable cultivation in a big way: it provided all local families with seeds of carrot, cabbage, cauliflower, tomato, chillies, and eggplant. That enabled them to grow a reasonable amount of vegetables to eat, as well as some surplus to sell. This

Figure 11 Compost making is an important part of maintaining soil fertility

vegetable seed was provided out of a revolving fund: farmers borrowed money, which they then repaid so the funds could be used to benefit other families in the watershed.

Trees and fences Nearly 80 farmers planted mangoes on land that had been fallow before the project began. This land was highly eroded, but after conservation methods were applied and the trees were planted, it revived amazingly. The farmers have started intercropping maize, sorghum and other crops between the young trees. Other farmers have planted *amla* (Indian gooseberry), guava and sapota trees.

The farmers used to fence their land with tree and shrub branches. That damaged trees in the forest, and the fences had to be replaced periodically. The project introduced live fencing using agave, a spiny plant that produces a fibre in good demand in the market.

Treadle pumps It is difficult to irrigate fields in the area because there is no electricity, and diesel engines are expensive to buy and run. Vikasa provided local people with four pedal-operated treadle pumps that can lift water to irrigate small areas.

Developing village institutions

Strong village institutions are vital to ensure that watershed activities are sustained. A watershed committee was formed to maintain the conservation works and to manage the watershed fund created through community *shramadan* (voluntary labour). The committee is composed of men and women from the eight villages, and includes landless people.

Women have formed savings-and-credit self-help groups in all eight villages. The government provided them with some monetary support, and the project also gave financial support to some of the groups, as well as training them in accounting and bookkeeping.

Vikasa took up livelihood activities with various vulnerable groups: local women engaged in sheep rearing, while the watershed fund provided landless people with bullocks they could use to earn some money by ploughing.

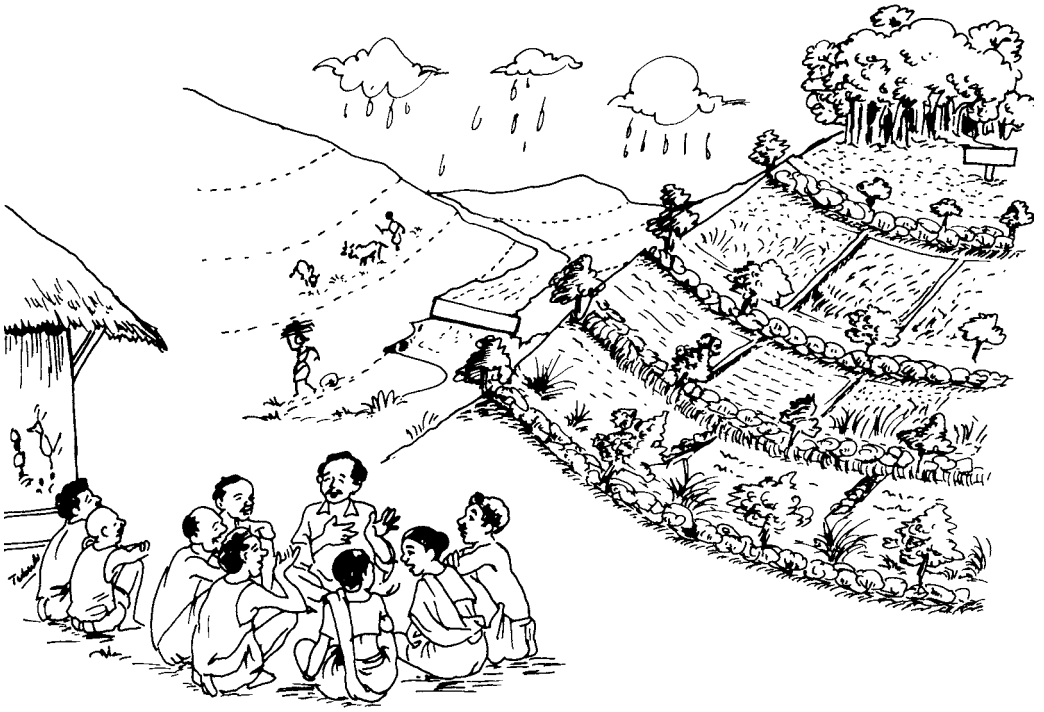


Figure 12 Village institutions are key to sustainable development

The NGO also collaborated with the Integrated Tribal Development Agency to help local people approach other government bodies for services such as education and health, and to promote the status of women.

Impacts

Soil and water conservation The gully treatment and bunds on farmland slowed down the flow of water and stemmed erosion, leaving clear water running in the streams. Groundwater levels improved considerably, and streams now flow for a longer period during the year. Overflow tanks at the natural springs now hold clean drinking water. There is more drinking water for animals too.

Crop production The improved soil fertility and moisture levels raised crop and fodder production (Table 9). Fallow land was brought into cultivation, resulting in more work for both farmers and landless people.

Forestry The tree cover has risen considerably as a result of the community forest programme in the reserve forest area. Local people say that there are now slightly more peacocks, other birds and monkeys in the area.

Economic benefits Local people now earn more because their yields are higher and they have planted more types of crops. As a result of the increased demand for labour, the wage rate has risen from Rs 30 to Rs 40 per day.

Table 9 Increase in yields due to soil and water conservation in watershed villages

Crop	Before project (kg/ha)	After project (kg/ha)
Paddy	625	1000–1250
Coarse grains	500–750	1250
Samalu (little millet)	250	500
Pulses	250	500
Niger	125	250

The watershed fund amounts to Rs 308,823, or Rs 2000 for each of the 155 families in the villages. This was possible because the people decided themselves to save Rs 10 out of their daily earnings and use the money for post-project activities. The funds revolve among the farmers of the eight villages. The fund aims to enable its members to maintain the soil-conservation works and to invest in crop production.

Twelve farmers used to practise shifting cultivation, which damages the environment as it involves indiscriminate cutting of trees. This has stopped completely, as the project interventions have taken care of the land and monetary needs of the farmers through watershed works and other incentives.

Some farmers have made enough money from their plots to lease extra land – some of which was previously unused. The project provided sheep to some landless farmers, who have earned enough to lease land to cultivate.

Social benefits The common fencing, the seed bank and the various other activities begun under the project have resulted in more interaction, social cohesion and unity within the community. Traditionally women play a vital role in the community; they control money and decide what to buy for the family. The role of women has increased with their membership of the village committees. Their confidence has risen considerably now they meet with staff of various government departments and banks to obtain services and financial support. It was important to include landless people in the project to ensure that these poorer members of society also benefited from an apparently land-based project.

Other benefits The number of *pukka* (tiled) houses has risen as people have become better off. Many families have bought farm animals, utensils, as well as items such as gold, wristwatches, radios and tape-recorders with their earnings.

The villagers (especially children) are healthier as a result of the better, more diverse nutrition and fewer malaria infections.

Sustainability and spread People from neighbouring villages have started applying the soil and water conservation works in their fields, without any support from outside. To Vikasa's knowledge, 57 families across four villages have done so. After the end of the project's 5-year involvement, the community has taken over the management of the various activities.

Lessons

Various factors supported and hindered the project activities. The community is homogenous; local people rely on farming, and have no tradition of migrating in search of work. They work hard, and already knew something about soil conservation techniques. They were willing to try out and adopt the practices suggested through the project. There was some initial resistance (reportedly motivated by local political factions), but Vikasa's transparent approach and frequent visits by the field team were able to overcome this.

Collaboration with the government departments was very good, despite some problems caused by the frequent transfer of staff and the lack of time that officials had to devote to project work. Without collaboration, it would not have been possible to do any conservation work in the forest land. The proximity of the government department office to the project area made for easy communication. The collaboration with the Forest Department's soil conservation unit and other IGBP partners enabled Vikasa to promote new technologies (check dams, percolation tanks, spillways) with the participation of the local communities. Previously unknown locally, Vikasa was also able to gain recognition through its work with the government in the area. Vikasa is still collaborating with the government in activities other than the IGBP project.

More information: P Viswanadh or K Srinivas Kumar, Vikasa,
vikasa_india@yahoo.com or vikasa@rediffmail.com, www.vikasaindia.org

Vikasa's work in the Indo-German Bilateral Project was supported by Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) and the KfW Development Bank.

www.gtz.de

www.kfw-entwicklungsbank.de

Realizing the potential of land and water management

Farmers in vast areas of India face problems of managing land and water. Many live in dryland areas, without irrigation, in easily eroded hilly areas. Others farm areas where there is too much water: low-lying lands that are easily flooded. The problems are enormous, but then so is the potential for improvement.

Potentials

The benefits of improved land and water management in upland areas are double: people in the uplands benefit from conserved soil and more water. People downstream benefit too, from less flooding, cleaner rivers, and less silt clogging irrigation works. Here are some of the potentials.

- **NGOs as facilitators** NGOs can implement watershed management projects efficiently by involving the community effectively. Using their facilitation skills, NGOs can ensure that land and water management projects serve the needs of local people, and involve them in all aspects of planning and implementation. This helps ensure that local people buy into and contribute to the projects, help sustain the activities, and ensure their long-term success.
- **Ensuring women's involvement** Women are typically the ones who collect water, manage the household and do much of the farm work. They are the main group to suffer from water scarcity and misuse. So local women should be centrally involved in making decisions about water resources, and in planning, implementing, monitoring and maintaining all watershed activities. This will help ensure effective protection and maintenance of water resources, increase farm productivity and promote income generating activities.
- **Using indigenous knowledge** Rural people have abundant indigenous knowledge on natural resource management, agriculture, health, livestock management and other subjects. This indigenous knowledge should be identified and used in watershed projects. New ideas should build on what people already know so they can understand and accept it readily.
- **In keeping with nature** Watershed management that is implemented in a nature-friendly way enhances biodiversity and increases the amount of biomass, raising productivity and producing food, fuel and fodder. As its name implies, watershed management treats the watershed as natural unit, in an integrated way, so simultaneously conserving soil and water.

- **Building on local organizations** Local people are members of local organizations: women groups, savings groups, youth associations, farmers' groups, water-users' associations, *panchayat raj*, and so on. By building on these organizations, watershed projects can gain the local strength and resilience needed to sustain activities into the future.
- **Focusing on food security** Effective watershed management increases the availability of water and enhances the soil fertility. Small-scale and marginal farmers focus first on growing enough grain to feed their families. Appropriate approaches can help them ensure their food security and that of their neighbours, grow a surplus to sell, and also grow other foods and raise livestock to improve their overall nutrition.
- **Livelihoods for the poor** A great number of rural people in India have between 0.5 and 1 ha of land. This land is generally not very productive because they cannot invest enough money or labour in it. Projects that aim to serve all such people within a watershed stand to bring about a lot of change in their lives: improve their crop and livestock production, provide employment to landless people, generate new opportunities to earn money, and stimulate the local economy.
- **Expansion of the area served** Despite the emphasis on watershed activities in India, there is still a huge area to be served, and to be served better. A large percentage of India's rural people stand to gain from such interventions.
- **Concern for rights** Watershed projects can benefit greatly from a rights perspective – ensuring that women and other marginalized groups are aware of their rights, and empowering them to organize, find their voice and press for justice.
- **Reducing tensions** Tensions around water are increasing, at a local level, as well as between states. Effective implementation of watershed approaches helps make more water available for all, so reducing political tensions and bringing harmony and unity within and among communities.

Constraints

The government recognizes many of these potentials. Indeed, watershed management has become one of the major approaches to tackle resource degradation and improve rural livelihoods in India. However, the results so far have not met expectations, and good practices have not been disseminated widely. Here are some of the constraints.

- **Funding** Problems include insufficient funding, delays in fund transfer and in expenditure, and diversion of funds to other projects.
- **Comprehensiveness** There is a tendency to focus on the number of watersheds covered, rather than ensuring that each watershed is comprehensively treated. The budget allocated for each watershed is insufficient to cover it comprehensively.
- **Neglected areas** The government's criteria for selecting watersheds are based on low rainfall. This excludes certain areas with high rainfall that would also greatly benefit from watershed management, such as the Konkan area of Maharashtra. There is also a lack of attention to saline and swampy areas, and a lack of awareness about the management needs of such areas.
- **Dependence on outside experts** There is a tendency to bring in outside specialists when skilled people such as engineers, agriculturists and foresters are available locally.

- **Administrative boundaries** Watersheds rarely coincide with administrative boundaries, so collaboration between different government organizations, and different levels of government is necessary – but hard to achieve in practice.
- **Land ownership** Different types of land ownership exist side-by-side in watersheds: private, state and common property. Rules prevent local people or NGOs from implementing work in government-owned forest areas in the upper part of a catchment – even though these must be treated first if conservation work is to be successful.
- **Institutional rigidity** Many official programmes are standardized and rigid, and government departments are many and scattered. There is little space for innovation and flexibility – though precisely these are needed if watershed approaches are to cater to the needs of local people.
- **Political sensitivity** Watershed management can be highly political. The watershed community often faces conflicts with the local *panchayat* government. Treatments are often not done according to natural characteristics but to political interests. That creates envy and tension within the community and endangers watershed project approaches.

Changes needed to achieve the potentials of land and water management

- **Provide enough funds** Easy to say but hard to do. The budget provision for watershed management and landshaping should be increased to enable these approaches to spread their impact to a much larger area and number of people.
- **Improve funding mechanisms** Ensure the timely release and utilization of funds that have been allocated for land and water management.
- **Apply treatments appropriate for each area** Treatments and designs must be modified to suit local conditions. Factors to be taken into account include the local geology (such as hard-rock conditions) and agroclimate, as well as land ownership, available infrastructure, markets and local people's opinions.
- **Expand the areas eligible for support** New areas to be considered include high-rainfall, swampy and coastal areas.
- **Promote equity** Effective measures (e.g., separate budget allocations) must be evolved to address equity issues related to landless agricultural workers, women and the households they head, artisans, small and marginal farmers.
- **Government–NGO collaboration** Both government and NGOs conduct watershed development programmes, but they rarely work together. Government programmes in general cover large areas, involve large target groups and apply relatively technical inputs. NGOs have fewer resources, so serve smaller areas and groups. They emphasize facilitation, capacity building, community planning, cultural issues and self-help practices. Both NGOs and the government approaches have advantages and disadvantages. Watershed projects would greatly benefit from collaboration between them, allowing them to combine the strengths of both approaches.
- **Participatory monitoring** Effective, participatory monitoring systems need to be developed. This is not just a question of effective monitoring; it also involves empowering the community. Examples include social audits and authorizing community representatives to sign approvals of activities and payments for work done.

- **Integrate sustainable agriculture** Sustainable agriculture approaches should be further integrated into watershed approaches. It is not enough to build soil conservation structures; watersheds must be seen with a more holistic approach to ensure farming practices do not continue to aggravate erosion and water problems.
- **Strengthen local organizations** Strong local organizations are key to the sustainability of watershed interventions. They must be fostered through capacity building and empowerment measures, and linkages established with higher-level organizations such as the government, farmers' associations, the private sector and broader civil society.
- **Promote market linkages** Good farming is profitable. That means that farmers must be able to sell what they grow, and grow what they can sell. They must also be able to buy the inputs they need. It is necessary to strengthen both forward and backward market linkages to enable them to do this.

4
New products, new markets

New market potential for small-scale farmers
Helga Stamm-Berg and Felix zu Knyphausen, Sustainet

Linking tea farmers with markets
Peermade Development Society, Kerala

Rainfed sericulture
BAIF Institute for Rural Development, Karnataka

The biofuel hype: Chance or challenge for sustainable agriculture?
BAIF Institute for Rural Development, Karnataka

New crops, new markets: Realizing potentials

New market potential for small-scale farmers

Helga Stamm-Berg and Felix zu Knyphausen, Sustainet

"About half of the world's hungry people are from smallholder farming communities, another 20% are rural landless and about 10% live in communities whose livelihoods depend on herding, fishing or forest resources. The remaining 20% live in cities."[1]

It is a paradox that so many hungry people are farmers – the very people who produce food. Why?

To understand this, a small digression is needed. Hunger occurs in three forms:[2]

- **Acute hunger** This occurs during famine, and is frequently caused by political unrest, war or environmental disasters.
- **Hidden hunger** This is caused by a lack of essential micronutrients (vitamins and minerals).
- **Chronic hunger** This accounts for about 90% of the hungry. It is caused by a constant or recurrent lack of access to food of sufficient quality and quantity. It results in underweight and stunted children, as well as high child mortality because of associated diseases.

The share of agriculture in India's gross domestic product declined from about 45% in the early 1970s to 27% in 2001. Despite this decline, some 60% of India's people still depend in one way or another on agriculture for their livelihood. Many are small-scale farmers, mainly producing for subsistence. Others are rural labourers, working as daily labourers on farms.

To understand the main causes of poverty, we have to distinguish among different groups of rural people. The Organisation for Economic Co-operation and Development[3] identifies five "rural worlds":

1 Large-scale, commercial agricultural households and enterprises
2 Traditional landholders and enterprises, not internationally competitive
3 Subsistence agriculture households and micro-enterprises
4 Landless rural households and micro-enterprises
5 Chronically poor rural households, many no longer economically active.

1 FAO. 2004. *The state of food insecurity in the world: Monitoring progress towards the World Food Summit and Millennium Development Goals*. Food and Agriculture Organization of the United Nations, Rome. p. 25. www.fao.org/sof/sofi/index_en.htm
2 UN Millennium Project. 2005. *Halving hunger: It can be done*. Task Force on Hunger, United Nations, New York. p. 2. www.unmillenniumproject.org/documents/Hunger-lowres-complete.pdf
3 OECD. 2006. *Promoting pro-poor growth agriculture*. DAC Guidelines and Reference Series. Organisation for Economic Co-operation and Development, Paris. www.oecd.org/dataoecd/43/46/36427716.pdf

While "Rural World 1" is above the poverty line, specific charity programmes are required for people belonging to "Rural World 5".

In the following we focus on Rural Worlds 2 and 3, which constitute 50% of the rural poor. Rural World 2 is composed of "traditional landholders and enterprises, not internationally competitive; devoted to both commercial and subsistence agriculture, with traditional orientation, embedded in local networks". Rural World 3 is made up of survivalists: fisherfolk, pastoralists, smallholders and associated micro-enterprises. Food security is their main concern, and their small production units are almost totally dedicated to home consumption.[1]

The causes for their poverty and low productivity level are many:

- Their farms are often too small to grow enough food for their own needs or to produce a substantial market surplus.
- Weak purchasing power in rural areas creates limited demand, in turn resulting in low prices for food crops on local markets.
- Remoteness from urban markets and inadequate storage facilities force farmers to sell their products during the peak season when prices are lowest.
- Decreasing prices for agricultural commodities impede their saving potential.
- Weak coping mechanisms minimize their ability to endure risks and shocks.
- Low creditworthiness limits their access to affordable credit and impedes their ability to invest in improving their productivity.
- Poor health limits their capacity for hard physical work.
- Insecure land tenure limits their readiness to invest in costly or painstaking land improvement measurements.
- Degraded land means low productivity.
- Unreliable input supplies, poor education and knowledge systems as well as poor linkages to information amplify a vicious circle and prevent them from recognizing and using what options they might have to raise their production level.

Principles of sustainable development

The goal of "sustainable development" implies that "development" (which takes place in some form or other anyhow) should be guided towards "sustainability". In the past, the term "development" was equated with economic growth. But today, new challenges call for new strategies. Instead of "more", we need "better" development that reflects all three dimensions of sustainability: it must be economically viable, socially equitable and ecologically sound. Where the poor do not participate and benefit from the development process, socially equitable development will not take place. So sustainable development needs to be pro-poor and environmentally friendly. Sustainable development approaches should use renewable resources, apply locally adopted procedures, select techniques that conserve resources and energy, clean up waste, and rehabilitate affected landscapes.

Past experience shows that unguided economic development does not automatically benefit the poor. If the process is left to market forces alone, better-off people usually benefit most,

1 OECD. 2006. p. 26

and the majority of small producers are left behind. Poverty persists in communities with poor market access, poor resource endowment and little political and social capital. To overcome this, pro-poor development efforts have to concentrate on increasing productivity in rural areas (where most of the poor live), with and for poor and marginalized groups, in the agricultural sector (where most earn their living). That means engaging with small-scale farmers, landless families and small-scale entrepreneurs. Fortunately, such development strategies are also very much suited to boost rural economic development in general.

Sustainable development must be grounded on three principles:

- It should be **holistic**: connected with different sectors, engaged on different levels, corresponding to actual needs without destroying future resources.
- It should be **process-oriented**: locally adapted to the natural environment and social and cultural way of living, using procedures appropriate to the existing government and civil society.
- It should be **value-oriented**. Appropriate values include participation, pro-poor growth strategies, transparency, democracy, accountability, and professionalism.

Holistic here means integrating business development strategies into an overall rural development strategy. Small-scale farm families should be seen as part of a complex livelihood system. Rather than directing all efforts to raise productivity, policies and programmes must tackle diverse problems at the same time: raising small-scale farmers' incomes and answering their various production and personal needs. This means enabling them to shift production towards higher value crops, promoting local processing of food and value addition, supporting health and education, improved risk-coping mechanisms, securing land user rights, improving access to small-scale credit, and upgrading infrastructure and market access.

Process-oriented means improving the capacity of service providers to deliver services that local people actually demand. It involves analysing the demand for these services, checking their quality, identifying problems and finding solutions together with the service providers and local people. Priorities need to be made through consensus. Three steps are needed:

- **Demand assessment:** identification of different groups' needs in various areas – food, income, health, recreation, education, skills, information, etc.
- **Identifying potentials, opportunities and constraints in the locality:** infrastructure, natural resources, etc.
- **Strategy development** based on the above analysis by developing and comparing alternatives, mapping of interest groups and identifying potential conflicts.

Effective groups such as producer associations are a key element in this. If such groups can formulate strong, well argued demands, they can have a major impact on development planning.

Value-oriented means that development strategies should further the goals of sustainable development: they should minimize risk and be pro-poor, participatory, democratic, transparent and accountable. That requires dialogue, negotiation and partnerships among the various actors: farmer associations, service providers, local administrations and development projects. It also means improving the management capacities of service providers, transparent decision making, developing procedures which rely on social capital and skills, and communication strategies that include all major groups and procedures.

In the past, agriculture has often played a lead role in the early stages of development. Agricultural development has been an especially good contributor to pro-poor growth. There are a number of reasons for this: many poor people rely on agriculture; growth in agriculture leads to lower food prices and stimulates rural economic growth; agriculture has other positive effects, such as assuring food security and reducing people's vulnerability to risk; and appropriate agricultural development controls erosion and promotes ecologically sound land use – which are essential to maintain the land's productivity into the long term.

Changing market opportunities

The market for food is changing rapidly. Demand is growing for higher value food, such as vegetables, fruit, meat and milk. Urban living boosts demand for semi-processed foods. Burgeoning cities and rising incomes have major implications on both demand and supply. Over the last decade, the retail market for food has consolidated rapidly. The 30 largest supermarket chains account for about 30% of total food sales worldwide. These supermarkets require certain quality standards – they need products of guaranteed quantity and quality, as the right time and place. Stimulated by improved communication and transportation, global traders are penetrating even remote rural markets. Small-scale farmers are confronted by the competition from cheap foreign imports.

Three developments bring opportunities for farmers.

- **Population growth** fuels demand for cereal crops, while real prices are projected to remain stable in the long run, creating a growing market in terms of volume and value.
- Many developing countries experience **rising average incomes**, assuring a widening consumer base for agricultural products.
- **Export markets** are expanding rapidly, opening new opportunities for niche and high-quality products.

It is generally assumed that only larger farms can exploit such opportunities. Smallholders indeed face considerable obstacles to participating in global trade – obstacles they find difficult to overcome on their own. They lack investment capital and market information. They have to make substantial investments to meet quality standards – such as for organic certification or to ensure product traceability. On the other hand, supermarkets face high transaction costs when negotiating with many small producers, so they may avoid doing so.

Such barriers can be overcome if small-scale form associations in which they can develop common strategies and follow a common interest. Smallholder producer associations that have succeeded in producing for export generate significantly higher incomes than their neighbours who still grow for the local market. The example of Peermade (page 130) shows how small-scale farmers have been able to link to export markets while still applying sustainable practices – indeed, by taking advantage of those practices.

High-value, niche products and certified organic exports are an option only for a limited group of small-scale farmers. The transaction costs are high, and small farms have few economies of scale, so have difficulty competing with larger, more efficient farms. To link small-scale farmers to global markets, producer and marketing associations would be required. The well-developed rural women's saving and credit groups in India might be a suitable starting point for such attempts.

Nevertheless, only a limited number of such associations can seize such opportunities, and they have often had outside support. In general, the globalization of food markets is more of a threat to the rural poor: rather than being able to engage in lucrative new enterprises, they risk being marginalized further. The percentage of exported food products that comes from smallholders is only about 18%, compared to 82% from commercial farms.

This means it is important for local actors to approach local, regional and national markets with a strategic view. They need to identify any advantages they may have so they can link to the most appropriate market for their situation. Because of the major challenges in trying to enter international markets, efforts should concentrate on local and national markets. In India these have significant growth prospects.

Linking small-scale farmers to markets

Which strategies are possible to improve linkages for small-scale farmers with markets?

- **Increasing returns from production** This includes improving farming methods to boost production, introducing higher value or niche products such as fruits, vegetables, herbs and spices, and improving storage to make it possible to sell products after the peak season when prices have improved. Market surveys are a first step for this.
- **Organizing as groups** Organizing farmers as groups is a prerequisite if they are to serve outside markets and to ensure access to inputs, production technology, certification and market information. The Peermade case (page 130) is an example of this.
- **Responding to local demand** Often local demands are not well investigated. Market surveys might identify untapped new options. It may also be possible to replace food produced elsewhere by local production.
- **Building on local knowledge** It may be possible to identify new options based on local people's rich store of indigenous knowledge. This might be converted into income, for example by making traditional medicines or herbal products, using traditional pest-control methods, or promoting local technologies such as water or wind mills.
- **Building on the local environment** Some places may allow development based on wind, solar or water energy, the use of specific plants that grow locally (as with jatropha in dry areas, page 144), or offering eco- or agro-tourism services.
- **Using labour-intensive technologies** Labour-intensive techniques may be more suited for small-scale farmers than are capital-intensive investments.
- **Link with local processing and marketing** It is difficult to start a new industry from scratch. Efforts should take advantage of existing processing and marketing channels (as in the sericulture case on page 138).

Sustainable agriculture approaches have much to offer here. Reducing the levels of external inputs cuts farmers' costs and their reliance on volatile, unreliable input supplies. Building on local knowledge and resources makes maximum use of farmers' own capabilities. Sustainable agriculture interventions use participatory approaches and emphasize farmer organization. Women's savings-and-credit groups have spread widely all over India and are a good basis for organizing disadvantaged groups and giving them a voice, so enabling them to participate in development. Serving local markets is promising if purchasing power of local people is rising.

Who are the actors?

A wide range of actors are involved in sustainable agriculture development. Below we group them into three major categories: the public sector, the private sector, and research institutions.

Public sector

The public sector has to create an environment that promotes lasting linkages between small farmers and markets. The key challenge is to identify those policies and institutional changes that stimulate pro-poor growth, and to find how they can be put into practice. This is a question of political will and power distribution.

Most national Poverty Reduction Strategies (a policymaking process supported by the World Bank and the International Monetary Fund) are not the result of a participatory process, and membership organizations, farmers associations and the private sector are hardly ever involved. If these strategies are to address the needs of the rural poor and contribute to poverty reduction, they must include the affected group in the process of consultation.

But participation of the rural poor should go beyond consultation. Empowering people is just as an essential element of economic empowerment as roads and electrification. The rural poor must be given a voice so they can express their interests, construct their own solutions and negotiate their relations with the private and public sectors. Empowering marginal social groups embraces two aspects:

- **Institutional and organizational empowerment** – e.g., marketing cooperatives, outgrower schemes, and farmers' associations that represent farmers' interests at government or private institutions.
- **The empowerment of people** – i.e., capacity building and training to provide farmers with the necessary skills to manage their organizations.

Policies are required which give priority to poverty reduction strategies and which promote pro-poor growth. Governments have a vital role in creating an enabling environment for small businesses and to link small-scale farmers to markets. They should enhance access to basic services for craftsmen, traders, vendors and other small-scale entrepreneurs. These services include business licensing, risk management and small-scale credit, as well as infrastructure such as roads, public transport, communication, electricity, water and local markets.

As governments withdraw from providing services directly, they have to create conditions that enable the private sector to fill this role. Services include advice to ensure food security or market-oriented production, marketing skills and market information, cooperative management, business management and environmental information. The new role of government is to reform such services so they are demand driven. That means enabling the clients of services (such as farmers) to articulate their demands, supporting the response by enabling dialogue between clients and potential service providers, and ensuring that policies enable the providers to supply the services.

The poor should be able to participate in these markets on equal terms. This can be assured

by improving infrastructure such as roads and electricity, the lack of which may make small-scale farming uneconomic. A considerable problem for small-scale farmers is the lack of marketing services in rural areas. In the past, NGOs have often provided these services. But most development professionals lack marketing expertise. The government should seek to create an environment that promotes the private sector to supply these services.

Entrepreneurship and investment determine the rate of growth in a country. Institutional changes and policies that reduce the risks and costs of doing business, and that provide equal access to productive resources, should create an environment favourable to investment and entrepreneurship. For pro-poor growth, it may be necessary to provide incentives specifically targeted towards the poor so they can become engaged in the market. The benefits of entrepreneurship and investment in the formal sector must be present – and visible enough to induce them to participate in it, rather than drifting into the informal sector.

The private sector can provide pro-poor growth. But the extent to which the poor are able to benefit from this growth is determined by the terms on which they are able to access markets and take advantages of the opportunities available. Government plays a major role in determining these terms and ensuring the development is sustainable. The state can improve the functioning of markets by developing institutions that regulate and facilitate markets and address market failures, lower transaction costs and reduce social exclusion. For example, improving trade linkages may provide access to new and growing markets. This may be facilitated by lowering internal and regional barriers to trade.

In the developing world, just as in industrialized countries, subsidies generally favour large farms. This distorts the market, crowds out small-scale farmers and narrows their competitive advantages. Withdrawing these subsidies would provide a level playing field for all enterprises and guarantee an efficient allocation of resources.

India has many remote and neglected areas that are already left behind. They have especially unfavourable environmental conditions and poor access to markets. Remote and poor regions that are dominated by subsistence agriculture typically have low business potential, and are unattractive for non-state service providers. They are inhabited primarily by disadvantaged groups, including tribals, elderly and poorly educated groups – the young, more dynamic people have moved away already. To make use of the limited opportunities these disadvantaged groups have, specific development strategies, protection measures and support structures are needed. The government and civil society must continue to provide basic services to those who cannot afford to pay for them. Specific support is needed so that groups that still have some potential are not pushed out of the development process altogether. For the poorest, charity programmes are required.

The poor are vulnerable to risks because they lack reserves. If a shock such as drought, price fall or illness hits, they often have to sell assets and productive resources, and lose labour. Coping with these risks means they cannot maximize their incomes. For example, they may choose to grow low-yielding but drought-resistant crops for subsistence, rather than high-value cash crops. With access to credit, the poor do not have to run down their resources to respond to such emergencies.

The risks of doing business are lower if the rules that govern the market are transparent, predictable and well-enforced. Important aspects are secure tenure and property rights, and a stable legal and political framework.

Different circumstances in different locations mean that no universal set of policies exists. The OECD[1] provides a framework to analyse the economic environment and how it favours economic growth. This framework can be used as a guideline for the public sector about measures that have to be taken to promote market linkages of small scale farmers. The framework embraces the following aspects:

- Providing incentives for entrepreneurship
- Increasing productivity: competition and innovation
- Harnessing international economic linkages
- Improving market access and functioning
- Reducing risk and vulnerability.

Strategies for linking small farmers to markets therefore comprise a whole package of measures. Policies and institutions have to be diversified and enabled to deliver security of land tenure, reduce risks and vulnerability, cut transaction costs, and promote pro-poor investments in key areas such as innovation support services, the maintenance of productive assets, the rural non-farm sector, market access, financial services and infrastructure. Where infrastructure is provided and the right incentives are given, the private sector can step in to replace the public sector as it withdraws from areas such as extension, marketing and credit provision.

Productivity can be raised by adopting innovations and introducing new technologies. Efficiency can be improved and by shifting resources to more productive areas. The public sector should facilitate appropriate institutions to invest their capital into those sectors where the poor may participate in growth and development options. Governments should also support access to inputs, information and innovations for small farmers. In cooperation with science and technology institutions, new strategies, options and development scenarios should be developed. The transaction costs of starting and running a business – the costs of complying with bureaucratic requirements, negotiating and enforcing contracts, using infrastructure, and the various entry barriers – are a great burden for smallholders. Governments should seek to minimize these costs by providing a sound regulatory framework and enforcing it strictly. This will minimize opportunities for corruption and obviate non-transparent and time consuming processes.

Private sector

The private sector also has a multi-faceted role. Since government is withdrawing as major service provider, this role has to be filled by others. New actors (such as private companies, semi-government institutions, cooperatives and NGOs) are becoming involved in rural services, so it is likely that a new pluralism in service provision will arise. The major services include:

- Inputs such as electricity, water, building land and markets
- Financial services (banks and credit schemes for small-scale enterprise development)
- Transport and communication

1 OECD. 2005. *Development co-operation report 2005*. Organisation for Economic Co-operation and Development, Development Co-operation Directorate, Paris. http://miranda.sourceoecd.org/vl=2955432/cl=12/nw=1/rpsv/dac/

- Business and marketing information
- Training and capacity building
- Trading and retailing
- Value-addition, local manufacturing and handicrafts.

Pluralistic service provision also means pluralistic financing. Services are not financed just by the government, but also receive co-financing from private sources such as international NGOs, the private sector and the users themselves. Funding from outside sources remains important. Increasingly, approaches involving several donors will become a standard mode of delivery for development interventions (multi-donor funding, "basket funding", specifically designed development packages funded through governments, and so on).

Recent agricultural growth strategies have been of limited success. They have provided inappropriate policy frameworks for small-scale business environments; they have also failed to identify appropriate ways to make development pro-poor. Experience shows that these approaches can best be identified by local institutions accountable to, or managed by, the poor. Consequently capacity building and support for local processes in the form of initial training, information provision and start-up funds, are essential elements of pro-poor development.

Small-scale farmers can break into niche markets by obtaining certification as "organic", "fair trade" or "environmentally friendly", so gaining a premium price. In such markets, profits depend less on how much a single farm produces, as the large quantities required are met by a groups of farmers or cooperatives. More important for the single farm is the quality of produce (it must comply with certain standards) and on how much of the value-addition chain can be brought under the farmers' control (for example if the farmers organize themselves into groups to process their output). Local and national markets for organic products are growing, but are not yet as consolidated as for conventional foods, and the barriers to entry are lower, making these markets attractive for groups of small-scale farmers.

A promising approach for linking small-scale farmers to markets is to focus on the value chain for a specific commodity, as the examples in the next chapter show. By producing value-added products, farmers can capture a greater share of the value in the chain. Sustainable agriculture has many of the features that people consider high value: "natural", free of chemicals, environmentally friendly, etc. Plus, sustainable methods often require relatively few external inputs (though frequently demand a higher labour input), so are "low cost".

Two prerequisites have to be fulfilled to link small-scale farmers to markets successfully. On the one hand, the state must provide infrastructure and a favourable policy framework. On the other hand, farmers have to identify viable marketing opportunities and possess the technical and managerial expertise to exploit them. Major obstacles that small-scale farmers face when entering markets for premium products are the expensive certification and control schemes, and the high volumes needed to satisfy supermarket demands.

These obstacles can be overcome, for example, by forming cooperatives or enrolling in outgrower schemes. By forming cooperatives, farmers can market larger amounts of products, so increase their ability to supply supermarkets. Associations can also own certification systems rather than have them provided by external companies.

Research institutions

The role of research must also to change. Research should focus on areas such as low-cost technologies; bioenergy and energy-saving technologies; product development of neglected local crops (root crops, pulses, local grains and cereals, herbs, fruits, vegetables); local processing, manufacturing and craftwork; and low-cost transportation.

Private research and development has so far focused on sectors where better-off farmers are willing to pay sizable sums for specific innovations. Small-scale farmers cannot afford such innovations, so are squeezed out. The state or external donors must fund research focused specifically on the needs of these farmers.

Linking tea farmers with markets

Peermade Development Society, Kerala

FARMING IS A HIGHLY seasonal business. Governed by the annual cycle of monsoon and dry, summer and winter, particular crops mature and are harvested at the same time. Today, there are mounds of mangoes in the market. Next week there is a glut of ginger. The following month comes a tidal wave of tomatoes.

The market cannot absorb these sudden surges in supply. Prices plummet. Farmers are forced to sell at a loss, or must watch their crops rot in piles by the roadside or unharvested in the fields.

Farmers can do little to avoid this tyranny of the seasons: if they plant their crop any earlier, they risk losing it to drought or frost. If they plant late, it may not flower and produce seeds.

Tea is no exception to this iron rule – as the small-scale farmers of Idukki, the largest district in Kerala, know only too well. Tea produces young leaves in flushes, usually from May to September. The farmers used to carry their freshly plucked young, green leaves to the privately owned factory, to find that the factory was willing to pay less than the regular market price for each sack. The farmers had no choice: the leaves had to be plucked within a certain period, or they would be too old. Fresh tea leaves are perishable: they must be processed immediately after harvest, or they become worthless. The market for tea was controlled by big plantation owners and private factories. Because tea is a perennial crop, the farmers were trapped: uprooting their bushes would mean losing years of investment.

Peermade Development Society

Peermade Development Society (PDS), an NGO founded in 1980, has helped Idukki's farmers overcome this predicament. It has helped them establish a consortium that runs its own tea factory, producing organic tea for the European market. This is how it happened.

PDS has operated in Idukki District, the second-largest but least developed district in Kerala, since 1980. It was well aware of the problems faced by the district's tea farmers through its network of partner "village development councils", which manage PDS's programmes in each village. These councils also coordinate self-help groups of farmers. These groups run savings schemes, and members help each other do heavy work on their farms.

In 1998, PDS conducted a series of participatory appraisals with these self-help groups. The group members discussed the problems they faced in small-scale tea farming and discussed

ways to overcome them. The ideas of switching to organic tea production, forming a consortium and building their own factory came out of these discussions.

Why organic? The farmers were playing a lot for chemical fertilizers. But the area has many trees and other vegetation, so there was more than enough material to make compost. Plus, processed tea faces a huge, well-established market that would make it difficult for the small-scale farmers to compete. Organic tea offered a niche market that promised to be highly profitable. PDS had a lot of experience in organic farming, so was in an ideal position to advise the farmers on how to switch.

The Sahyadri Tea Farmers' Consortium

As a result of these discussions, the farmers together decided to form the Sahyadri Tea Farmers' Consortium, named after the Sahyadri Hills, or Western Ghats, where Idukki district lies. PDS also uses "Sahyadri" as the brand name for a range of ayurvedic medicines and spices that it promotes.

Organic tea fetches a premium price in the market. To ensure that the farmers (rather than the private factory owners) would benefit, PDS and the Consortium decided to build its own factory to process the members' leaves.

PDS helped obtain the funding to build a state-of-the-art factory at Valanjanganam, in Peermade. Several partners supported the construction: the European Union, Naturland e.V., (a German NGO promoting natural farming and organic practices), Equal Exchange (a British NGO), and Verein Familien Partner Kerala (Austria). This covered one-third of the factory cost of Rs 61,000,000 (€1,220,000). PDS obtained a loan to cover the remaining two-thirds from local banks. The factory is owned jointly by PDS and the Consortium.

The Sahyadri Organic Tea Factory was opened in November 2003 by a member of the Indian National Planning Commission. It currently serves nearly 1200 smallholder tea growers, but has a production capacity of 800 tons of made tea a year, so can serve more than 10,000 farmers in Idukki District. The factory was the first venture of its kind in India involving a group of organic farmers.

Certification

The factory complies with organic quality standards set by the Indian government, the European Union, the United States and Japan, as well as by Naturland.

An important part of complying with these standards is organic certification. PDS arranges for the farmers to be certified as a group by Skal International, an internationally accredited agency. PDS has also arranged for FairTrade certification for the tea through the FairTrade Labelling Organization. PDS covers the expenses involved in these various certifications, and recoups them by including the costs in the sale price of the final produce.

Purchasing and selling tea

The factory implements a closed purchase system: it takes tea only from registered organic farmers who are members of the consortium. It guarantees the farmers a price 30–70% above the open market rates (the actual level depends on the season). This ensures a regular supply of quality green leaves from the farmers.

The factory sells the finished tea through FairTrade channels. One of the requirements for FairTrade certification is that part of the profit must be used to improve the socio-economic situation of the growers, their families and the community. So the Consortium earmarks €0.50 from every kilogram sold for development projects in the community. The community itself decides how this money will be spent.

The factory is now in the process of establishing markets both locally and in Belgium, Spain, the United Kingdom and other countries.

Quality assurance and training

A quality product is vital if the Sahyadri factory is to keep its certified organic status and retain its markets. It does this through an internal control system headed by a manager stationed at the tea factory, and six inspectors posted at the 5 zonal headquarters in the district. Members of this team travel continuously to each of the grower villages. They advise farmers in all activities from input preparation until the leaves are harvested. They monitor the procurement of tea by the Consortium, as well as production and marketing.

Figure 13 Every year, more farmers in Idukki are converting to organic production

The team trains farmers in various subjects, including bookkeeping, the standards required for organic farming, organic and biodynamic farming practices, various aspects of tea cultivation, the use of botanical pesticides and biocontrol agents, pest and disease surveillance, the application of organic manure and vermicompost, and good harvesting and post-harvest practices. The project's 10 field staff assist the farmers in carrying out day-to-day activities.

Women play a key role in tea production and harvesting. They also are involved in management: the women's development wing of the Consortium plans the development projects that are paid for by the FairTrade premium. These projects include educating children, creating public utilities such as drinking water, providing services such as medical care, and installing computers for use in education and community welfare.

The women are also responsible for upgrading the quality of the harvested leaf and improving the standards of organic cultivation.

Structure of the Consortium

The Consortium is a registered body with its own bylaws. It functions as an umbrella federation of 51 separate village-level groups, composed of nearly 1200 members, who farm a total area of nearly 800 ha – so each member farms less than a hectare of tea (Figure 14).

Unit committees Each village-level group, or unit, has between 20 and 40 members. They elect a committee consisting of a president, secretary and three model farmers. The internal inspector of that region also sits on the unit committee, and can overrule decisions by the committee if necessary.

Zonal and central committees The presidents of the unit committees in a zone form a zonal committee, which coordinates and plans activities within that zone. The presidents of the five zones, plus a representative of PDS, manage the activities of the Consortium as a whole. This central committee monitors the tea collection in the villages, payment to the farmers, and quality at the farm level. In addition, the central committee reviews activities of the zones and approve their development plans.

Central approval committee This committee coordinates the activities of the factory and the Consortium. It consists of the Consortium president and vice-president, the factory director, quality manager and two farmer representatives. This committee defines the standards for cultivation and harvesting, admits new members, imposes sanctions based on the recommendations of the group or zonal committees, reviews progress and finalizes development plans.

Benefits to farmers

The farmer members of the Consortium have benefited from the project in many ways (see Box 22).

Farmers who are not members of the Consortium have also benefited from the project. The price of the tea leaves used to go down drastically each year during the flush season. But because the Sahyadri factory pays more for the green leaf, the private factories were

Box 22 Before and after the formation of the Sahyadri Tea Farmers' Consortium

Before	Now
• No farmer organization. Small-scale farmers were exploited by private tea factory owners	• Farmers organized into Consortium. They process the tea in their own factory
• In the flush season, farmers had to sell their produce for throwaway prices	• The farmers get an assured price irrespective of the season
• Price of tea based on the Cochin Tea Auction	• Price based on the projected inflow of tea in different seasons and negotiated price at the established regular markets for tea
• No uniform quality of plucked leaves	• Consortium staff train farmers and monitor uniform quality of plucked leaves
• No training on tea cultivation or organic farming	• Periodic training on cultural methods and organic farming practices
• Prices below the current market price	• Premium price, expected to rise
• No social benefits from sale of tea	• €0.50 per kg sold earmarked for community development
• Farmers could not afford organic certification	• Group certification under the umbrella of PDS
• Inputs purchased individually; high cost	• Inputs purchased by the Consortium in bulk; low cost

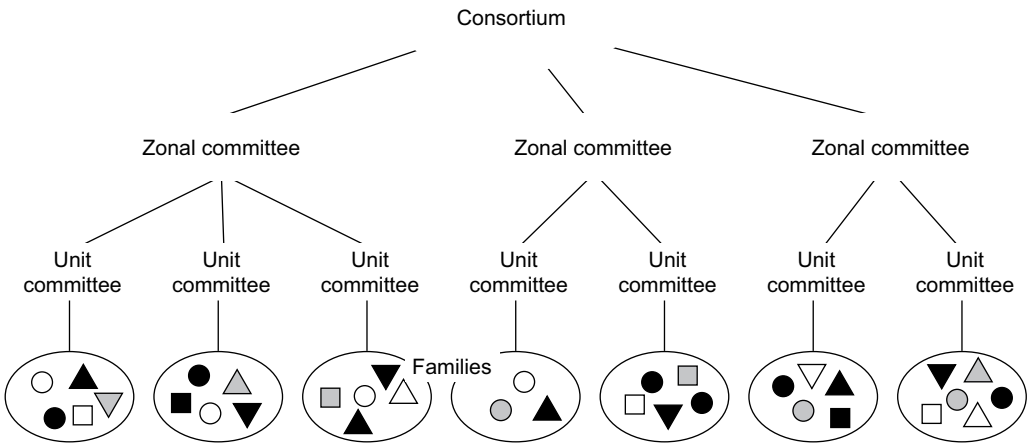


Figure 14 Structure of the Sahyadri Tea Farmers' Consortium

also forced to raise the prices they paid. A comparison with Connoor, a tea-growing district in Tamil Nadu with many smallholder growers, show this well: in Connoor, prices of green leaves the flush season fell as low as Rs 1.50 to 2 per kilogram, while prices offered by private factories in the project area never went below Rs 4.50.

Every year more and more farmers in Idukki are converting to organic farming. By 2010, it is planned to make all 10,000 small-scale tea growing farmers in the district organic. Once the factory reaches break-even (forecast in another 3.5 years, when enough farmers have switched to organic), it will be able to share the profits with the Consortium members.

In the year from April 2004 to March 2005, the Consortium bought nearly 1500 tons of green leaves from the farmers through the Consortium, and processed this to produce 332 tons of made tea. In the past 1½ years, the farmers have earned about Rs 15,000,000 (nearly €300,000) from the sale of green leaves. In addition, the project has negotiated a special loan scheme for the Consortium members with the State Bank of India; this distributed Rs 5,000,000 (about €100,000) to the farmers in 2004.

The project ensures that the harvested leaves and the finished product are high quality. The factory spends Rs 85,000 (€15,000) a year just on quality control.

Farmers have documented their daily farm activities, so have a better idea of their farm business than before. They are better organized, and are learning to cooperate to the benefit of the entire community.

Perhaps most important, the farmers are experiencing the power of unity. They now have the strength to compete in the market without being exploited by private factory owners and middlemen. The days of external dependency are over.

Challenges

The Consortium faces various challenges in the years ahead.

- **Competition from private factories** The private factories may raise the prices they offer to the Idukki farmers – perhaps just for a short time – in order to deprive the Sahyadri factory of its supply of fresh leaves.
- **Domestic market** There is no ready market for organic produce in India. The domestic market needs to be established.
- **Conversion costs** The farmers need 3 years to convert their land and become certified as organic. During this period, their produce cannot be sold as organic – so the Sahyadri factory will not accept it. The farmers' yields also decline for a couple of years before they recover as a result of the improved organic practices. The farmer risks losing income during this transition period.
- **Capital investment** A sizeable capital investment is required to establish a processing plant. Small cooperatives are unlikely to be able to raise the money needed on their own – they need outside assistance to do so.
- **Cost of monitoring and technical support** Continuous monitoring and technical support are required to maintain the quality of the product. This is more difficult with a large number of smallholders than it would be on a single large estate.

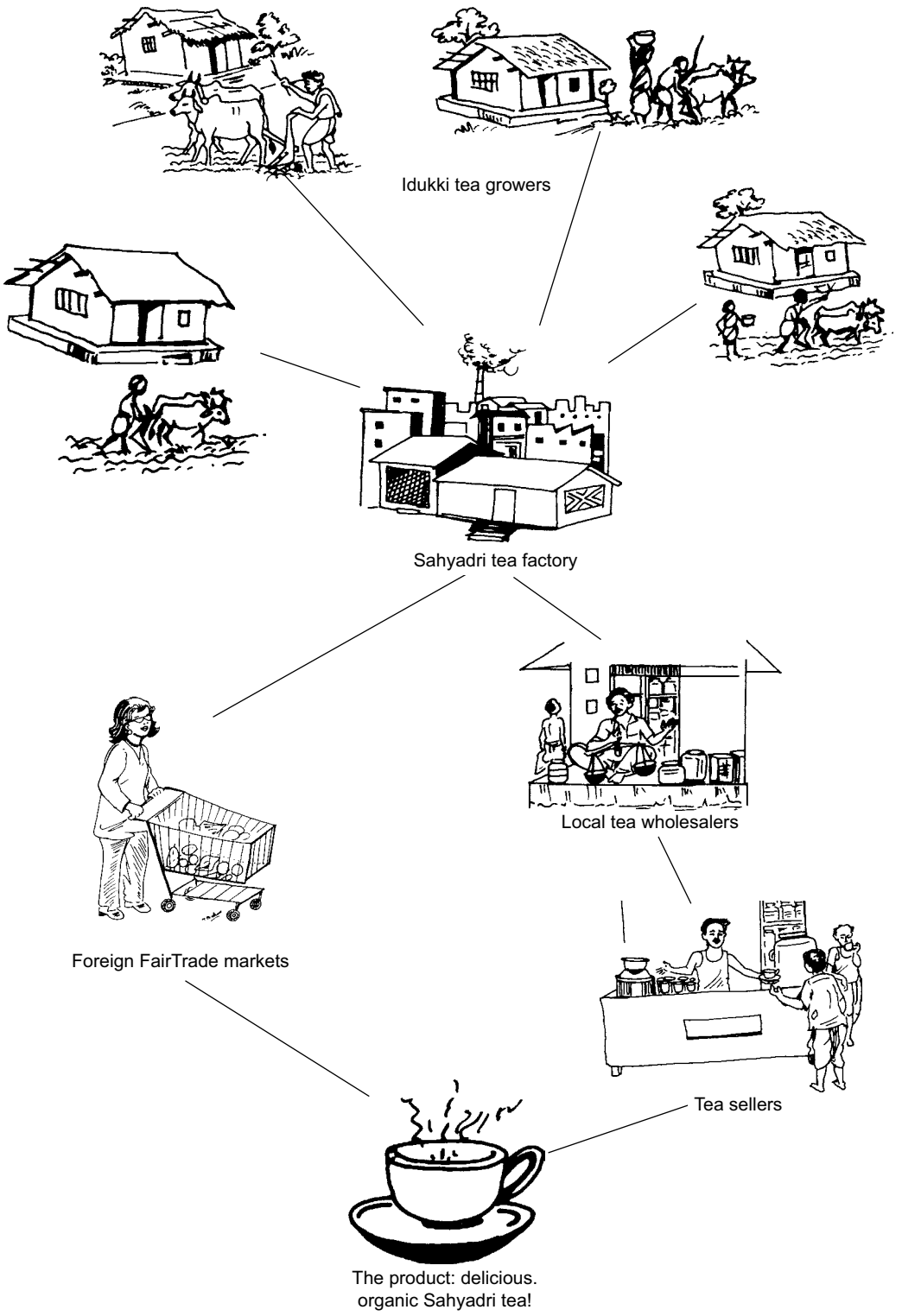


Figure 15 The Sahyadri Tea Farmers' Consortium processes and markets tea produced by farmers in Idukki District

Lessons and recommendations

- **Seek guaranteed markets for organic produce** Because of the costs of organic certification, it is worthwhile to produce certified organic products only if the market is reasonably assured.
- **Form groups to increase negotiating power** Individual small-scale farmers have very little negotiating power and cannot hope to compete with larger producers. They can only increase their negotiating power if they organize themselves into groups or cooperatives. The most appropriate model for such groups will depend on the local situation and the type of produce.
- **Build markets for organic produce** There are no certifying agencies for Indian standards. Until such agencies are established, a solution might be for groups of farmers who do not use pesticides or other chemical inputs merely to announce that they are "organic". This would help build a market for organic produce.
- **Include cost of services in price** Professional services for marketing, certification, etc., are needed to sell products in export markets. The facilitating agencies should not exit the programme, as this would strand the farmers without their vital support. This means that the price of the product must support the costs of these services.
- **Build strong institutions** Strong institutional arrangements, both among the farmers and between the farmers and their partners in the value chain, are essential if the organic programme is to be sustainable.

More information: Joseph Mathew or Sabu M Simon, Peermade Development Society
pedess@sancharnet.in, pedes@md2.vsnl.net.in, www.pdspeermade.com, www.pdsorganicspice.com

Dryland sericulture

BAIF Institute for Rural Development, Karnataka

Farmers in the village of Thammadihalli had heard a lot about silkworm rearing. They knew that the silkworm caterpillars have to be fed with mulberry leaves before they go on to spin their cocoons. They knew that Karnataka has a big market for cocoons – one of the largest in India. If only they could grow mulberry plants, they would be able to rear silkworms and sell the cocoons – and make a lot more than the few thousand rupees they currently earned from sorghum, finger millet and coconuts.

But there was a seemingly insurmountable problem. Mulberry plants like moist soil. Along with the rest of Tumkur district, in eastern Karnataka, the village of Thammadihalli is fairly dry: it gets only about 450 mm of rain a year. It rains on only about 40 days in a year. The village has no irrigation, and installing an irrigation system would be far too expensive. There seemed to be no way the farmers of Thammadihalli could take up sericulture.

Until the BAIF Institute for Rural Development–Karnataka came in. The village was close to other BAIF projects, and many of the villagers had some land – an average of half an acre (0.2 ha) that they could use to grow mulberry.

In 2002, BAIF suggested that the villagers try growing mulberry trees without using irrigation. Most were sceptical at first: how could they keep the soil moist enough to grow the plants? They thought it would be a lot of work, and were doubtful about the returns.

But the BAIF staff persisted. They showed the villagers how to harvest rainwater and store it in the soil so it would be available for the mulberry gardens. They showed the villagers how to cultivate mulberry and rear the silkworms, and helped them market the cocoons. And they arranged for the villagers to buy silkworm eggs to hatch and rear.

The result? By planting mulberries and raising silkworms, the villagers were able to boost their income significantly.

Here's how it happened.

Why silkworms?

Silkworm production (or "sericulture") is an attractive option for small-scale farmers. Once the mulberry gardens are established, it can earn the farmer money very quickly: the whole process from egg to cocoon takes only a month. The silkworms are raised in a shed, and the mulberry garden does not need much land. Silkworm rearing also creates jobs; it requires

skills, but these are easily learned and the work not arduous. Plus, Karnataka has well-knit service and marketing facilities for silkworm production.

The process of rearing silkworms consists of four steps:

1 Grow mulberry plants and harvest the leaves.
2 Hatch caterpillars from silkworm eggs and feed them with mulberry leaves. Maintain the humidity at 75–80% and the temperature above 27°C.
3 Let the larvae turn into cocoons.
4 Harvest and sell the cocoons.

Egg production is a separate activity. It requires a very clean environment and special skills. Silkworm egg production sites are called "grainages". Small-scale silkworm raisers do not produce their own eggs; rather, they buy the eggs from a grainage.

Raising rainfed mulberries

How can mulberries be grown without irrigation? BAIF developed a method called the "biomass-filled trench system". As its name implies, this uses trenches dug across the slope, filled with vegetation and manure. The biomass in the trenches decomposes, acting as a sponge to catch and hold scarce water. The decomposing materials also provide nutrients for the mulberry plants.

The trenches are 60 cm wide and 60 cm deep. They are dug parallel to one other, 90 or 120 cm apart, running across the slope so they catch water running downhill. The mulberry saplings are planted either side of the trenches, at a 90 x 90 cm spacing. This enables the roots to reach the moisture and nutrients in the trenches easily.

The mulberry garden is planted on a slope. That way, water from upslope can be carried in channels down into a farm pond next to the garden. An outlet from the pond leads into the garden. Water from the pond helps keep the soil moist and can be used to water the gardens during very dry periods.

It can be difficult to find enough vegetation to fill the trenches. But BAIF's baseline survey in Thammadihalli showed that trees such as *Euphorbia*, *Cassia* and *Lantana* would provide enough leaves and branches for the trenches. Farmers were also able to throw weeds into the pits, as well as lots of coconut shells and pith (many farmers in the area grow coconuts). They could also add cow manure and poultry droppings to add nitrogen and speed the composting process. The biomass could be covered with a layer of soil to help it decompose faster.

Working with the villagers

BAIF's project on rainfed sericulture started in April 2002 and finished in March 2004. It worked with 120 farmers in three villages: Thammadihalli and Baluvaneralu (both in Tumkur district) and Bagadagere, in Dharwad district in the western part of Karnataka. In all three places, farmers knew of silkworm rearing – they had seen better-off farmers doing it – but without irrigation, they could not see how they could do it themselves. The three villages had similar problems: inappropriate farming methods meant that much of the rain that fell

was wasted, groundwater was overexploited, and soil erosion was severe. The farmers were able to grow only a few, unprofitable subsistence crops: green gram, finger millet, paddy, horsegram, and fodder sorghum. The people were very poor, and they were forced to look for work outside the farm to make ends meet during the dry season.

Baseline survey BAIF conducted a baseline survey and helped the farmers identify places where in each micro-catchment where mulberry could be grown.

Self-help groups BAIF also helped the villagers form self-help groups that would play a key role in sharing information, making decisions and implementing the project activities. These groups decided about buying inputs (such as silkworm eggs and the disinfectants needed to clean the silkworm-rearing sheds between batches), and taking out loans.

Training Training was an important part of the project. It aimed to enable the farmers to tackle problems they were likely to face and to guide them in establishing mulberry gardens and silkworm-rearing units. It covered mulberry cultivation and nurseries, rainwater harvesting methods, vermicomposting (making compost using earthworms), silkworm rearing, and how to organize and manage groups. This training was done in the villages, at BAIF's training centre in Tiptur, or through visits to other sericulture locations.

All 120 participants received training. Special emphasis was given to training women.

Rearing sheds Individual farmers and members of the self-help groups built low-cost sheds for rearing silkworms in each farmer's mulberry plot. A few had no space in their gardens, so built their sheds in the village itself. The sheds were made of local materials such as stones, mud, poles and coconut thatch.

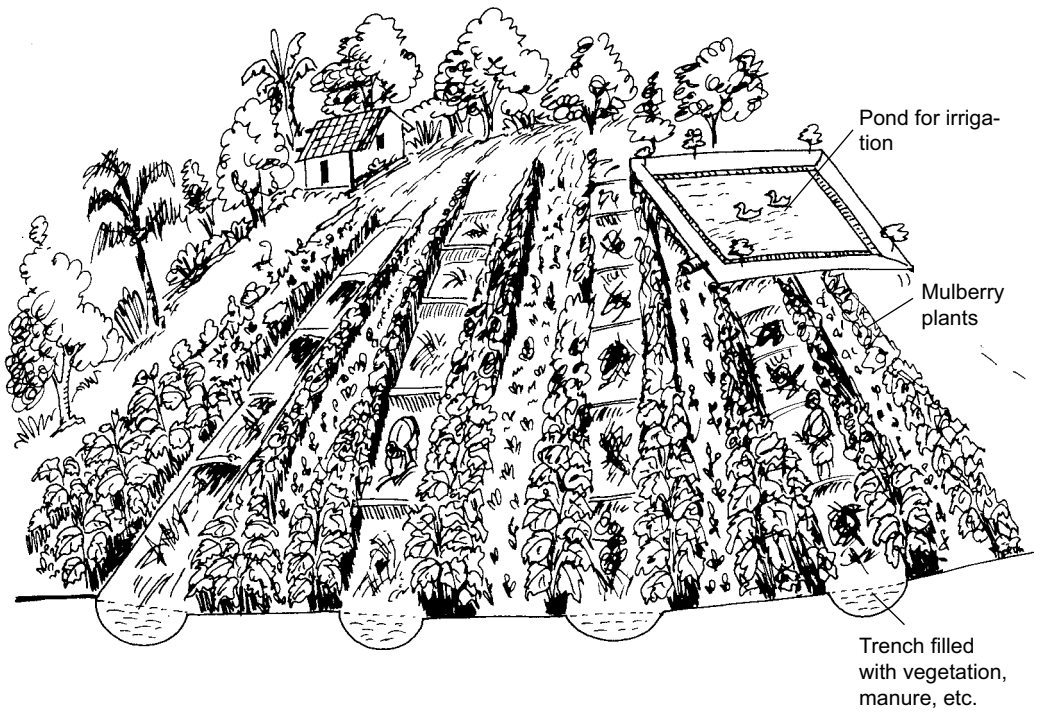


Figure 16 The biomass-filled trench system

Equipment and supplies To get the farmers started, BAIF provided equipment such as stands, trays, thermometers, fly screens and disinfectants. BAIF also gave them the first two batches of eggs free of charge. They could buy further batches of eggs from BAIF's grainage at a reduced cost. It is possible to raise three or four crops of silkworms each year.

Marketing The farmers sold their cocoons at the nearest market. Cocoons are very perishable, so have to be sold straight after harvest.

Impacts

Income The farmers' income has more than doubled. Previously, a typical farmer with 3.5 acres (1.4 ha) of land planted an acre each of sorghum (*jowar*), finger millet (*ragi*) and coconuts, and left half an acre uncultivated. That brought in only Rs 8,000 a year.

Converting the uncultivated land to a mulberry garden meant the same farmer could produce four batches of cocoons a year, weighing at least 40–50 kg each. That would earn an extra Rs 15,000–18,000 (Table 10).

In addition, the farmers were also able to grow crops such as horsegram, green gram or cowpea between the mulberry plants.

The increased incomes mean that farmers no longer have to look for work outside the village in the off-season.

Before, the farmers often had to sell their livestock or other property to pay for their children's schooling or for medical care. Now, many have been able to buy items such as radios, televisions and satellite antennas.

Soil conservation The organic matter added to the trenches has raised the soil fertility, improved the soil structure and boosted the soil's ability to store water. Erosion has been checked, and it has been possible to bring more land into cultivation.

Water The water table has begun to rise again. The farm ponds and trenches help recharge the nearby borewells and improve the quality of their water. That means more and better-quality water for people and livestock alike.

Employment Building and maintaining the rearing sheds, establishing mulberry nurseries and digging trenches created jobs for the farmers and for landless labourers. Villagers

Figure 17 Sericulture generates employment and income for village women

Table 10 Farm income before and after the introduction of sericulture

Before	Before (Rs)	After (Rs)
1 acre sorghum (jowar): 300 kg	1,800	1,800
1 acre finger millet (ragi): 400 kg	1,200	1,200
1 acre coconut: 2 x 2500	5,000	5,000
½ acre mulberry, 4 crops of cocoons: 160 kg x Rs 110	–	17,600
Total income	8,000	25,600

with skills such as masonry and carpentry were able to help one another build the required structures.

Running the sericulture is ideal work for women and other family members, including children and the elderly. This work includes harvesting mulberry leaves, rearing the silkworms, cleaning the beds, transferring the worms to frames where they spin their cocoons, and harvesting the cocoons.

Women Women involved in the project were for the first time able to earn some money of their own. They were actively involved in the self-help groups and in making decisions, and have gained enough confidence to speak up in discussions and open their own bank accounts. There has even been a drop in conflicts between husbands and wives, and shops have stopped selling alcohol in the village.

Savings and credit Some farmers have started savings accounts at the local post office. A local bank has provided financial support to the self-help groups, which take loans on behalf of their members.

Spreading the news

This new approach to sericulture works under certain conditions. There has to be a certain minimum rainfall, and it must be possible to capture and store much of it in the soil – for example, by channelling water from upslope into the mulberry garden. Red loamy-sandy soils are ideal for mulberry, but the plants can be grown on other soils as well. Most important, a grainage to supply silkworm eggs and a market for the cocoons must be within reach.

The extra income from the silkworm industry is impressive, and several of the farmers in the three villages plan to extend their mulberry plantings so they can raise more silkworms. BAIF staff have visited other villages and told local people about the success, and many farmers – often from a long way away – have come to see the gardens and rearing sheds for themselves. Apart from the 120 original farmers, about 30 additional farmers in the project area have adopted rainfed sericulture. Several farmers who have the luxury of irrigation have also dug trenches and filled them with organic matter – they say it reduces the amount of irrigation water they need.

Other NGOs working with sericulture and with community organizations, officials from the

Department of Sericulture, and members of "Sericulture Quality Clubs" (self-help groups of farmers who raise silkworms) have visited farmers and BAIF field officers to study this model so they can replicate it.

Lessons

BAIF and the villagers of Thammadihalli, Baluvaneralu and Bagadagere have shown that it is possible for poor farmers to grow mulberry without irrigation, so enabling them to make money from silkworm rearing. They have also shown the value of land that is currently unused. With relatively little input, and sensible use of water and other natural resources, this idle land can be turned into a highly productive asset.

Silkworm rearing works only if an established market and a grainage are within easy reach. However, once a critical mass of farmers start doing sericulture, it should be possible for them to capture more of the value chain by establishing a silk-spinning facility.

Scaling up potential lies mainly in those areas where markets and grainages are in place. Establishing these in other non-irrigated areas would enable local residents also to take up silkworm raising, so scaling up the approach.

More information: B N Champa, or S Sakthi Kumaran, BAIF Institute for Rural Development, Karnataka, gramodaya@sancharnet.net.in, www.birdk.org

The work of the BAIF Institute for Rural Development, Karnataka, is supported by SDC-Swiss Development Co-operation and German Agro Action.

www.sdc.admin.ch

www.welthungerhilfe.de

The biofuel hype: Chance or challenge for sustainable agriculture?

BAIF Institute for Rural Development, Karnataka

High global petroleum prices have stimulated interest in biofuels such as bio-ethanol and biodiesel. There has been a lot of debate on the possible role of biofuels in a sustainable energy strategy, but it has focused mainly on reducing greenhouse gases and the depletion of fossil fuel resources.

Less attention has been given to their effect on other farming activities. Might they compete with other farming activities for land and water? Can they be grown alongside other crops? Would they benefit small-scale farmers? Can they form part of a sustainable agricultural system?

Biofuels are often seen as having several advantages. They could be produced in many different places, from different crops. The crops can be converted to biofuel, which is easily stored and can be made available when needed. A liquid fuel is ideal for most energy needs: transport, electricity, illumination or cooking. Biofuels are climate-friendly, as the carbon dioxide released when they are burned is re-absorbed from the atmosphere when the biomass regrows. Moreover biofuels could enable local people to add value and generate income, helping reduce rural poverty and improve livelihoods.

Jatropha (*Jatropha curcas*) is one such biofuel which Sustainet partners in India have been studying. Jatropha grows well in rainfed areas; it could be grown by small-scale farmers and might contribute to the local economy as well as relieve India's dependence on imported petroleum. This section investigates the potential of biofuels in India in general, and of jatropha in particular.

India's interest in biofuels

Energy security is a major challenge for India: the country imports 70% of its oil needs, and oil accounts for about 30% of its imports and a similar percentage of the energy it consumes.[1] India has devoted a great deal of attention recently to biofuels to reduce its high dependency on these imports.

Finding new farmland to grow energy crops is not a large-scale option. So much interest has been given to non-edible oil-bearing trees and shrubs, such as jatropha. These crops need not compete directly with food crops because they can be planted on degraded land and around the edges of fields. The oils are not edible, so using the crops for fuel would not reduce the amount of food produced – at least directly. The oils can be used to make soap and grease, but these would not absorb large quantities of output.

1 Economist Intelligence Unit. 2005. India country profile.

About 50 research and state institutions, private companies and NGOs are currently working on biodiesel in India. The government's Planning Commission established a Committee on Development of Biofuels in 2002, which proposed establishing demonstration projects and then expanding the programme in a second phase. The Ministry of Rural Development will administer this proposed national mission.

The National Biodiesel Programme is under development. So it is not yet clear how much priority will be given to promoting biodiesel. The Minister for Petroleum and Natural Gas recently announced that biodiesel would be purchased for Rs 25 a litre. From January 2006 on, public-sector oil marketing companies began to purchase biodiesel that meets the fuel quality standards prescribed by the Bureau of Industrial Standards.

Potential threats

Discussion of the environmental, economical and social impacts of a large-scale biofuel programme has just begun. More research is clearly needed. Some tentative answers are given below. The details will depend on the strategy, measures and goals that are chosen.

- **Use of land** Energy crops (such as sugarcane) involve a high land use in comparison to other energy sources. This can be avoided if oil-bearing trees and shrubs are planted on degraded land and field bunds. Disadvantages of doing so include dispersed cultivation, lower harvests from marginal soils, and higher labour costs.
- **Competition with food production** If oil crops are profitable on degraded land, they may be even more attractive on normal soils and under irrigation. There is no way even for a successful biodiesel programme to guarantee that competition with food production will not occur**.**
- **Labour costs** If only additional plantations on field bunds or degraded land are discussed, local farmers will have more work to do, and that work will be labour-intensive. There has to be sufficient labour available, and costs need to be low enough to make growing the crop profitable.
- **Environmental impacts** Some 300 species of oil-bearing trees and shrubs are specified. But plant breeders and other scientists must focus on only a few if they are to have a chance of success. There is a risk of stimulating new monocultures, with negative impacts on soil fertility, water resources and biodiversity.
- **Risk** Energy crop production depends on climate and ecosystem changes, so is subject to uncertainty. Large, monocropped plantations may be vulnerable to substantial risks. These risks can be minimized if different species are used, grown in a variety of locations and conditions.

It will not be sufficient to address these issues only through national policy. Rather, all political and economic stakeholders, from the national to the local level, need to be included. A large-scale biodiesel programme will be consistent with sustainable development only if the goals of generating livelihoods and restoring the environment are built into the design and implementation of the programme.

The experiences of small-scale and marginal farmers in incorporating jatropha in sustainable agriculture practices can provide useful insights in the development of such a biodiesel programme.

Box 23 Biofuels

There are three different types of bioenergy resources:

- **Naturally occurring resources** (mostly wood) Even though firewood can be used sustainably, in fact it is heavily overused in most developing countries, leading to the rapid destruction of forests and resulting in many ecological problems.
- **Animal and plant residues** Farm residues include primary residues from cultivation and harvest (such as maize stover and dung), and secondary residues produced during the crop processing (such as bagasse). While they can be used as fuel, some of these residues are more valuable if used in other ways – to make compost or for construction.
- **Energy crops** Energy crops are grown specially for the fuel they produce. They include plantations of trees or reeds (where all or most of the plant is burned), and crops rich in carbohydrates or oil, such as sugarcane or jatropha.

How to convert this biomass into energy? There are three main ways:

- **Burn the solid material** Wood, stover and dung can be dried and burned directly, though this produces a lot of smoke and little heat. Biomass may also be crushed or turned into pellets, briquettes or charcoal.
- **Convert it to liquid or gas**, which can be burned. Liquid and gas fuels can be used more easily for transport or to generate electricity. Biogas is produced mainly by fermenting dung or by gasifying dry, solid biomass. Ethanol is produced by fermenting liquid carbohydrates and sugar-rich biomass such as bagasse from sugarcane. Biodiesel is produced from plant oils by a process called transesterification.
- **Generate electricity** All types of biofuels can be used to generate electricity using a steam or gas turbine, or in gas or diesel engines.

Cultivating jatropha

Jatropha originated in Central America but now grows wild all over India. It grows up to 5 metres high and produces small, yellow fruits with two or three black seeds. The seeds contain about 30–35% oil.

Almost all varieties of jatropha are poisonous as they contain curcin, a toxic protein. People know the plant is poisonous, so they are unlikely to eat the seeds accidentally. During harvest, the milky juice from the fruit sticks to clothes, but it is harmless on the skin or even in the eyes. Threats to livestock, crops and wild animals and plants are not known. The seedcake also contains the poison, so its large-scale use as a fertilizer could affect the environment and must be studied.

Jatropha offers a variety of potential uses (Figure 18). The plants have mainly been extensively cultivated, but large monocropped plantations on degraded wasteland are under discussion. To produce oil, the fruits can be harvested from May to September; during the whole of this time the plant produces flowers and fruits simultaneously. The fruit hulls have to be removed and the seeds dried before pressing. A small or medium press can be used to extract the oil; these presses can extract up to 30% of the seed weight in oil. More efficient solvent-based industrial-scale extraction can reach 35%.

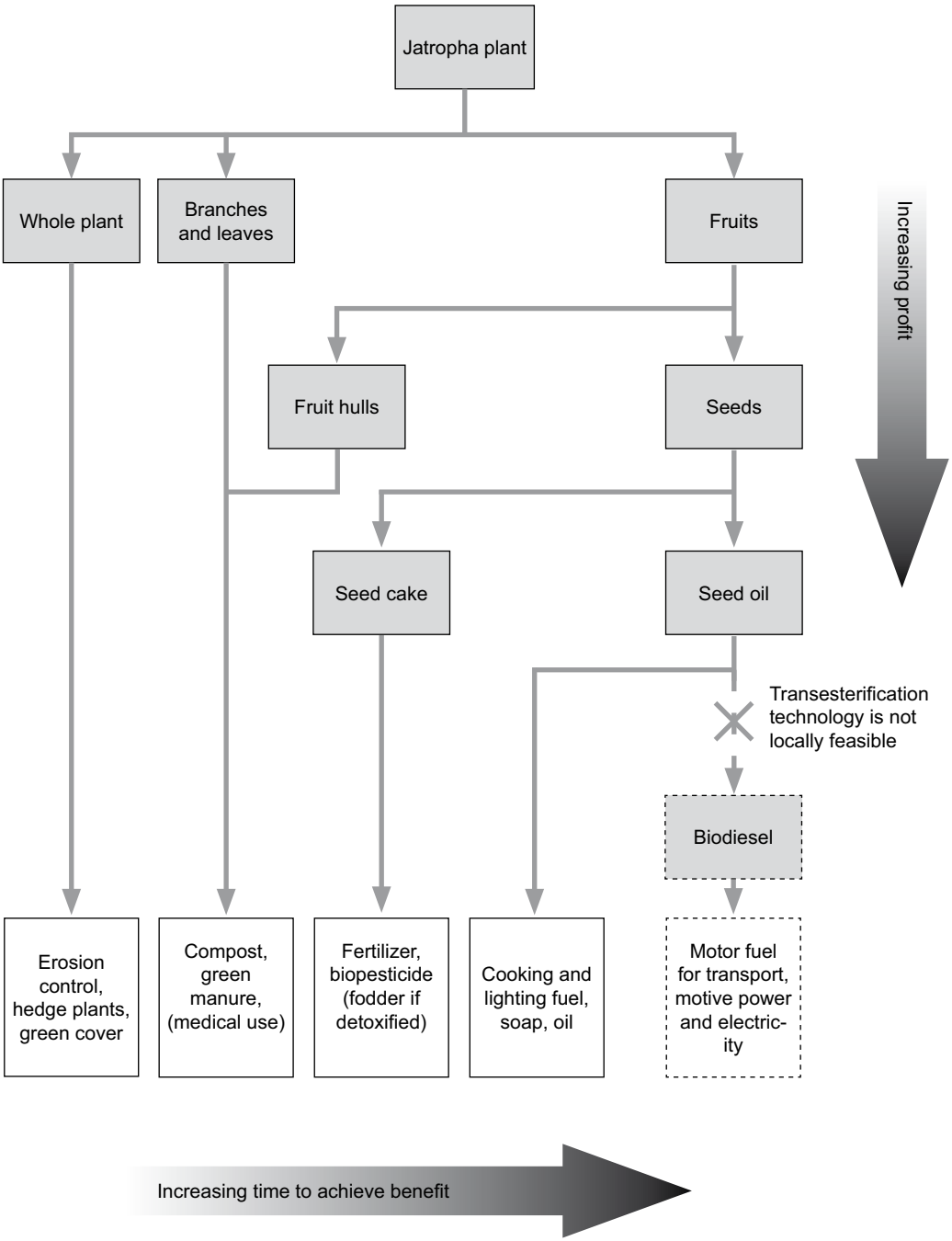


Figure 18 *Products of* Jatropha curcas *grown by small-scale farmers*

BIRD-K's work on jatropha

The BAIF Institute for Rural Development–Karnataka (BIRD-K) is a branch of BAIF, an NGO active in agriculture and rural development throughout India. BIRD-K has had extensive experience in integrating trees in diversified small farming systems. It started its research on jatropha in 1983. The objectives of current research are to:

- Compare the growth and yield of three jatropha varieties at different plant population densities.
- Study the suitability of vegetative propagation for jatropha.
- Examine the potential of jatropha for agroforestry on small farms, and to establish demonstration plots of jatropha on farmers' fields.
- Organize a national workshop on jatropha.

This research has shown that jatropha is a potential species for degraded lands where little water is available. Jatropha is affected by few pests, and the plant will survive a drought or frost – though it will not produce a yield that year. Jatropha does not grow in competition with other crops, but even shows favourable effects on their yields. This makes it an appropriate species for mixed cropping.

The bushes start to produce a harvestable amount of seeds only after 5 years. A yield of 1 kg per plant is unlikely in the fifth year, but is probable for the following year. The literature[1] cites yields of up to 12 t/ha for irrigated plantations, but such yields are not realistic on poor soils and without irrigation. Irrigation systems are costly, use scarce water resources, and are not feasible for small-scale and marginal farmers.

Farmers already use jatropha as fencing and green manure, but they are generally unwilling to plant it as a sole crop in their fields because they cannot sell it. However, farmers in a village near Tiptur agreed to establish demonstration live fences along the border of their farms. The jatropha is now very well established. These farmers had been collaborating with BAIF before this, and were trained in agroforestry.

Local people already know quite a lot about jatropha, and this knowledge could be useful in establishing commercial cultivation. Seedlings of the local variety could be produced locally on a small scale. Further modification and development of cultivation will benefit greatly from farmers' experiences. Although normal farmers cannot improve the germplasm, there is a wide scope for improvements in the planting system and the use of different products. However, introducing jatropha as a cash crop, with the harvest and processing of seeds into oil, would be a new aspect for farmers.

Jatropha production systems for small farms

Large-scale monocropping on degraded wastelands, as being widely discussed, would bring with it significant environmental, social and economical risks. In monocrops, jatropha's resistance to pests could decline significantly, leading to large-scale use of pesticides. Irrigation would compete for scarce water. There is no "wasteland" that is not used in some way

1 Heller, J. 1996. *Physic nut – Jatropha curcas*. International Plant Genetic Resources Institute, Rome; Becker, K. and G. Francis. 2003. *Bio-diesel from jatropha plantations on degraded land*. University of Hohenheim, Dept of Aquaculture Systems and Animal Nutrition, Stuttgart; and Hegde, N.G., J.N. Daniel, and S. Dhar. 2004. *Jatropha and other perennial oilseed species – Proceedings of the national workshop*. BAIF Development Research Foundation, Pune.

by herders, marginal farmers, etc. The economic viability of yield-oriented cultivation on wastelands is uncertain, as few experiments to measure yields have been done on degraded land, and as mentioned above, yields of 8–12 tons per hectare are highly improbable. The long harvest period and limited scope to mechanize picking reduce the efficiency of large farms compared to small.

The opposite may be true of decentralized cultivation by small-scale farmers. Integrating jatropha in diversified farming systems offers high potential benefits in all dimensions of sustainability. Getting the market started will be critical, as jatropha growers need someone to buy and process the seeds. Entrepreneurs are unlikely to invest in the required infrastructure unless farmers have already planted the crop 5 years beforehand. Farmers have no incentive to plant unless they can be sure of a market. This means that outside intervention may be needed to get the process started.

Decentralized jatropha production could consist of a cluster of farmers in one or more villages, cultivating up to 500 plants per hectare as hedges or on field bunds. The farmers would benefit immediately from the fencing, erosion control and the production of green manure. After 5–6 years, they could start to harvest the jatropha fruits. Landless people could earn money by picking the fruits on private and community land, or from wild growing plants. An oil-extraction facility could be set up by a cooperative or a private entrepreneur. The farmers could bring their seeds to the press, and collect the oil and seedcake for their own use or for sale. The oil can be used for cooking or lighting; the village might run a small diesel generator to produce electricity. The seedcake and fruit husks could be used as fertilizer.

Potential impacts

Environmental

Jatropha can easily be planted as a hedge or on bunds, and it fits in well with horticultural, agroforestry and pasture systems. It would increase the biodiversity in such farms.

Jatropha affects soil quality in several ways. Grown as a hedge, on bunds or across the slope, it helps reduce erosion. The leaves and branches can be used as green manure and incorporated into the soil during land preparation. Jatropha can be planted on a wide range of soils, and grows profusely within a short period. It can live up to 40 years and has a good tap-root system which holds the soil tightly.

Extensive use of jatropha in mixed cropping can reduce the dependence on one monocrop. Adding to diversity in this way could help avoid pest and disease problems, so reducing the indiscriminate use of pesticides and fertilizers. Jatropha could alleviate the pressure on soil and water and reduce competition for nutrients. It adds green cover and biomass to the field, fixing carbon dioxide from the atmosphere.

Economic and financial

Both farmers and the landless stand to gain from growing jatropha: farmers would gain income from growing the crop, and landless people could earn money harvesting and processing it during the lengthy picking period. The biggest potential added value lies in processing seeds to produce oil and refined products such as soap. Producing, picking, cleaning and drying the seeds are less profitable: in Tanzania, the added value per hour's work was US$ 0.29 for picking the seeds, $0.73 for oil extraction, and $2.49 for making soap.[1]

A locally run oil-press could increase farmers' earnings. They could sell the oil or use it as cooking fuel, for lighting, or to make soap. They could use the seedcake as fertilizer – provided that the ecological questions (see above) have been resolved.

Figure 19 *Given the right conditions, jatropha could be a valuable new crop for small-scale farmers*

How much could farmers earn from jatropha? The estimates in Tables 11 and 12 are for jatropha plantings on field bunds and as hedges on rainfed land, with about 500 plants per hectare. They assume a yield of 1 kg per plant, or a total of 500 kg of seeds per hectare per year.

The largest cost is for harvesting the seeds. There is little experience on how much fruit can be picked in a day. A labourer earning Rs 50 a day could collect, clean and dry perhaps 60 kg of fruits a day, producing 12 kg of seeds. At Rs 5 per kg, this amount could be sold for Rs 60, giving Rs 10 profit a day to the farmer. At 40–42 harvesting days a year, this yields a profit of only around Rs 400 for the whole year – too small given the uncertain calculations and the fact that the farmer has still to pay back the initial investment for planting (Table 11).

The picture changes if the farmer also extracts oil from the seeds. A traditional *ghani*-type press can produce 15–20% of the seed's weight in oil, yielding perhaps 100 kg of oil from 500 kg of seeds.

The price of the oil is then important: at the Rs 25 per kg currently offered by the government is too low for farmers to make enough profit (the low estimate in Table 12). If the price of diesel rises to Rs 40/kg, the profit becomes attractive. The seedcake left over after pressing can also be sold, but the farmer may prefer to use it as fertilizer on his or her own fields.

The initial investment costs during the first 3 years should be less than Rs 5,000. These costs include site preparation, digging of pits, planting, replanting, weeding, soil work and raising or buying seedlings. Most of this investment consists of labour costs, which farmers should be able to do themselves, so there is no cash outlay. Even small-scale farmers can afford to plant about 500 plants over a period of 1–3 years.

1 Henning, R.K. 2004. *The jatropha system – Economy and dissemination strategy.* Presentation at the international conference "Renewables 2004", Bonn.

Table 11 Estimated profit from selling unprocessed seeds from 500 jatropha plants

	Rs
Value of seeds harvested: 500 kg x Rs 5/kg	2,500
Labour costs for harvesting: Rs 50/day x 42 days	–2,100
Profit from selling 500 kg of unprocessed seeds	400

Table 12 Estimated profit from processing seeds from 500 jatropha plants

If seeds are pressed to make oil and seedcake	**Low estimate**	**High estimate**
	Rs	**Rs**
Income		
Value of oil: 100 kg x Rs 25 (low estimate) to 40/kg (high)	2,500	4,000
Value of seedcake: 400 kg x Rs 2 (low) to 3/kg (high)	800	1,200
Total income	3,300	5,200
Costs		
Labour costs for harvesting: Rs 50/day x 42 days	–2,100	–2,100
Cost of pressing 500 kg of seed: includes 25% profit for press owner	–350	–350
Total costs	–2,450	–2,450
Profit	850	2,750

More problematic is the time needed before the jatropha starts to produce a yield: 4–6 years. Most small-scale and marginal farmers cannot afford to wait that long. Here the mixed use of jatropha comes into its own. The promise of profit in 5 years' time is a distant one: other crops offer faster profits. A more immediate spur for farmers is the use of jatropha as a live hedge and to control erosion. BIRD-K's experiences in watershed projects have shown that farmers are interested in such possibilities.

Socio-cultural

Since people already know jatropha, no great difficulties are expected in expanding its use. Farmers in watershed projects have broadly accepted it for erosion control and as live fencing. Jatropha can benefit all social groups, including marginal farmers and landless labourers, if it is introduced to a broad group and if decentralized processing and marketing chains are in place.

The main problem that has been identified is the possibility that the workload of farmers, particularly women, will increase. This may occur if the yields do not produce a large enough

return (especially if farmers can sell only the unprocessed seeds). Jatropha cultivation involves two different types of work:

- Establishing the plantation. This is typically done by men, and is covered as a labour cost during the first 3 years in the estimate above.
- Picking the fruit and cleaning and drying the seeds. These are typically considered as women's and children's work. There is much more uncertainty about these costs, and they may be underestimated.

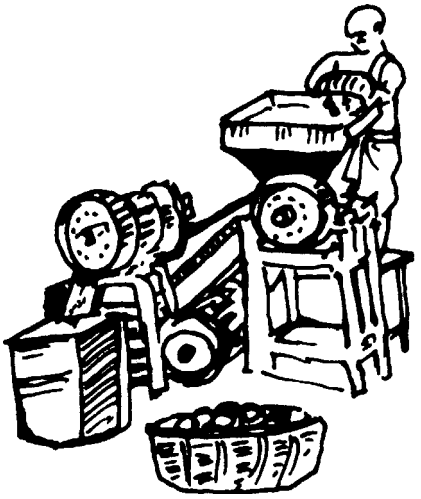


Figure 20 *Processing jatropha locally into oil and seedcake can boost farmers' profits*

There is a risk of underestimating the amount of work that women and children have to do. Introducing a cash crop like jatropha to small-scale farmers with a market price below the minimum daily wage would increase exploitation. The introduction of jatropha should carefully address this question, and discussions should involve women and women's organizations.

Conclusions

The current market price for oil of Rs 25/kg offered by the Indian state oil companies is too low to make jatropha oil production viable. But jatropha shows reasonable potential to contribute to the livelihoods of small farmers if all benefits are taken into account. Still, various questions need to be answered before a decision is made to promote jatropha on a broader scale.

- **Improved yields** High-yielding jatropha varieties need to be developed that are adapted to rainfed conditions. This research should be conducted in each agroclimatic zone, based on local wild varieties. The August 2003 BAIF National Workshop on Jatropha made detailed recommendations for research on plant improvement and cultivation practices.[1]
- **Handling seedcake** Because jatropha is poisonous, research is needed to ensure that the seedcake is safe before large amounts are used as fertilizer. Additional possibilities include using it as a biopesticide, and neutralizing the poison so the protein-rich seedcake can be used as livestock feed.
- **Ensuring positive environmental impacts** If jatropha is grown extensively on marginal soils, slopes and field bunds, it can have many positive environmental impacts. Large-scale monoculture plantings would have none of these benefits. Scaling-up strategies need to be developed to encourage the former but discourage monocultures. Possibilities to be studied include introducing other oil-bearing trees, and mixed cropping with food plants.

1 Hegde, N.G., J.N. Daniel, and S. Dhar. 2004. *Jatropha and other perennial oilseed species – Proceedings of the national workshop*. BAIF Development Research Foundation, Pune.

- **Labour costs** The cost of labour could become the main limiting factor for commercial cultivation. Realistic daily picking rates have to be assessed, considering the difference in yield in the high season (July and August) compared to the low season (June and September). At the current price of Rs 5/kg seeds and a minimum daily wage of Rs 50, a labourer must harvest at least 10 kg of seeds, or 50 kg of fruit, just to earn his or her salary.
- **Workload of women and children** Jatropha cultivation might increase the workload of women and children. Women and women's self-help groups must be included in making decisions about the type and scale of jatropha cultivation. Estimates of time demands, costs and benefits must be discussed with them. The scope for mechanizing various steps (such as de-pulping seeds) should be analysed.
- **Processing technologies** Appropriate technologies should be developed for small-scale processing units, and these should be made available to cooperatives and small entrepreneurs. Local farmers and their institutions should be motivated to build oil-processing infrastructure (India's decentralized dairy production infrastructure could be taken as a model). Local networks should be established to link self-help groups engaged in seed collection to operators of processing units and oil dealers. Information and marketing services should be strengthened to stabilize prices for oilseeds, oil and by-products.
- **Institutional and policy support** A national institution should be established to promote and regulate production, processing and utilization of tree-borne oilseed species. The long gestation period of these species means that outside interventions are needed to initiate the market and coordinate production and processing. For example, growers of perennial oilseed species could be given a specific period of tax exemption from the time the plantation starts yielding commercially.

However, biofuels will yield no benefits for small-scale farmers, and they will not be environmentally sound, if they are not integrated into sustainable agricultural systems which focus on the potentials and needs of small-scale farmers.

Based on a report by Mirco Gaul, 2005. *Jatropha curcas production systems for small farms: Research, demonstration and information exchange*. GTZ-Sustainet, Eschborn. More information: www.birdk.org; Mirco Gaul, mirco.gaul@gmail.com

The work of the BAIF Institute for Rural Development, Karnataka, is supported by German Agro Action.

www.welthungerhilfe.de

Realizing the potential of new products and markets

There is great potential in sustainable agriculture for farmers to produce new products, and to tap new markets. As the three cases above, and the cases in the earlier section on organic agriculture show, with appropriate interventions, the apparent disadvantages of India's many smallholder farmers may be turned into advantages. Farmers who cultivate in a traditional way can market their produce as organic. Those who have become dependent on agrochemicals can switch to organic production and so escape from the crushing burden of debt. Organic farmers can tap into lucrative markets for tea and other specialist products. With suitable measures to conserve water, dryland farmers can grow new crops – such as mulberries. Small dryland farms on poor soils may be the most appropriate place to grow biofuel crops.

Potentials

- **Local value addition** By processing their agricultural products, farmers can add value locally, earn more money, and form the basis of thriving small-scale rural industries.
- **Growing demand for organic products** The demand within India for organic products is still small, but it is growing. Awareness campaigns for organic products could boost demand for organic products among the growing middle class.
- **Organic certification** The creation of a national certification system for organic food would enable organic produce to be distinguished from conventional products. The labelling of sustainably produced goods would be the first step in promoting such products in India.
- **Competitive products** Indian farmers traditionally grow a range of products – tea, spices, fruits – that require certain soils or climatic conditions, so can be grown in a few places elsewhere. India's low labour costs also make it competitive in producing labour-intensive organic products.
- **Farmers' organizations** Supermarkets have spread all over India in recent years, but it is still difficult for small-scale farmers to sell to them because they need a constant supply of goods of consistently high quality. Supermarkets also ask for their produce to be traceable so they can avoid food scandals. To keep costs low, they prefer to contract with a few rather than with many producers. To access this market, smallholder farmers need to organize themselves.
- **Premium prices** People are willing to pay premium prices for sustainably produced goods. These products are sold in niche markets, especially in the developed world. It is necessary to link groups of farmers with these markets.

- **Range of products** Multiple cropping practices in sustainable agriculture produce small amounts of many products. These products have a variety of markets, and many are unfamiliar to local consumers, so it is necessary to seek new markets for them.

Constraints

The constraints to producing new products and markets through sustainable agriculture can be grouped into three levels: farmer, government and global.

Farmer level

- **Big players** Input and output markets are controlled by big players: seed and fertilizer companies, supermarkets, etc. Individual small-scale farmers have little market power and lack the ability to produce the volumes and qualities that the major buyers need.
- **Risk** Small-scale farmers need to balance different needs: the need for profit, consumption and ecological sustainability. Unlike large-scale farmers, small farmers risk all if they invest in new technologies: they are left only with debts if the new approach does not work out. Insurance could reduce this risk, but it is expensive, hard to find information about, and hard to get.
- **Contracts** Small-scale farmers generally lack marketing skills and are unused to making contracts. A common form of contract is with middlemen or dealers: the dealer provides the farmer with inputs; the farmer in return agrees to sell his or her output to the dealer at a fixed price. Lacking negotiating skills and information about alternatives, farmers are often trapped by such contracts – or at least feel that they are trapped – so do not stick to them. This leads to mistrust, and discourages bigger companies from making contracts with small-scale farmers. In the worst case, farmers feel they are so hopelessly caught in a debt trap that suicide is the only way out.
- **Infrastructure and information** There is a lack of infrastructure – roads, storage facilities, telephones – and market information available (e.g., on choice of crops and prices).
- **Economies of scale** Small-scale farmers find it difficult to use modern technologies efficiently. For example, it is not profitable to buy a tractor to plough just half a hectare. Farmers who cultivate larger areas can take better advantage of such technologies, so produce at lower cost.
- **Access to modern technology** Small-scale farmers have limited access to improved technologies, for example, for further processing of output. This lack of access has various aspects: a lack of capital, of information about technology options, of places to buy it, and of the technologies themselves: relatively little research has been done on sustainable agriculture.
- **Markets** Small-scale farmers lack established market chains from the field to national and international markets. Farmers can try to sell products directly at the market, but most lack the necessary negotiation skills, transport, etc. If they go to local market, they lose a whole day on the farm.
- **Value addition** Individual farmers do not have the capacity to add value to their produce – sorting, grading, processing, packaging and labelling.

Government level

- **Government support** The government provides subsidies for inputs such as fertilizers and hybrids, but not for sustainable agriculture. Government policies promoting these products is influenced by big companies. The playing field is not level!
- **Certification** India has no established system to monitor quality or certify sustainable agriculture products. Only small example projects have been set up recently. On the international level, there are possibilities for certification, but these are expensive.

Global level

- **Trade barriers** Agricultural exports are hampered by trade and tariff barriers.
- **Foreign subsidies** Other countries' farm subsidies reduce the competitiveness of India's farm exports and allow cheap imports to compete with local products.

Changes needed to achieve the potentials of new products and markets

Various changes are needed to enable small-scale farmers who practise sustainable agriculture to tap new products and new markets. They fall into four main categories.

- **Help farmers organize** Organization is a key to overcoming many of the constraints listed above. Groups of farmers have the potential to serve larger, more distant markets. They have more bargaining power than individual farmers. They can produce the volumes and quality of produce that markets demand. They can access loans and invest in technology needed. They can bypass middlemen and undertake extra steps such as processing and grading. But forming sustainable groups can be a big task: problems include a lack of accounting and management skills, corruption, and differences of opinion among group members. Small-scale farmers usually need support to form and manage organizations; the government or NGOs should help them do so.
- **Improve infrastructure and rural services** Roads, telephones and storage facilities must be improved. Investment is necessary in processing facilities. Training should aim to build entrepreneurial skills among young rural people and farmer groups, and such groups should be provided with initial capital so they can invest in productive enterprises. Rural credit systems should be strengthened to make it easier for farmers to obtain bank loans. Local groups should be given investment capital and encouraged to run custom hiring systems for tractors and other equipment.
- **Stimulate demand and market linkages for sustainable agriculture products** Demand for products produced organically or using other sustainable approaches can be stimulated by public awareness campaigns. Market information must be made available (e.g., by radio broadcasts). Information must actually reach farmers in remote areas. It is also necessary to help farmers improve their negotiating skills, monitor quality and certify produce as organic. Government officers could provide such services at minimal cost; NGOs and farmer organizations themselves can also play key roles.
- **Level the playing field** The government should provide the same level of support for sustainable agriculture (e.g., for planting trees or using green manure) as for chemical-based farming. Increased investment is needed in research and extension to improve techniques and matters of sustainable agriculture.

5
Participants' profiles

Dilip Akhade

Coordinator and in-charge, Centre for Experiential Learning – Rural Communes

Narangi Village, Post-Donwat off Khopoli Road, Taluka-Khalapur, District Raigad, Maharashtra 410203, India. Tel. +91-2192-278040, +91-2192-278081, fax +91-2192-278302, ruralcommunes@vsnl.net, celrccampus@vsnl.com, rgd_celrccampus@sancharnet.in, www.rcmpcc.org

Dilip is a village-level activist with experience in watershed development, community organization, training and capacity building, project co-ordination, monitoring and evaluation. He holds a BA and diploma in rural development.

Alka Awasthi

Senior deputy director, natural resource management, Swaraj

F-159-160, Industrial & Institutional Area, Sitapura, Tonk Road, Jaipur 302022, Rajasthan, India. Tel. +91-141-2771488, +91-141-2771855, fax +91-141-2770330, dralkaawasthi@yahoo.com, www.cecoedecon.org

Alka holds a PhD in botany from Rajasthan University, an MPhil in microbial biochemistry, and a postgraduate diploma in management of NGOs. She has been a senior research fellow of the Council of Scientific and Industrial Research and has written 20 research publications and a book. She worked for 12 years in environmental monitoring, biodiversity conservation, gender, health and sanitation, and natural resource management with the National Environmental Engineering Research Institute, WWF-India, and the Indian Institute of Rural Management.

Ashok Bang

Director, Alternative Agriculture Resource Centre (AARC), Chetana Vikas

PO Gopuri, Wardha, Maharashtra 442001, India. Tel. +91-7152-241931, +91-7152-240806, fax +91-7152-244005 (attn Chetana Vikas), chetana_wda@sancharnet.in

Ashok holds an MSc in horticulture (pomology) from the Indian Agriculture Research Institute, and a BSc in agriculture. His 25 years of experience include research in agricultural sciences, technology development with field research in sustainable and organic agriculture, including food crops, food and nutrition security, natural resource management, gender issues, rural development, training, human resource development, policy and advocacy. He has been involved in various development organizations and networks from the village to international levels, consultancies and evaluations.

Tubuli Behera

Artist, Agragamee

At/PO, Kashipur District, Rayagada, Orissa 765015, India. Tel. +91-94372-33701, +91-6865-285149, fax +91-6865-285174, tubuli23@rediffmail.com, www.agragamee.org

Tubuli has done conceptual and schematic artwork and book publication for Agragamee for the last 10 years. He graduated in arts. He has 15 years of experiences in fine art, paintings, modern art and sculpture. He has contributed to 40 books and more than 300 poster designs.

Isaac Bekalo

Regional director for Africa, International Institute of Rural Reconstruction (IIRR)

PO Box 66873-00800, Nairobi, Kenya. Tel. +254-20-4442610, 4440991, fax +254-20-4448814, admin@iirr-africa.org, www.iirr.org

Isaac holds a PhD in organizational development and planning. His experience includes teaching, NGO training, curriculum design and organizational development. He provides consultancy services on strategic planning, participatory monitoring and evaluation, project design and proposal writing. He specializes in participatory development approaches and organizational development.

Daniel Bhasker

India coordinator, Sustainet

Tel. +91-44-52615099, +91-44-52615077, fax +91-9444440947, danielbhasker@yahoo.com

Daniel has an MA in international relations, a bachelor of commerce degree, and a postgraduate diploma in computer applications. He was project manager with World Vision for multisector project for 8 years, covering health, education, infrastructure development, watershed management, monitoring and evaluation, leadership building and fundraising in six blocks of three districts in Maharashtra. He has been coordinator for Sustainet-GTZ for the past 2 years, coordinating activities with partner NGOs in India.

Vinod Kumar Bhatt

Deputy director, Navdanya

105 Rajpur Road, Dehradun 248001, Uttaranchal, India. Tel. +91-135-2743175, fax +91-135-2749931, navdanya@sancharnet.in, vinodkbhatt@rediffmail.com, www.navdanya.org

Vinod holds a doctorate in plant sciences from HNB Garhwal University, Srinagar Garhwal, Uttaranchal. He worked as a lecturer at the university, joining the development sector in 1995 after completing his doctoral degree in mushroom cultivation for the uplift of rural women in Dehradun. He joined Navdanya in June 1997. He has written several research papers as well as two books on medicinal plants of the Doon Valley and diversity in Navdanya's farm in the valley.

Franziska Bringe

Researcher, Leibniz Centre for Agricultural Landscape Research (ZALF)

Eberswalder Strasse 84, 15374 Müncheberg, Germany. Tel. +49 334 3282425, +49 163 686285, franziskabringe@hotmail.com, www.zalf.de

Franziska holds a master's degree in international agriculture from Humboldt University in Berlin. After graduating in 2005 she worked for GTZ in Germany and Kenya. She now works for ZALF on scaling-up of good practices in sustainable agriculture.

B N Champa

Research officer, BAIF Institute for Rural Development, Karnataka

PO No. 3, Kamadhenu Sharada Nagar, Tiptur, District Tumkur, Karnataka, India. Tel. +91-8134-250659, +91-8134-250658, fax +91-8134-251337, gramodaya@sancharnet.net.in, www.birdk.org

Champa holds a master's degree in sericulture from the University of Agricultural Sciences, GKVK, Bangalore. Her work experience includes training, demonstrations, proposal writing and other activities related to sericulture. She has also worked with the World Bank-funded Sujala watershed project.

Mirco Gaul

Freelance consultant in renewable energy and rural development

Graefe Str. 71, 10967 Berlin, Germany. Tel. +49-776-27457740, mirco.gaul@gmail.com

Mirco holds a master's degree in energy engineering and has completed post-graduate training at the Centre for Advanced Training in Rural Development (SLE). He has participated in the development of Sustainet's self assessment methodology and is currently working for the energy unit of the Environment and Infrastructure Department of GTZ.

Manas Ghosh

Senior lecturer and project co-ordinator, Ramakrishna Mission Ashrama, Narendrapur

Narendrapur, Kolkata 700103, India. Tel. +91-33-24772207/1/2/3, +91-33-24770715, fax +91-33-24772070, rkmlpndp@cal.vsnl.net.in

After completing his PhD on eco-friendly rice pest management, Manas did various research jobs for the ministries of agriculture and textiles for 7 years. He has worked as a senior lecturer in the Ramakrishna Mission Ashrama Narendrapur's Agricultural Training College and has been involved in the Mission's rural development, extension and research work since 1997.

Vivek Gour-Broome

Co-ordinator and in-charge, Medicinal Plants Conservation Centre – Rural Communes

Flat No 2, Taj Apartments, Next to Pune Adventist Hospital, Salisbury Park, Pune 411037, Maharashtra, India. Tel. +91-20-24269418, +91-20-24270216, ruralcommunes@gmail.com, www.rcmpcc.org

Vivek is a field biologist and taxonomist with a BSc in botany. He carries out field biodiversity surveys, photography and documentation, training for barefoot village biologists and taxonomists, and prepares training materials on medicinal plants, amphibians and reptiles.

Charlotte Haeusler

Development worker, GTZ Sustainet

GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit), Division 45 (Agriculture, Fisheries and Food), Dag-Hammarskjöld Weg 1–5, Postfach 5180, 65726 Eschborn, Germany. Tel. +49-6196-796489, charlotte.haeusler@gtz.de, www.sustainet.org

Charlotte holds a master's degree in geography and has done various internships in development co-operation. She has been working with Sustainet since November 2005, supporting network members and assisting with documentation activities.

Zakir Hussain

Programme manager, Centre for Sustainable Agriculture

#12-13-445, Street No. 1, Tarnaka, Secunderabad-500 017, India. Tel. +91-40-27017735, +91-40-27014302, fax +91-40-27002018, zakirhussainhyd@yahoo.com, www.csa-india.org

Zakir has a postgraduate qualification in agriculture. His experience includes programme planning, management and monitoring; capacity building of partner NGOs, farmers and a cadre of barefoot resource persons; identifying, validating and disseminating farmer innovations; developing resource materials on disease management; and developing communication and training manuals on alternative models of agriculture.

Felix zu Knyphausen

Development worker, GTZ Sustainet

GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit), Division 45 (Agriculture, Fisheries and Food), Postfach 5180, D-65726 Eschborn, Germany. Tel. +49-6196-791415, fax +49-6196-796103, felix.knyphausen@gtz.de, www.sustainet.org

Felix studied land management and then agricultural economics, and recently finished his MSc in agricultural economics at Imperial College London at Wye. After a short period working as a freelance consultant in the food industry, he joined the Sustainet project at GTZ.

K Srinivas Kumar

Project coordinator, Vikasa

Vuda Layout, Near Bank Colony, Bheemunipatnam 531163, Visakhapatnam District, Andhra Pradesh, India. Tel. +91-8933-229614, +91-9866707102, vikasa@rediffmail.com, www.vikasaindia.org

Srinivas has been in the field of rural development for more than a decade. He has worked in projects on forest and natural resource management with rural and tribal communities. He has experience in documentation, proposal writing and training staff and community members. His current work involved a project dealing with women and children in coastal communities.

S Sakthi Kumaran

Research officer, BAIF Institute for Rural Development, Karnataka

PO No. 3, Kamadhenu Sharada Nagar, Tiptur, District Tumkur, Karnataka, India. Tel. +91-8134-250659, +91-8134-250658, fax +91-8134-251337, baif1@sancharnet.in, gramodaya@sancharnet.in, www.birdk.org

Sakthi holds a master's degree in agriculture plant pathology. His work experience includes over 2 years in research on disease management at the National Research Centre on Sorghum, and 6 months in promoting biofuels. He is currently working on planning and proposal writing.

Niranjana Maru

Head of department and project co-ordinator, Alternative Agriculture Resource Centre (AARC), Chetana-Vikas

PO Gopuri, Wardha 442001, Maharashtra, India. Tel. +91-7152-241931, +91-7152-240806, +91-7152-244005 (attn Chetana-Vikas), chetana_wda@sancharnet.in

Niranjana is the project co-ordinator and head of natural resource management at Chetana Vikas's Alternative Agriculture Resource Centre. She has a master's in botany with a specialization in ecology. For the past 17 years she has worked on technology development in various aspects of sustainable agriculture, such as food and nutrition security for drylands, organic agriculture and watershed management, as well as rural development work, including awareness generation, capacity building and evaluation. She is also involved in networking and interacting for policy and advocacy interventions at national and international levels.

Joseph Mathew

Training coordinator, Peermade Development Society

Peermade, District Idukki, Kerala 685531, India. Tel. +91-4869-232197, +91-4869-232725, fax +91-4869-232096, pedess@sancharnet.in, pedes@md4.vsnl.in, www.pdspeermade.com, www.pdsorganicspice.com

Joseph holds a master's degree in economics from Kerala University. His experience covers community organization, participatory planning, formation of micro-level organization, and teaching. He has published several papers on indigenous health practices.

Paul Mundy

Independent consultant in development communication

Weizenfeld 4, 51467 Bergisch Gladbach, Germany. Tel. +49-2202-932 921, fax +49-2202-932 922, paul@mamud.com, www.mamud.com

Paul is a British consultant in development communication. He holds a PhD in journalism and mass communications from the University of Wisconsin-Madison. He specializes in easy-to-understand extension materials, developed through intensive writeshops like the one used to produce this book. He also provides consultancy services in various aspects of development communication. He has worked extensively in Southeast Asia, South Asia and Africa.

V Nandagopal

Process facilitator, Krushi Samstha/RWDP

16-621-4-1, Seshappathota, Madanapalle 517325, Chittor District, Andhra Pradesh, India. Tel. +91-8571-231253, +91-8571-230106, fax +91-8571-231880, krushi_samstha@rediffmail.com, rwdp@rediffmail.com

V Nandagopal holds MSc, MA and LLB degrees. He has 27 years of experience in rural development, mainly in rights-based approaches, community organization and mobilization, watershed projects, project planning, monitoring and evaluation, and working with networks.

Bonaventure Nyotumba

Art/desktop publishing consultant, International Institute of Rural Reconstruction (IIRR)

PO Box 66873-00800, Nairobi, Kenya. Tel. +254-723-667788, +254-20-444 2610, +254-20-444 0991, +254-20-316912, fax +254-20-444 8814, bonnie@iirr-africa.org, nyotsz@yahoo.com, www.iirr.org, www.developmentart.com/artists.htm

Bonaventure is a freelance designer-cum-artist based in Nairobi. He has a diploma in fine art. He has worked as a designer/painter for Bellerive Foundation, CARE-Kenya, *Rainbow* magazine, Jacaranda Designs, Don Bosco, Jericho Church and the International Institute of Rural Reconstruction. He specializes in fine and graphic art, product design and desktop publishing.

P M Paul

Director of operations, Cecoedecon

F159-160 Industrial & Institutional Area, Sitapura, Jaipur, Rajasthan. Tel. +91-141-2771488, +91-141-2770812, fax +91-141-2770330, email pmpaul_2002@yahoo.co.in, www.cecoedecon.org

P M Paul is one of the directors of Cecoedecon, one of the leading NGOs in Rajasthan. He has a master's degree in social work, and a diploma in social development from Coady International Institute, Canada. He has wide experience with communities on different approaches to development. He has been part of many networks in the region working on different issues.

G V Ramanjaneyulu

Executive director, Centre for Sustainable Agriculture

#12-13-445, Street No. 1, Tarnaka, Secunderabad-500 017, India. Tel. +91-40-27017735, +91-40-27014302, fax +91-40-27002018, ramoo@csa-india.org, gvramanjaneyulu@gmail.com, www.csa-india.org

Ramanjaneyulu holds a PhD in agriculture extension with bachelor and master's degrees in agriculture. He has worked as a scientist with the Indian Council of Agriculture. His experience includes decision making and information management, curriculum design, developing communication and training materials, policy research and documentation on various models of agriculture.

Omprakash Rautaraya

Monitoring and Evaluation Officer, Agragamee Watershed Co-ordination Office

#ND-8, VIP area, IRC Village, Nayapalli, Bhubaneswar 751015, Orissa, India. Tel. +91-674-2551123, +91-94371-90119, fax +91-674-2551130, omprakash1972@rediffmail.com, www.agragamee.org

Omprakash holds a master's degree in business administration from Central University Pondicherry, and a BSc in agriculture from Orissa University of Agriculture and Technology. He has 8 years of experience in the development sector, especially in planning, monitoring and evaluation, project design, implementation of watershed development, agricultural development and rural development projects.

Stefan Sieber

Agriculture economist/project coordinator, Leibniz Centre for Agricultural Landscape Research (ZALF)

Eberswalder Strasse 84, 15374 Müncheberg, Germany. Tel. +49-334-328 2125, +49-30-6167 5435, fax +49-334-3282308, stefan.sieber@zalf.de, stefan_sieber@gmx.de, www.zalf.de

Stefan holds a doctoral degree in agricultural economics and a diploma in agricultural sciences. His experience includes managing both EU-relevant and development projects. He has worked for 2 years in development collaboration in Latin America. He specializes in project evaluation and impact monitoring, impact assessment of policy instruments, sector analysis and agricultural modelling, environmental and economic support, policy information systems, and capacity and institution building.

Sabu M Simon

Scientist and head, Sahyadri Research Institute, Peermade Development Society

Peermade 685531, Kerala, India. Tel. +91-4869-232197, +91-4869-232160, fax +91-4869-232096, pedess@sancharnet.in, pedes@md4.vsnl.in, pedes@satyam.net.in, sabumsimon@sancharnet.in, www.pdspeermade.com, www.pdsorganicspice.com

Sabu currently heads the Sahyadri Research Institute, the research division on organic agriculture of the Peermade Development Society. He has a postgraduate degree in science and completed an MPhil in future studies. He has been working in the field of social work since 1998 and has previously worked with multinational companies in the field of biotechnology and plant tissue culture. His present work involves technology development, research and training in organic agriculture.

Samuel Sundar Singh

Network manager (genetic engineering), Deccan Development Society

101 Kishan Residency, Street No. 5, Begumpet, Hyderabad-16, Andhra Pradesh, India. Tel. +91-40-27764577, +91-40-27764744, fax +91-40-27764722, lyd2_ddsppvri@sancharnet.in, samuel_665@rediffmail.com, www.ddsindia.com

Samuel has an MPhil degree. His main interests are in agriculture and rural development, with a special interest in sustainable agriculture. His work focuses on issues related to the adverse effect of Bt cotton and its ramifications on ecology, and on promoting non-pesticide management methods.

Helga Stamm-Berg

Project coordinator, Sustainet

GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit), Division 45 (Agriculture, Fisheries and Food), Dag-Hammerskjöld-Weg 1–5, Postfach 5180, 65726 Eschborn, Germany. Tel. +49-6196-791476, +49-6173-320866, fax +49-6196-7966103, helga.stamm-berg@gtz.de, www.sustainet.org

Helga holds a master's degree in land use planning. She has worked for more than 20 years in development co-operation. She has lived and worked about 8 years in Nepal, Indonesia and Thailand before joining GTZ in Eschborn. There she worked as desk officer for Mozambique and Malawi as well as for the Technical Environmental Department. Her professional experiences include agricultural and rural development, land use and regional planning, watershed management and environmental impact assessment. Helga has also worked for FAO, GTZ and for World Vision Germany.

P Viswanadh

Executive secretary, Vikasa

Vikasa Cooperative Colony, Chodavaram Visakhapatnam District, Andhra Pradesh 531036, India. Tel. +91-891-2717309, +91-8934-245206, fax +91-98495-12172, vikasa_india@yahoo.com, www.vikasaindia.org

P Viswanadh holds an MSc in agriculture and a post-graduate diploma in horticulture. He has 25 years of experience in natural resource management related to dryland agriculture. In 1997, Vikasa, the organization he leads, was honoured with the "Rajiv Gandhi Patri Bhoorni Mitra Award", a prize constituted by the Ministry of Rural Development, for its contribution to wasteland development.

Millions of farmers in remote rural areas of India struggle to feed themselves and their families. At the same time, their environment - the resources on which they depend - is deteriorating daily: their yields decline as erosion and deforestation gnaw at vital resources, and wells run dry as the groundwater sinks. Driven ever further into debt by the pressure to pay for expensive yet unnecessary inputs, thousands of desperate farmers have taken their own lives.

It does not have to be so. This book shows how sustainable agriculture can help India's farmers - especially those in poor, remote areas - pull themselves out of poverty. It details 14 examples of how development initiatives have helped farmers in some of the remotest parts of the country break out of the cycle of poverty, debt and environmental degradation, and improve their lives and livelihoods through agriculture that is economically, ecologically and socially sustainable. These examples cover organic agriculture, land and water management, and strategies to improve market access for small-scale farmers.

The examples in this book have been chosen not only because they have been successful - but also because they can be replicated on a large scale. The analysis and lessons can be applied to a wide variety of situations, not just in India, but also throughout the world. Such large-scale application is vital if the Millennium Development Goals of eradicating extreme poverty and hunger and ensuring environmental sustainability are to be met.

Sustainet is an initiative of the German Council for Sustainable Development in partnership with Bread for the World, German Agro Action, Misereor and GTZ (in Germany) and local organizations in Asia, Africa and Latin America. (www.sustainet.org)

Deutsche Gesellschaft für
Technische Zusammenarbeit (GTZ) GmbH

Sustainet (Sustainable Agriculture Information Network)

Dag-Hammarskjöld-Weg 1-5
65760 Eschborn/Germany
T +49 61 96 79 - 1426
F +49 61 96 79 - 11 15
E info@gtz.de
I www.gtz.de, www.sustainet.org