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Sustainet
Sustainable Agriculture Information Network

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Sustainable agriculture

A pathway out of poverty for India's rural poor

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SUSTAINABLE AGRICULTURE

SUSTAINABLE AGRICULTURE

A PATHWAY OUT OF POVERTY FOR INDIA'S RURAL POOR

Sustainet

Sustainable Agriculture Information Network

Sustainet aims to systematically evaluate, communicate and disseminate successful approaches and concepts of sustainable agriculture in selected pilot regions. It works at various levels. Discussion between Sustainet's German NGO project partners on the poverty reduction impacts of different models and strategies, coupled with reflection and assessment in the pilot regions in close cooperation with local partners, contribute to harmonizing implementation strategies. Analysis and discussion of successful and promising dissemination strategies aims to influence funding priorities for agricultural and rural development. The exchange of information and networking between public, civil society and private partners on sustainable land use, as well as capacity building of private and public rural service providers, strengthens advocacy and the delivery potential of change agents.

Sustainet's goals are to:

- Highlight the significance of sustainable agriculture for global food security,
- Identify promising key promotion priorities in rural areas,
- Specify fields of action for agricultural policy, and
- Establish networks between local and international partners, thereby promoting the dissemination of successful concepts.

More information: www.sustainet.org

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Contents

Figures

Boxes

Tables

Foreword

Josef Sayer[1]

We tend to think of "sustainability" as having three dimensions: ecological, economic and social. But these three dimensions are not separate: in reality they are intertwined. Plus, sustainability has an international perspective that we must consider.

Acting and behaving according to this concept of sustainability is a global task, and is a key question for humanity. In combating poverty, all three dimensions of sustainability have to be taken into account. In the ecological dimension, conserving a sound environment for future generations is closely related to the fight against poverty. Millennium Development Goal 8 aims at the economic dimension: it calls for a global development partnership which overcomes discrimination between poor and rich countries. Finally, there is a close connection between poverty and the social dimension. If people are starving, their health is at risk – this is especially true for the children of the poor – and combating diseases like HIV/AIDS, malaria or tuberculosis becomes very difficult.

How does Sustainet, as a "lighthouse project" of the German Council for Sustainable Development, meet the task of combating poverty while taking into account the concept of sustainability? A lighthouse project is supposed to have a big political impact. But we know that any project is able to make only a limited contribution to global challenges like combating poverty and assuring food security in rural areas. So, what are the interesting features of Sustainet? It focuses on two crucial aspects:

- On one hand, Sustainet creates awareness of errors in the so-called "Green Revolution". With the Green Revolution it seemed possible to solve the problem of food insecurity worldwide. But as the principles of sustainability were not taken into account; the Green Revolution failed, and even worse, contributed to the impoverishment of small farmers by trapping them in debt.
- On the other hand, transnational companies pose a similar threat to sustainability through campaigns that promise to abolish hunger through "green gene" technology.

As a reaction to the Green Revolution, development cooperation – above all NGOs and churches – established practices taking into account the criteria of sustainability. Proofs were shown in Africa, Asia and Latin America that it is possible to increase yields by 100% through sustainable agriculture especially for small farmers. Sustainable agriculture actually combats hunger in rural areas and significantly enhances degraded soils.

1 Member of the German Council for Sustainable Development and Executive Director of Misereor. This Foreword is based on a speech presented at the Annual Conference of the German Council for Sustainable Development, Berlin, September 2005.

How can these experiences and models of "good agricultural practices" be disseminated? Why are such solutions limited to certain areas? What are the preconditions for a successful scaling up, and what factors hamper dissemination? As there are no systematic analyses to answer these questions, the lighthouse project aims to figure out how successful, sustainable approaches assuring food security could be spread. In this way, the project will present a real alternative to "green gene" technology, and will have a strong political impact.

The local approaches analysed by Sustainet deal with soil conservation, upgrading soil fertility, integrated animal husbandry, diversification of cultivated crops, protection of biodiversity, natural pest management, post-harvest improvements, marketing, and strengthening local institutions. These are diverse approaches; they all minimize the consequences of agricultural production but differ in the level of external resources used and in the type of tillage operations.

In conclusion, the main objectives of the lighthouse project are:

- To implement the three correlating dimensions of sustainability in the field of agriculture in developing countries.
- To show the effectiveness of networks between local and international partners and contribute to the dissemination of successful approaches of sustainable agriculture.
- To make policymakers increasingly aware of the significance of sustainable agriculture for rural economical growth and for fighting poverty.
- To identify promising strategies that should be promoted to meet the Millennium Development Goals and which can result in recommendations for agricultural development.

Sustainet partners in Germany and India

German organization	*Indian organization**
Bread for the World (Brot für die Welt) www.brot-fuer-die-welt.org	**Navdanya** (p. 24) www.navdanya.org **Chetana-Vikas** (p. 50) chetana_wda@sancharnet.in **Krushi Samstha** (p. 67) krushi_samstha@rediffmail.com
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) www.gtz.de	**Indo-German Bilateral Project** (p. 100) www.watershedindia.50megs.com **Vikasa** (p. 108) www.vikasaindia.org
German Agro Action (Deutsche Welthungerhilfe) www.welthungerhilfe.de	**Centre for Sustainable Agriculture** (p. 40) www.csa-india.org **Agragamee** (p. 62, 75) www.agragamee.org **Ramakrishna Mission Ashrama** (p. 94) rkmlpndp@cal.vsnl.net.in **BAIF Institute for Rural Development** (p. 138, 144) www.baif.com, www.birdk.org
Misereor www.misereor.org	**Deccan Development Society** (Permaculture Society) (p. 34) www.ddsindia.com **Rural Communes** (p. 81) ruralcommunes@gmail.com **Centre for Community Economics and Development Consultants Society** (Cecoedecon) (p. 88) www.cecoedecon.org **Peermade Development Society** (p. 130) www.pdspeermade.com

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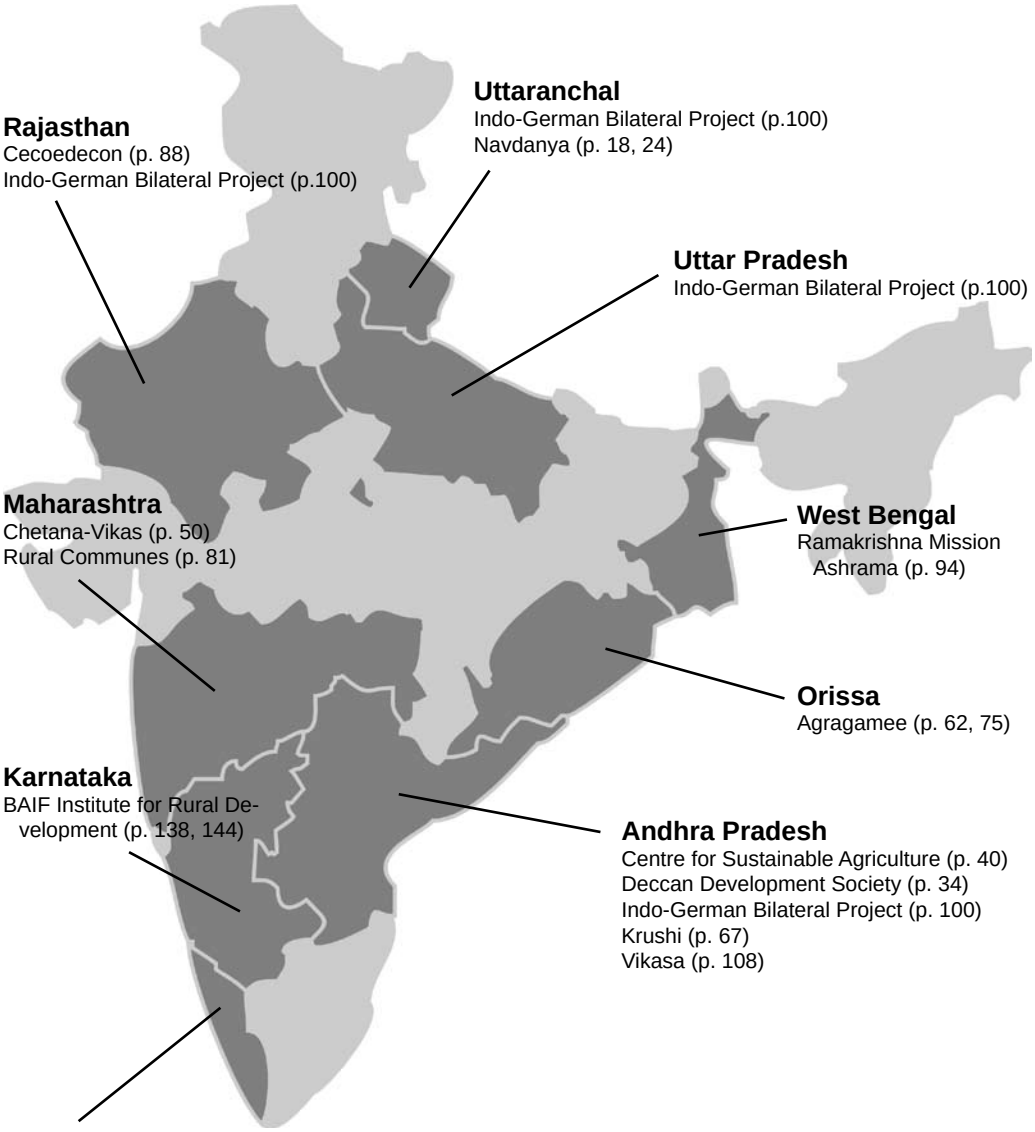
Federal Ministry for Economic Corporation and Development (BMZ), www.bmz.de

Federal Ministry of Food, Agriculture and Consumer Protection (BMELV), www.verbraucherministerium.de

*Recipients of current or past support

Locations of projects described in this book



Uttaranchal
Indo-German Bilateral Project (p.100)
Navdanya (p. 18, 24)

Rajasthan
Cecoedecon (p. 88)
Indo-German Bilateral Project (p.100)

Uttar Pradesh
Indo-German Bilateral Project (p.100)

Maharashtra
Chetana-Vikas (p. 50)
Rural Communes (p. 81)

West Bengal
Ramakrishna Mission Ashrama (p. 94)

Orissa
Agragamee (p. 62, 75)

Karnataka
BAIF Institute for Rural Development (p. 138, 144)

Andhra Pradesh
Centre for Sustainable Agriculture (p. 40)
Deccan Development Society (p. 34)
Indo-German Bilateral Project (p. 100)
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Peermade Development Society (p. 130)

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For further information and contact details, see the *Participants' profiles*, page 157.

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1
Introduction

Helga Stamm-Berg, Sustainet

Sustainable agriculture needs to be brought back into the development agenda! This book not only shows that sustainable agriculture works; it also outlines what should be done and how it can be done.

All the agricultural practices described in this book highlight in one or the other way how sustainable agriculture contributes directly to the United Nations' Millennium Development Goals (MDGs). They cover a whole range of improving sustainability: raising soil fertility, improving water storage capacity, increasing water quality, diversification, raising people's capability to cope with risks and withstand natural calamities, reducing energy consumption, minimizing risk, and so on.

It is impossible to achieve sustainable development without applying sustainable agriculture on a large scale. The relationship between agricultural production and eradication of extreme poverty and hunger is very strong: agriculture is the very basis for food security. Together with fisheries, it provides practically all of the world's food. So it is of critical importance for the achievement of **MDG 1**, "**eradicate extreme poverty and hunger**".

Although agricultural production amounts to one-and-a-half times the global population's basic needs – and is growing constantly – there is still widespread hunger in the world.

So hunger is not simply a function of how much food is produced. Differences in purchasing power and access to land and resources are among the major causes of underdevelopment in rural areas. Agriculture can be sustainable when it not only produces a lot of high-quality food, but also generates income for poor people. That means rural development: improving transport, development of market facilities and linkages, improving (access to) information, participation of the rural poor in decision making, providing access to credit, and so on.

Why agricultural and rural development?

The Indian government's commitment to agriculture is a global success story. Since Independence in 1947, India has succeeded in significantly reducing the number of people living in poverty.

In the early 1960s, India introduced "Green Revolution" technologies: high-yielding grain varieties, fertilizer, pesticides and irrigation. By the early 1990s, India was self-sufficient in food-grain production. But not everyone has enough access to the food produced, and India is still the country with the most poor people on our globe: of India's 1028 million people (in 2001), around 300 million people were classified as "poor", and the majority of

these live in rural areas. India's ability to reduce poverty will determine the overall success of achieving MDG 1.

Most people in rural India depend directly or indirectly on farming for their livelihood. Despite this, not enough attention has been given to agriculture to overcome poverty. The importance of agriculture to stimulate rural growth is generally accepted, but politicians have failed to establish the necessary frame conditions for rural economic growth.

It is widely accepted that agricultural growth and human development (in the fields of education, health and women's issues) are key factors for rural development. The World Bank, the Food and Agriculture Organization of the United Nations, the International Fund for Agricultural Development, as well as bilateral development agencies agree that investment in agricultural growth helps reduce poverty and ensure pro-poor growth more than any other form of intervention.

The agricultural sector has potential to create economic growth in rural areas. It generates job opportunities in adding value (as in the food processing industry), in bringing agricultural products to the consumer (market linkages), and in providing support (infrastructure, information, quality control and training).

Rising populations mean more demand for food. Improved standards of living in much of the world also mean greater demand for quality food (more meat, dairy products and organic food). If these demands are to be met, national farm outputs must rise, and farmers must produce different types of products. In addition, access to food must be improved for those who still cannot meet their basic needs, wherever they live – in remote rural areas, marginal areas or urban slums.

India is a vast, diverse country. The 28 States and seven Union Territories differ vastly in terms of their natural resources, administrative capacity and economic performance. The northern and northeastern states, especially, are still very poor. There is a wide range of scientific knowledge on how to practise sustainable agriculture; what is missing are the steps needed to implement these techniques on a much larger scale.

Why small-scale agriculture?

A crucial challenge for India's development is to ensure that small-scale farmers participate in and contribute to agricultural and rural growth.

India is urbanizing fast, but some 73% of the population still lives in rural areas. India is still a land of small-scale farmers: about half of all farms are less than 1 ha in size, and another 20% are less than 2 ha. There are strong, direct relationships between agricultural productivity, hunger, and poverty. Most poverty is concentrated in rural areas, especially amongst small-scale farmers and landless families. The slow pace of poverty and hunger reduction points to an urgent need for strategies that better target the areas where poor people live and the activities on which their lives depend.

The international community has adopted the reduction of poverty and hunger eradication as overarching goals for development. At the 1996 World Food Summit in Rome, all nations committed themselves to halving the number of undernourished people from around 800 million to 400 million by 2015.

Box 1 "Small farms are more efficient than large farms"[1]

"Not every agriculture will have significant impacts on poverty reduction. Both FAO and the Hunger Task Force are in favour of a small-holder focus:

- The bulk of poor people in rural areas of regions where poverty and hunger are high and resistant are: smallholders producing staple for own consumption or small surpluses for the local markets.
- There is significant potential for the expansion of staples production as population expands in the developing countries (for Africa, it is expected that traditional staples demand will double by 2015).
- Small farms are more efficient than large farms: land productivity is higher for small farms.
- Small farms employ more labour per hectare than large farms. This contributes to an increase in wages and rural employment.
- Producing for own consumption (subsistence) or for local markets reduces transaction costs associated with purchased foods and improved food access and nutrition.
- Expenditure patterns of smallholder households promote local growth."

1 Source: Kostas Stamoulis, Chief of Agricultural Sector in Economic Development Service, FAO, and member of the Hunger Task Force, in a Sustainet panel discussion, 6 September 2005, Berlin.

The most pressing questions are, what needs to be done to enable poor rural people to develop sustainable livelihood systems? And what is required to enable small farmers to adopt sustainable agriculture on a large scale?

FAO has formulated the following priority areas:

- Improve agricultural productivity in poor rural communities
- Develop and conserve natural resources
- Expand rural infrastructure and market access
- Strengthen capacity for knowledge generation.

Interventions towards sustainable agriculture will be viable in the long run only if they are economically viable. Economic viability will be achieved if the total costs of the intervention are significantly lower than the overall economic benefits achieved at the target group level. Policy interventions and investments that fulfil this criterion make sense.

Interventions which do not meet this condition might also be sensible in certain circumstances, for example to ease political unrest in specific areas, or to reduce the costs of subsidizing groups who are unable to survive on their own.

Why sustainable agriculture?

We can compare three broad types of farming: traditional production systems, conventional modern agriculture (such as Green Revolution technologies), and sustainable agriculture. We can compare them across three dimensions: ecological, economic and social.

Ecological sustainability

Many traditional and most conventional farm practices are not ecologically sustainable: they overuse natural resources, reducing soil fertility, causing soil erosion, and contributing to global climatic change. Sustainable agriculture has several major advantages over both traditional and conventional practices:

Soil fertility A continuous fall in soil fertility is a major problem in many parts of India. Sustainable agriculture improves fertility and soil structure and prevents erosion, so would be an answer to this problem.

Water Irrigation is the biggest consumer of fresh water, and fertilizer and pesticides contaminate both surface- and groundwater. Sustainable agriculture increases the organic matter content of the topsoil, so raising its ability to retain and store water that falls as rain.

Biodiversity Sustainable agricultural practices frequently involve mixed cropping, so increasing the diversity of crops produced and raising the diversity of insects and other animals and plants in and around fields.

Pollution Pesticides are hazardous to human health as well as to the local ecology. Incorrect handling, storage and use of pesticides lead to health and pollution problems. Sustainable agriculture reduces or eliminates the use of hazardous chemicals; instead it controls pests with a variety of biological and agronomic measures and the use of natural substances.

Landscape Agriculture and forestry clothe the rural landscape. Inappropriate use causes erosion, landslides and flooding, clogs irrigation channels, and reduces the ability of the land to support the local population. Impoverished rural people flock into the cities in search of jobs, forming unsightly, insanitary slums that further destroy the landscape. Rehabilitating ecologically damaged areas needs huge investments that few countries can afford. Sustainable agriculture avoids these problems by improving productivity, conserving the soil, avoiding the expansion of farming into unsuitable areas, and preserving rural jobs.

Climate The way agriculture is practised contributes significantly to global climatic changes. Conventional agriculture contributes to the production of greenhouse gases in various ways: by reducing the amount of carbon stored in the soil and in vegetation, through the production of methane in irrigated fields, and through energy-intensive activities such as the production of artificial fertilizers. Adopting sustainable agriculture would reduce these impacts significantly.

Economic sustainability

Agriculture cannot be sustainable unless it is economically viable over the long term. Conventional agriculture poses greater long-term economic risks than "sustainable" alternatives.

Export vs local orientation Governments tend to view export-oriented production systems as more important than those that supply domestic demands. This is misguided. Focusing on exports alone involves hidden costs: in transport, in assuring local food security, etc. Policies should treat domestic demand and in particular food security (either by farmers producing food for themselves, or by selling produce for cash they can use to buy food) as equally important to the visible trade balance.

Debt The Green Revolution raised India's grain output significantly, but a vast number of small-scale farmers ran into a debt trap: they took out loans to raise their production, then found they could not pay the money back. About 40,000 were so desperate that they committed suicide.

Risk Concentrating on specific commodities seems to promise high economic returns. But market production implies certain risks: markets change quickly, and international agricultural prices are dropping. Cheap foreign food may sweep into the national market, leaving Indian farmers without a market. As a World Trade Organization signatory, the Indian government is under pressure to deregulate and open its economy to the world market, so cannot protect its farmers behind tariff walls.

Niche markets Organic agriculture is one of the strongest ways to farm in an environmentally sustainable way. The demand for certified organic products is increasing quickly, opening opportunities to expand sales of such products and to explore niche markets.

Employment Farming is the main source of employment for rural people. Trends towards specialization and mechanization may increase narrowly measured "efficiency", but they reduce employment on the land. The welfare costs of unemployment must be taken into account when designing national agricultural support programmes. Sustainable agriculture, with its emphasis on small-scale, labour-intensive activities, helps overcome these problems.

Social sustainability

The social sustainability of farming techniques is related to the ideas of social acceptability and justice. Ignoring these issues risks losing valuable local knowledge and provoking political unrest.

Inclusiveness Development cannot be sustainable unless it reduces poverty for the broad masses of people in India. The government must find ways to enable the rural poor to benefit from agricultural development.

Political unrest Gaps between the "haves" and "have-nots" feed a feeling of social injustice among those who feel neglected and excluded from development opportunities, as well as from better-off sympathizers. The result is a climate favourable to political opposition and even violence.

Local acceptance Many new technologies fail because they are based on practices or assumptions from outside. Sustainable agricultural practices usually are based on local social customs, traditions, norms and taboos, so local people are more likely to accept them and adapt them to their own needs.

Indigenous knowledge Sustainable agricultural practices often rely on traditional know-how and local innovation. Local people have a wealth of knowledge about their environment, crops and livestock. They keep locally adapted breeds and crop varieties. They have social structures that manage and conserve common resources, help people in need, and maintain the social fabric. Rather than ignoring or replacing this knowledge, sustainable agricultural development seeks to build on it and enrich it with appropriate information from outside.

Gender In traditional agriculture, women traditionally bear the heaviest burdens in terms of labour. In modern conventional farming, too, men often benefit the most: they control

what is grown and how the resulting income is spent. Sustainable agriculture attempts to ensure that the burdens and benefits are shared more equitably between men and women.

Food security Traditional farming techniques often fail to produce enough food, or enough variety of food for a balanced diet. Conventional modern farming focuses on a few commodities, so people still do not have a balanced diet. Sustainable agriculture improves food security by improving the quality and nutritional value of the food, and by producing a bigger range of produce throughout the year.

Participation Traditional society in India is riven by wealth and caste distinctions. Introducing conventional farming innovations tends to exacerbate these: the rich and higher-caste tend to benefit, while the poor and lower-caste are left out. Sustainable agricultural interventions consciously target the less well-off, and empower them so they can organize and speak with their own "voice", so promoting dialogue and democracy.

Approaches to sustainable agriculture

Sustainable agriculture is a broad concept that covers a number of different approaches. All try in one way or other to achieve environmentally sound, economically profitable, ethically acceptable and socially responsible form of land husbandry. They have much in common with each other, and different people and organizations define them differently, so overlap is not unusual. The discussion below illustrates some of these approaches.

Box 2 Definition of sustainable agriculture

At the 1992 Earth Summit in Rio de Janeiro, the UN Food and Agriculture Organization (FAO) defined "sustainable agriculture and rural development" as follows:

"Sustainable development is the management and conservation of the natural resource base and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations. Such sustainable development (in the agriculture, forestry, and fisheries sectors) conserves land, water, plant and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable and socially acceptable."[1]

In 1995 FAO went on to define sustainable agriculture and rural development more specifically as a process that meets the following criteria:

- "Ensures that the basic nutritional requirements of present and future generations, qualitatively and quantitatively, are met while providing a number of other agricultural products.
- Provides durable employment, sufficient income, and decent living and working conditions for all those engaged in agricultural production.
- Maintains and, where possible, enhances the productive capacity of the natural resource base as a whole, and the regenerative capacity of renewable resources, without disrupting the functioning of basic ecological cycles and natural balances, destroying the socio-cultural attributes of rural communities, or causing contamination of the environment, and
- Reduces the vulnerability of the agricultural sector to adverse natural and socio-economic factors and other risks, and strengthens self-reliance."[2]

1 www.fao.org/docrep/W7541E/w7541e04.htm
2 www.fao.org/wssd/Sard/index-en.htm

Organic agriculture Organic agriculture was developed as a holistic, ecosystem-based approach, conceived as an alternative to what proponents see as the ecologically unsound practices of conventional agriculture.

It is necessary to distinguish between certified organic agriculture, and agriculture which is practised in an organic way but without certification.

Different countries (and international bodies such as the European Union) have introduced regulations determining what can be recognized and sold as "organic", as well as procedures for inspection and certification. Many of these regulations are based on standards set by the International Federation of Organic Agriculture Movements (IFOAM), an international grouping of NGOs and groups of organic producers.

In India, the government's National Programme for Organic Production accredits inspection and certification agencies.[1]

Traditional organic practices Many traditional agricultural practices around the world refrain from using chemical fertilizers and pesticides. They do this for various reasons: by tradition, because farmers cannot afford agrochemicals, they cannot buy them locally, or they do not know how to use them. This traditional form of organic agriculture is not necessarily sustainable, even if it has been adapted to local conditions over many generations. Population growth, declining prices, insecure land tenure and water-use rights, along with many other factors, have often led to overuse, loss of diversity, soil degradation and other environmental problems. In many instances, traditional forms of agriculture can no longer produce enough income and a secure livelihood. Hence then urgent need for more sustainable approaches. There are numerous modern attempts to update these traditional forms of land use. Some of them are described below.

Site-appropriate agriculture, or ecofarming This tries to cut down on costly inputs and minimize negative environmental impacts by making intelligent use of existing ecological factors. It developed as an alternative to the increasingly intensive use of irrigation and fertilizers, and tries to free farmers from constraining factors in the local natural environment.

Low-external-input agriculture This also aims to practise sustainable agriculture with minimal use of external inputs, but does not completely exclude the use of pesticides or synthetic fertilizers.

Integrated pest management This approach reduces the use of synthetic pesticides by integrating a range of ways to control pests and disease pathogens, from crop rotations to determining damage thresholds before applying plant protection products.

Integrated nutrient management This approach makes a special effort to minimize fertilizer inputs.

Watershed management The rehabilitation of degraded watershed areas has become a high priority. Watershed management aims to adapt land management practices in ecologically vulnerable hill and mountain regions to the natural carrying capacity by means of systematic management. Unlike the other methods mentioned above, it is not an agricultural production system. Rather, it is a process that plans and regulates the use of land, water and other resources within a watershed area, in ways that sustain these resources. It involves not just

1 www.apeda.com/organic/index.html

technologies, but also devising policies and usage guidelines. It emphasizes adapting technical solutions to the socio-economic circumstances of users, respecting the (often conflicting) needs of different resource users and attempting to reconcile their interests.

Conservation agriculture and minimum tillage This aims to conserve the soil structure and improve the water storage capacity of the soil. Introduced on a large farm level it is often combined with weed management through pesticides. Because it eliminates ploughing, conservation agriculture needs less labour, so is a viable option for areas with labour shortages. By using crop rotation and intercropping, it reduces risk through diversification.

How sustainable agriculture contributes to the Millennium Development Goals

The application and distribution of sustainable agricultural practices on a large scale would contribute significantly to the achievement to all Millennium Development Goals. The following section highlights the connections and the possible contribution of sustainable agriculture to these goals.

Box 3 Sustainable agriculture: A shifting interpretation

Since the Rio Earth Summit in 1992, a diverse range of scientists, state and non-governmental development bodies and private-sector organizations have taken their lead from the concept of "sustainable agriculture". Various organizations and approaches put emphasis on different areas, but the underlying principles are the same: they all derive from a vision of sustainability. There appears to be a consensus, more or less in line with the FAO definition, that sustainable agriculture must be economically viable and socially responsible, and must conserve land, water, genetic and other resources for future generations.

The approaches certainly differ, however, in their details. Emerging as they do from disparate backgrounds and experiences, in some cases with a particular political or economic agenda, differences in interpretation are inevitable. Many approaches were originally developed as a means of turning away from conventional agricultural practices and as a countermovement to the Green Revolution. As a result, these approaches place the ecological dimension at the centre of their conception. Newer approaches emphasize the social dimension, and especially poverty reduction. The Task Force on Hunger, set up under the UN Millennium Project, described the priority intervention areas related to the three dimensions of sustainability. All the intervention areas need to be pursued simultaneously:

- Increasing agricultural productivity for food security (economic dimension of sustainable agriculture)
- Restoring and conserving natural resources for food security (ecological dimension)
- Promoting good governance, gender equality and development approaches focused on people and their needs (**social** dimension).

There is strong competition between these three different dimensions of sustainability. The challenge is to find an optimum balance between them. This takes place by negotiating in a spirit of partnership, in order to reconcile contradicting interests while shaping complex processes of social reform, transformation and development. The challenge is to respond adequately both to the immediate needs of the population and to the ecological conditions at a specific location, and to manage resources in a manner that safeguards them for the future. The goal is to optimize yields (by making optimum use of land and water resources) without causing adverse short-term or long-term impacts on nature, the environment or society.

MDG 1 Eradicate extreme poverty and hunger

There is a close link between food and nutrition security and agricultural production: sufficient food supply is required to meet the food and nutrition demands of the population. But adequate production is not enough: everyone must also have access to the food produced.

Agriculture as a major source of income: four-fifths of all poor people in the world live in rural areas, where agriculture is the most important source of livelihood. It provides direct income for landowners, farming families and agriculture labourers, and generates income indirectly for a host of other poor people involved in processing, transport, food preparation and sale.

MDG 2 Achieve universal primary education

Investments in agriculture contribute indirectly to this goal: poor families who earn more from farming can afford to send their children to school. Many poor families make extraordinary sacrifices to ensure their children are educated; improving farm production and rural incomes will enable them to do so more easily. Better nourished children also perform better at school.

MDG 3 Promote gender quality and empower women

In India, as elsewhere, women provide the main source of agricultural labour. Introducing sustainable agricultural practices involves women's participation, and very often leads to the empowerment of women.

MDG 4 Reduce child mortality

Crop diversification – growing a wider variety of crops – is a strong element of sustainable agriculture. Security of yield and income translates into food security in the farm household. This in turn reduces mother and child malnutrition, a major contributor to the child mortality rate.

MDG 5 Improve maternal health

Agriculture contributes to this goal in the same way as the previous one.

MDG 6 Combat HIV/AIDS, malaria, and other diseases

The relationship between this goal and agriculture is a inverse one: agriculture does not contribute directly to this goal, but where labour is scarce because of HIV/AIDS and other diseases, labour-saving approaches such as conservation agriculture enable farmers to continue to produce enough food for themselves and their families.

MDG 7 Ensure environmental sustainability

Over and above the food supply, land management in rural areas has a major influence on the availability of clean water, on climate trends, and on biodiversity – the diversity of wild

plant and animal species as well as crop varieties and livestock breeds. Agricultural practice not only influences the working environment of farmers and the living environment of rural people, but also has a bearing on the global environment. Without sustainable agriculture it will not be possible to achieve this goal.

MDG 8 Develop a global partnership for development

Agriculture involves partnerships on several different levels. Globally, international trade in agricultural products is huge: in 2004 it was worth US$ 783 billion, or 8.8% by value of all merchandise trade. Facilitating this trade is a massive network linking input suppliers, farmers, traders, processors, transporters, brokers, wholesalers and retailers, supported by research, extension and regulatory agencies. Part of the challenge for sustainable agriculture is to link small-scale farmers into this network, especially as agricultural trade becomes freer. A World Bank paper nicely highlights why this remains a major challenge in India and for the rest of the world: "Smallholders may be uncompetitive and unable to participate in many of most profitable sub sectors under a wholly free-trade system. Establishing appropriate institutions is necessary to enable broad welfare gains to be achieved through trade".[1]

Sustainable agriculture itself is the focus of a dynamic network of organizations involved in developing, testing and promoting alternative forms of agricultural production. These partners include thousands of farmers' groups in India and around the world, community organizations, national and international NGOs, UN agencies, donors, policymakers and research organizations. The sustainable agriculture agenda has begun to find its way into mainstream activities. Once-fringe approaches such as participatory research and farmer-led extension, developed as part of sustainable agriculture, are now being taken seriously by government research and extension institutions.

How would ignoring the Millennium Development Goals affect agriculture? We can see some of the impacts already: climate change and large-scale changes in the groundwater level are environmental influences which can mean the difference between success and failure for farming. And it is usually the poorest of the poor – those who are the least responsible for climate change – who are most vulnerable to its effects.

The Sustainet project

Combating world hunger through sustainable, adapted agriculture is one of the main goals of the German government's Programme of Action 2015. To contribute towards achieving this goal, a supra-regional joint venture among German development cooperation organizations was initiated in December 2003 by the government's Sustainability Council. The core idea behind this project, called "Sustainet", is to demonstrate the benefits, viability and widespread applicability of sustainable, locally adapted land use as a strategic way to overcome hunger and poverty in the developing world.

Three major non-governmental development organizations – Bread for the World, German Agro-Action and Misereor – along with the German Agency for Technical Cooperation (GTZ) participate as equal partners in the joint venture. From May 2006, World Vision will

1 *Agriculture and achieving the Millennium Development Goals*. Agriculture and Rural Development Department, World Bank; Conference Edition, March 2005, chapter 2.9.: MDG 8, p.18.

Box 4 How do you know your agricultural practice is sustainable?

Ecological dimension

- Does it help conserve soil fertility?
- Does it conserve the quality and availability of water?
- Does it increase biodiversity?
- Does it spread hazardous substances?
- Does it affect the landscape (relief, vegetation cover, settlement structure)?
- How much energy would be required if this technology is scaled up?
- If it is scaled up, would there be a significant impact on the climate?

Economic dimension

- Does the practice improve incomes?
- Does it lead towards food and income security?
- Does it enable farmers to accumulate their working capital?
- How would the nutritional situation and food availability change if the approach is applied on a large scale?
- Is it able to compete with other sectors?
- Is it possible to aggregate an economic gain to the national level?

Social and cultural dimensions

- Are the rural poor involved in the approach?
- How does the approach draw on or affect social customs, traditions, norms and taboos?
- How is indigenous knowledge recognized within the approach?
- Does the approach ensure a more equitable division of labour and distribution of income between men and women? Poor and rich? Young and old? Different ethnic groups and castes? Participating farmers and non-participants?
- Will broad adoption improve the health situation of the people?
- Does the approach assure equitable access to assets, agricultural inputs such as land (secure land-use rights), water, capital (credit), skills and knowledge? Is it accessible to the poor?
- Is the technology safe for humans and animals?
- Do the beneficiaries gain opportunities for empowerment, access to social services, control and decision-making?
- Is the approach legally stable?

also participate in the project. At an international level, Sustainet cooperates closely with FAO, in particular with the Sustainable Agriculture and Rural Development Initiative and the conservation agriculture project. The programme secretariat, based at GTZ in Eschborn, near Frankfurt, manages coordination and networking activities. The programme is funded by the German Ministry of Economic Co-operation and is advised by the German Ministry of Consumer Protection, Food and Agriculture.

Sustainet is an acronym for "Sustainable Agriculture Information Network". As the name suggests, the programme aims to establish networks between institutions involved at local, regional and international levels. Although various good examples of sustainable agriculture were developed with the assistance of German development agencies and their partner organizations, hardly any analyses on the possibilities of scaling up such successful concepts have been published. In response, Sustainet aims to systematically evaluate and communicate "good agricultural practices": successful local to international approaches and strategies in sustainable agriculture. This will lead to a better understanding of the fostering and hampering factors relevant for the dissemination of sustainable agriculture models, identify locally adapted agriculture, define promising key priorities for promotion, and specify fields of action for agricultural policy.

Sustainet's objectives go beyond analysis and evaluation: it also aims to promote the process of scaling up itself.

Sustainet currently concentrates on two pilot areas: India (the focus of this book), and Kenya and Tanzania. In 2006, activities will start in Latin America: in Peru and Bolivia. In each of these pilot areas, a number of projects were selected that have been especially successful. Among them are projects that apply the techniques of organic farming, integrated pest management, linking small farmers to markets, public-private partnerships, dryland agriculture, watershed management, protection of biodiversity and post-harvest improvement.

Sustainet has various audiences. It aims to help the local cooperating organizations to learn from each other. Through them, it hopes to help the poor rural population in the pilot regions. It also aims to contribute to political discussion on a national and international level. Through promotional activities and meetings, it highlights the significance of sustainable agriculture for the global food security to political institutions in the pilot countries and in Germany.

The Sustainet process

During the initial project phase (December 2003 to November 2006), Sustainet covers three main activities: (1) systematically analysing successful examples of sustainable agriculture, (2) evaluating and documenting the impacts of local projects, and (3) determining possibilities for disseminating best practices.

To document established and tested good practices, Sustainet selected partners in the pilot areas which have been running successful projects for at least 5–10 years. These partners were chosen by the Sustainet steering group from a list drawn up by a team of consultants. Through regional workshops, Sustainet familiarized the local partners with the project idea and discussed future working relationships. Interested partners were then invited to join the

Sustainet activities. They agreed to undergo a self-assessment process and prepare a report of a selected "good agricultural practices". Sustainet promised to promote and publish their experiences (this book is one of these outputs).

Sustainet has established regional information networks and international communication structures on sustainable agriculture. To document the selected projects in a way that would make it possible to compare and assess them (and so evaluate their potential for scaling up), the Centre for Advanced Training in Rural Development (SLE) at Humboldt University Berlin developed a set of self-assessment guidelines in cooperation with the partners in India. This self-assessment generates information on the techniques used (both on- and off-farm), the project approach, the support provided by the outside organizations, external conditions (local and national) and dissemination activities. Sustainet guides and assists the local partners during the self-assessment process.

The Leibniz Centre for Agricultural Landscape Research (ZALF) is analysing the data collected through the self-assessment, with funding from the German Federal Ministry of Consumer Protection, Food and Agriculture. The analysis pays particular attention to the degree to which local people have adopted the sustainable agriculture approaches after the end of the project, and how many people not directly linked to the project have copied them spontaneously. This assessment and analysis exercise will also estimate the impact of the improved practices on poverty reduction and on food and nutrition security.

The evaluation will generate information on factors that foster and hamper the dissemination of the approaches. This will enable Sustainet to identify factors relevant for successful scaling up of good practices. The results, case study reports and lessons will be published.

An important component of Sustainet is the exchange of experience and a strategic dialogue with key actors in partner countries and among German and international development agencies. This dialogue aims to generate recommendations for future agricultural funding strategies.

How this book was prepared

This book was prepared through a 1-week intensive "writeshop" – an intensive, participatory workshop in which participants wrote, presented and revised the manuscripts that form the various chapters of the book. The 26 participants came from 12 Sustainet partners throughout India, Sustainet headquarters at GTZ, and the Leibniz Centre for Agricultural Landscape Research (ZALF) in Germany. They were supported by a facilitator, artists, an editor and logistics staff.

Before the writeshop, participants prepared manuscripts describing their project, following a set of guidelines provided by Sustainet.

During the writeshop, each participant presented his or her draft manuscript. The other participants commented, critiqued, asked questions, and suggested revisions. After each presentation, the presenter discussed the manuscript with an editor (the chief editor or one of the Sustainet-Germany staff), and they incorporated the audience's comments and together restructured the manuscript so it would fit in the book. An artist drew illustrations to accompany the text. Meanwhile, other participants were also presenting their manuscripts

to the group. Each author worked in turn with the team of editors and artists to revise and illustrate the text.

Each participant then presented his or her revised draft to the group a second time. Again, the audience critiqued it and suggested revisions. After the presentation, the author, editor, and artist again revised the manuscript and developed a third draft. Towards the end of the writeshop, the third drafts of some manuscripts were made available to participants for final comments and revisions. These manuscripts form the bulk of Parts 2–4 of this book.

At several stages during the writeshop, small groups of participants discussed the constraints, potentials and actions needed to ensure that sustainable agriculture could be scaled up successfully in India. Each group then presented its findings to the plenary for further discussion. The results of these discussions form the sections on *Realizing potentials* in Parts 2–4.

Through this process, individual manuscripts were revised substantially, and the information they contained was combined with ideas from other sources and was distributed throughout the book. Each section in the book contains information provided by many different participants. This means it is not possible to label a particular section as the sole work of a particular participant. The "authors" of the book are thus the participants listed on page xv.

The writeshop process was developed by the International Institute of Rural Reconstruction (IIRR), which has used it to produce extension and information materials on a wide range of subjects. A senior IIRR staff member facilitated the writeshop for Sustainet.

Structure of this book

The remainder of this book is divided into four parts.

Parts 2–4 each focus on a particular aspect of sustainable agriculture. Each Part contains several cases (listed below), each telling the story of a sustainable agriculture project in India supported by a German development agency. The cases describe the project, its results and impacts, and draws lessons from it that can be applied to other projects elsewhere.

Experience has show that sustainable agriculture will not happen by itself. The playing field is too sloped too steeply towards high-input, extractive agriculture – the sort of farming that causes so much ecological damage to India's soils and natural resources, and that results in economic dislocation and despair among its farmers. At the end of each Part is a section describing the potentials and constraints facing that aspect of sustainable agriculture, and some recommendations for policy changes and actions needed to realize the potentials and overcome the constraints.

Part 2, Organic agriculture, focuses on producing food and other agricultural products without depleting the earth's resources or polluting the environment. Like sustainable agriculture itself, this is a wide field with many different approaches. An introductory section describes the potential for organic farming in India. It is followed by case studies on four projects on various aspects of organic agriculture.

- The first describes **Navdanya's** work to help farmers in Uttaranchal break the vicious circle of debt and dependency by switching to organic farming.

- The second case describes how the **Deccan Development Society** helps farmers in Andhra Pradesh assure their food security by producing, storing and exchanging their own seed.
- The third shows how, with the support of the **Centre for Sustainable Agriculture**, another village in Andhra Pradesh has managed to rid itself of expensive, ecologically damaging pesticides.
- The fourth case focuses on farming for self-reliance. It describes how **Chetana-Vikas** helps farmers in Maharashtra break their dangerous reliance on a single crop by diversifying their farms.

Part 3, Managing land and water, starts with an introduction to watershed management approaches in India. It also contains seven cases focusing on land and water management in various agro-ecological zones.

- The first case shows how **Krushi**, an NGO focusing on rights of marginalized communities, is combining a rights-based approach with watershed management techniques in a watershed in Andhra Pradesh.
- The second case describes how **Agragamee** in Orissa bases watershed management work on local people's own knowledge.
- People will plant trees only if they see a direct benefit from them. The third case describes how **Rural Communes** promotes forest home gardens in Maharashtra.
- Rajasthan is India's driest state. **Cecoedecon** has helped farmers get organized so they can overcome problems of drought and erosion, shortage of food and fodder, and even polluted wells.
- The low-lying wetlands of the Sundarbans of West Bengal suffer from the opposite problem – too much water for much of the year. The **Ramakrishna Mission Ashrama** has developed a technique called "landshaping" that enables farmers to grow a variety of crops on raised or sunken beds.
- The final two cases focus on government–NGO collaboration in watershed management. The **Indo-German Bilateral Project** (IGBP) worked in four states at different levels: national, state and local, and was a pioneer in integrating the different approaches used by NGOs and government agencies to promote watershed development.
- **Vikasa** was one of the NGOs involved in the IGBP in Andhra Pradesh. The last case describes how it helped farmers in one watershed halt erosion and grow more food – and how it helped the villagers understand and collaborate in the work of the government agencies in the same watershed.

Part 4, New products, new markets, begins with an analysis of the role of sustainable agriculture in developing market potential for small-scale farmers. This is followed by three cases illustrating how sustainable agriculture approaches can be used to promote new crops or to develop markets for smallholders' products.

- The farmers of Idukki in Kerala have been able to establish a thriving organic tea industry, thanks to the work of the **Peermade Development Society** to promote organic technologies and build market linkages for their product.
- Silkworm raising is already a profitable industry in Karnataka. But so far it has been restricted to irrigated areas. The **BAIF Institute for Rural Development, Karnataka,**

has developed ways for small-scale farmers to grow mulberry trees without irrigation, so enabling them to raise silkworms.

- Finally, is it possible for small-scale farmers to benefit from the growing trend towards biofuels? The final case, also based on the work of the **BAIF Institute for Rural Development, Karnataka**, shows what needs to be done to make this a reality.

Part 5, Participants' profiles, provides contact addresses and profiles of the people who helped compile this book.

2
Organic agriculture

Organic farming in India[1]

Navdanya, Uttaranchal

ORGANIC FARMING FOLLOWS THE principles of nature, which are self-sustaining developing systems. It respects the environment's own systems for controlling pests and diseases in raising crops and livestock, and avoids the use of synthetic pesticides, herbicides, chemical fertilizers, growth hormones, antibiotics or gene manipulation.

Through its emphasis on high production, conventional agriculture has contributed to degrading soil and water and reducing biodiversity, which is the key element in assuring food security. Various forms of organic farming have arisen recently as a reaction to the industrial model of agriculture; they are variously referred to as "natural", "organic", "alternative", "holistic", "biodynamic", and so on.

In the 1960s, the Green Revolution model of agriculture swept India. With its focus on high-yielding seed varieties and high external inputs, it resulted in monocrops and the chemicalization of agriculture. Much of the native agricultural biodiversity in irrigated zones was destroyed. The irrigated zones now have reached saturation, and further yield increases are unlikely. Green Revolution protagonists are now likely to turn to dryland areas, where farming practices are still largely "organic by default".

Ecologically productive, financially viable

"Productivity" is the output produced per unit input. Farming systems have many different outputs, while inputs include natural resources (land, biodiversity, water), human labour, energy, and in the case of chemical farming, synthetic pesticides and fertilizers. If all the outputs and all the inputs are taken into account, organic farming, which relies on internal inputs, has higher productivity than external-input chemical agriculture. When all the energy and chemical inputs are taken into account, the productivity of industrial agriculture is actually negative: it uses more resources as inputs than are produced as outputs.

If machinery and chemicals displace human labour, we normally think of this as increasing "productivity". But what if labour is not the scarce input? In many places, land and water are the limiting factors. If instead of labour, we take into account use of energy, natural resources and external inputs, industrial agriculture is no more productive than ecological alternatives.

1 Based on a manuscript by Vandana Shiva, Director, Navdanya

Low-yield organic farming: A myth

Small farms, everywhere in the world, almost always produce far more agricultural output per unit area than large farms.

A number of studies have shown that organic farming ensures better yield and fetches more income. For example, a study by Jules Pretty[1] showed how farmers in India, Kenya, Brazil, Guatemala and Honduras have doubled or tripled yields by switching to organic or semi-organic techniques.

Organic farming is economically viable because it reduces the use of external inputs and increases the use of on-farm organic inputs with the greatest potential to benefit the health of farmers and consumers. It raises productivity by incorporating natural processes such as nutrient cycles, nitrogen fixation and pest–predator relationships into agricultural production. It makes greater productive use of the biological and genetic potential of plants and animals. By improving the match between cropping patterns and the land's productive potential and physical limitations, it ensures that current production levels can be sustained in the long term. It enhances profit and efficiency by improving management and by conserving soil, water, energy and biological resources.

According to Dr Manggala Rai, Director General of the Indian Council of Agricultural Research, several studies have shown that under drought conditions, crops grown under organic agriculture produce sustainably higher yields than those in conventional systems, and may out-yield the conventional crops by up to 90%.[2]

Potential of organic farming in India

Organic farming is practised in approximately 130 countries around the world. More than 26 million hectares are currently under organic farming worldwide,[3] and the area under organic management is continually growing. The area under certified production of organic crops is also rising. Despite this, the organic market is still a niche market, located mainly in developed countries, where it is possible to charge a premium price for certified products.

Certified organic farming has tremendous scope in India. In 2005, only around 30,000 ha of farmland were under certified agricultural production.[4,5] This certainly underestimates the total area where farming is free of pesticides and other non-organic production techniques. After all, poor farmers in many parts of India practise organic farming by default: they use traditional farming practices. Over 65% of the country's cultivated area is rainfed, where negligible amounts of chemical fertilizers and pesticides are used. Agrochemicals are rarely used in eastern and northeastern parts of the country: Uttaranchal in the Himalayas and three states in the Northeast (Sikkim, Nagaland and Meghalaya) have declared themselves

1 Pretty, J. 1995. *Regenerating agriculture: An alternative strategy for growth*. Earthscan, London

2 Rai, Manggala. 2005. Organic farming: Potentials and strategies. Millennium Guest Lecture, S.V. College, Tirupati, 3 June 2005. www.icar.org.in/dgspmr/03062005.htm

3 IFOAM, FiBL and SÖL. 2005. More than 26 million certified organic hectares worldwide. Press release, International Federation of Organic Agriculture Movements (IFOAM), Swiss Research Institute of Organic Agriculture (FiBL) and Foundation Ecology and Farming (SÖL), Germany. www.ifoam.org/press/press/pdfs/pm-weltweit-englisch.pdf

4 Nair, G.K. Tap domestic market potential for organic products. *Hindu Business Line*, 2 Feb 2005. www.thehindubusinessline.com/2005/02/02/stories/2005020200921200.htm

5 Krishnakumar, Asha, 2004. Organic versus transgenic. *Frontline* 21(13), 2 Jul 2004. www.frontlineonnet.com/fl2113/stories/20040702002709500.htm

"organic-farming states", while Madhya Pradesh has declared 3,300 villages as being under organic farming. And with all this low-input farming, India still produces enough food.

Nutrient management

The term "organic" does not explicitly refer to the type of inputs used. Rather, it refers to the concept of farm as an organism. Nutrient management is key to this: organic farming uses management practices such as crop rotation, green manuring, recycling of residues, water management and so on, to ensure that available nutrients are used on the farm to grow crops and raise livestock. Conventional practices tend ignore or waste these resources, and use artificial replacements instead: for example they rely on artificial fertilizer rather than manure and compost.

How much agricultural waste could be recycled in this way? Estimates vary widely, but the amount is huge: something like 1800 million tons of animal dung, 800 million tons of compost, and 400 million tons of crop residues a year. These "wastes" are rich in nutrients: well-rotted farmyard manure, for example, contains 0.5% nitrogen (N), 0.2% phosphorus (P_2O_5) and 0.5% potassium (K_2O).

Most of these valuable resources are not used properly.[1] For example, even if only one-third of the 1800 million tons of animal dung were used as manure, it would be equivalent to equivalent to 2.90 million tons of nitrogen, 2.75 million tons of P_2O_5 and 1.89 million tons of K_2O.[2] The crop residues have the potential to supply another 7.3 million tons of NPK. According to one estimate, a quarter of the nutrient needs of Indian agriculture can be met by using various organic sources.[3]

Vermicompost

Vermicompost (compost made by earthworms) is very rich in nutrients: it contains 1.5% nitrogen, 0.5% phosphorus and 0.8% potassium, as well as other micronutrients. Vermicompost can act as the single source of all nutrients the crop needs. It also contains 10% organic carbon, and continuous applications increase the soil's organic matter content significantly. Earthworms can convert about 1,000 tons of moist organic waste into 300 tons of rich, dry vermicompost. They work hard: they can eat almost any type of organic matter, including bones and eggshells, and they consume their own weight of residue every day, converting it into nutrient-rich worm casts. In 45–60 days, one kg of earthworms (1000–1250 worms) can produce 10 kg of casts.[4]

1 Veeresh, G.K. 1998. Organic farming: Ecologically sound and economically sustainable. *Man and Development*, pp. 142-48 http://csdngo.igc.org/agriculture/agr_organic_India.htm

2 Ramaswami, P.P. 1999. Recycling of agricultural and agro-industry wastes for sustainable agricultural production. *Journal of the Indian Society of Soil Science* 47: 661–5, quoted in Ramesh, P., M. Singh and A. Subba Rao. 2005. Organic farming: Its relevance to the Indian context. *Current Science* 88 (4), 25 Feb 2005. www.ias.ac.in/currsci/feb252005/561.pdf.

3 Indiaagronet.com. *Integrated nutrient management in soils for improving crop productivity* www.indiaagronet.com/indiaagronet/soil_management/Soil_mgmt.htm

4 Rangasamy, A., and C. Jayanthi. 2001. *Integrated farming systems – A boon to farming community*. www.tnau.ac.in/scms/Agronomy/IFS.htm

Biofertilizers

Biofertilizers are organisms that fix nitrogen from the air and make it available to the crop. They are applied to the seed before planting, or directly to the soil. Research shows that these biofertilizers can save around 20 kg of nitrogen per hectare, depending on the application rates and local conditions.[1]

Rhizobium bacteria that live in the root nodules of legumes fix nitrogen from the air and make it available to crops. Worldwide, these bacteria fix around 14 million tons of nitrogen a year – almost half the world's output of artificial nitrogen fertilizers. Many legume seeds have to be inoculated with the right type of rhizobium before they can fix nitrogen; India needs around 15,000 tons, while present production is only 800 tons. Using efficient strains of rhizobia would save half the nitrogen fertilizer farmers currently spread on their fields.

Blue-green algae also fix nitrogen: they can be cultured in shallow ponds, then harvested and used to inoculate rice fields. India needs about 400,000 tons of these algae to cover the entire rice area. Other nitrogen-fixing biofertilizers include preparations of *Azotobacter* and *Azospirillum* (two types of bacteria) and *Azolla* (a water fern).

Legumes and green manure

Green manuring is a traditional way to improve soil fertility and supply part of the crop's nutrient needs. A green manure is a crop (usually a nitrogen-fixing legume) that is grown in a field, then cut and incorporated into the soil, or left of the surface to decompose. A 40–50 day-old green manure can supply up to 80–100 kg of N/ha.[2] So if (say) the following crop can use just half of this nitrogen, the green manure is equivalent to 50–60 kg/ha of nitrogen fertilizer.

Potential green manures include sesbania (*Sesbania aculeata*, *dhaincha*, *dhunchi*), sunn hemp (*Crotalaria juncea*), cowpea (*Vigna unguiculata*), mungbean (*Vigna radiata*), cluster bean (*Cyamopsis tetragonoloba*, *guar*), berseem clover (*Trifolium alexandrinum*), etc.

Leguminous green manures can fix a large quantity of nitrogen from the air. For example, sesbania, sunn hemp, mungbean and cluster bean grown during the *kharif* season (south-west monsoon, July–October) as green manure can contribute 8–21 tons of green matter and 42–95 kg of nitrogen/ha.[2] Similarly, grass pea (*Lathyrus sativus*, *khesari*), cowpea and berseem grown during the *rabi* (winter) season can contribute 12–29 tons of green matter and 68 kg of nitrogen/ha.

Domestic markets for organic products

The domestic market for organic products in India is still small, though the country has 2–3 million customers for such products, according to a Swiss expert.[3] The problem is the absence of marketing outlets. In developed countries, every supermarket has an array of shelves displaying certified organic products. Such a marketing network still has to be established in

1 NIRI-KVIC, www.niri-kvic.org

2 Mishra, B.B., and K.C. Nayak. 2004. Organic farming for sustainable agriculture. *Orissa Review*, Oct 2004. http://orissagov.nic.in/e-magazine/Orissareview/oct2004/englishPdf/organicfarming.pdf

3 www.thehindubusinessline.com/2005/02/02/stories/2005020200921200.htm

Table 1 Forecast growth (%) for organic products in the Indian domestic market, 2002–7

Fruits		**Oil crops**		**Others**	
Bananas	15	Oil seeds	5	Rice	10
Mangoes	5	Groundnuts	5	Herbal extracts	7
Oranges	5	Coconuts	5	Cotton	7
Pineapples	5			Honey	5
All fruits	8	**Spices**		Baby food	5
		Pepper	5		
Beverages		Turmeric	4.5		
Tea	13	All spices	14		
Coffee	5				

Source: ORG-MARG, 2002

India. It will be viable only when customers can buy the products they want in the shops. For that, a consistent supply chain is necessary.

Effective promotion is necessary for this to be successful. The sale of organic produce is generally restricted to major cities: Mumbai, Delhi, Kolkata, Chennai, Bangalore and Hyderabad. To a large extent, sales are based on the individual initiatives of farmers, NGOs and a few traders. Domestic demand for "green" products is mainly for fruits, vegetables, rice and wheat. Other products include tea, coffee and pulses. According to a 2002 survey by ORG-MARG (a market research agency now known as AC Nielsen), the prospects of other commodities, such as organic spices, fruits, herbs and cotton are fairly good: in the next 5 years it is projected that sales of organic spices could grow by 14%, fruits by 8% and herbs and cotton by 7%.

Nutritional qualities of organic food

Organically produced foods have lower levels of pesticides than conventionally grown produce; they also have fewer medicinal and hormonal residues, and in many cases lower nitrate contents. Nitrates are significant contaminants of foods; they are generally associated with intensive use of nitrogen fertilizers. Organic food reportedly also stores better than conventional produce.

Organic produce is richer in minerals than conventional produce. One study in Chicago, USA, found that organic apples, potatoes, pears, wheat and sweet corn had 63% more calcium, 78% more chromium, 73% more iron, 118% more magnesium, 178% more molybdenum, 91% more phosphorus, 125% more potassium and 60% more zinc than comparable conventionally grown foods. The organic food also contained 29% less of the undesirable element mercury than the conventional produce.[1]

1 Smith, B.L. 1993. Organic foods vs supermarket foods: Element levels. *Journal of Applied Nutrition* 45(1):35–39. www.soilandhealth.org/01aglibrary/Arun/Organic%20vs%20supermarket--element%20levels.pdf

Policies to support organic farming

Research is beginning to show the benefits of organic farming. Studies show it to be ecologically productive and financially viable, and producing more nutritious yields than vertically integrated production methods. It improves soil quality, is better for the environment, and achieves greater economic sustainability than conventional farming methods.

Here are some ways to promote and scale up organic agriculture.

- Develop appropriate extension services to inform small-scale farmers about organic farming and how to practise it.
- Develop strong linkages between growers and consumers, with minimum influence of middlemen.
- Reduce the costs of certification to make them accessible to small farmers, without diluting standards.
- Make biofertilizers, bioagents, biopesticides and other organic inputs available to smallholders in sufficient quantities and at reasonable prices.
- Encourage and develop the domestic market for organic products.
- Provide subsidies and other financial support to help small-scale growers cover the initial expenses of converting to certified organic farms. Ensure that organic farming gets a level playing field with industrial agriculture.
- Improve infrastructure such as roads, transportation, storage facilities, etc.
- Enhance linkages in the supply chain of organic products – forwards to processors, wholesalers and retailers, and backwards to suppliers of inputs such as seed and biofertilizers.
- Promote research on organic agronomic practices, biocontrol of diseases and pests, biofertilizers, etc.
- Take the positive externalities of organic farming into account when setting development policies.

Based on a manuscript by Vandana Shiva, Navdanya, www.navdanya.org

Biodiversity-based sustainable agriculture

Navdanya, Uttaranchal

Balbeer Singh is an innovative man. He was quick to convert to "modern" farming when he first heard of it: he started using fertilizers, high-yielding varieties and pesticides on his small farm near Dehradun, the capital of Uttaranchal. He knew he would have to buy these inputs, but was confident he could pay for them because they would enable him to produce more.

The first few years were successful. But then his production started to decline. At the same time, the costs of inputs rose. At first he thought that bad weather was to blame for the poor yields. But his output continued to fall, and he noticed that his onions began to rot faster than they had before. He was forced to sell his crop soon after harvest, instead of storing them and waiting for a good price. What could he do?

A glimmer of hope

One day Balbeer heard that a meeting about farming was to be held in his village, organized by Navdanya, an NGO working on organic agriculture. He went along. During this meeting, he and his neighbours described the problems they were struggling with: yields falling year after year, and crops such as potatoes and onions rotting before they could be sold.

The Navdanya staff explained how all the problems were related, and how they were caused by the type of farming the villagers practised. They told the villagers about organic agriculture, and Balbeer was interested enough to test the idea. Navdanya offered to compensate him if the yield was lower than expected.

Looking back, he says that this decision was a turning point in his life.

Together with six other farmers from different villages, Balbeer started growing onions on a small plot of land. They followed Navdanya's instructions to stop using chemical fertilizers, and apply farmyard manure, ash and cow urine instead. All the farmers got a satisfactory yield. Navdanya asked them to hold on to the crop to see how long it could be stored. They found they could keep these onions much longer, so could sell them for a higher price later on.

Balbeer and colleagues' success persuaded their neighbours to follow their example. They tried organic farming with other crops, and within 3 years, around 100 farmers had converted to organic agriculture. Some of the cooperative shops selling fertilizer had to close as demand fell. Farmers who had shifted to organic agriculture started to collect seeds from their harvest to plant the following year – as they had done in "the old days". Traditional

Box 5 Breaking the vicious circle

"We knew that the chemicals are harmful for human beings, animals and environment, and hybrid seeds do not perform well. For few years we got higher yields, which slowly started declining. We had to increase the use of fertilizers every year and also the use of pesticides.

As we cannot use our grains to select the seeds for the next year we have to buy these fertilizers and agro-chemicals in the market. This needs a lot of money every year which we have to spend. By organic agriculture we can use compost and plant-based pesticides which we can make at home without much investment."

Balbeer Singh

farming practices were recalled, including how to store the yield and how to control pests. Half-forgotten old crop varieties and types of food were reintroduced. Now more than 45 villages in the region are totally free of chemicals, and are using eco-friendly traditional techniques – ancient techniques that have worked for centuries in India.

As one of the first farmers to successfully introduce organic farming in the area, Balbeer was appointed regional coordinator for the organic programme in 1995.

From chemical to organic

The transition from chemical-based to organic farming means big changes in a farm. The cost of chemicals goes down as farmers phase these out and replace them with organic fertilizers. That may mean lower yields in the first few years, as Balbeer found (Table 2). But in the third year, his yields had recovered, and from then onwards he was able to produce as much as, or more than, with chemical fertilizers.

Table 2 Inputs and yields on Balbeer Singh's farm, Utircha village, Uttaranchal

Year		Inputs		Yields	
		Cost of agro-chemicals (Rs/ha)	Cattle manure (t/ha)	Wheat (t/ha)	Rice (t/ha)
0	1994–95	3000	3	2.0	2.25
1	1995–96	1632	4.2	1.35	1.13
2	1996–97	788	25	1.23	1.15
3	1997–98	0	50	2.25	2.50
4	1998–99	0	25	2.75	3.13
…		…	…	…	…
10	2004–05	0	12.5	3.13	3.75

Source: Balbeer Singh, Utircha village and Navdanya records

Balbeer's production costs fell because he had to buy fewer external inputs. At first, he had to put in a lot more work to apply manure and control weeds. But his fields now need less work because the soil fertility is restored and weeds are under control.

Balbeer found that he could grow a greater variety of crops in his fields. For example, he was able to grow pulses in his ricefields. His black gram yields had fallen when he applied chemical fertilizers, but have risen again since he adopted organic farming. The various crops in the field reduce the risk of one crop failing, and the nutritional value of their food has risen.

Balbeer and his wife's lives have improved significantly since they started organic agriculture. The couple has been able to save money by selling their surplus produce. They getting good yields, and their output no longer goes up and down unpredictably.

Navdanya's approach

Unlike many other Indian NGOs working on sustainable agriculture, Navdanya operates at three different levels:

- Its field programme identifies specific agricultural problems that farmers face, and helps the farmers analyse and solve them. The stories of Balbeer Singh (above) and Yogambar Singh (Box 6) are typical of this level. Navdanya uses these experiences as a basis to scale up organic agriculture approaches to more farmers.
- Navdanya has a strong research component: it studies the problems that farmers identify, and develops and tests solutions to them. The most urgent and typical problems are chosen for research, so the solutions are highly relevant for many farmers.

Box 6 Organic produce buys taxis

"Although I am illiterate, I know how to do farming", says Yogambar Singh. "For some years I used chemicals in my fields, but the soil fertility as well as the soil texture deteriorated. Initially when I shifted to chemical farming, I got very good yields, but slowly they started going down. I was not getting pulses and oilseeds, which I was growing earlier. Now I am happy with organic farming. Crop yields are stabilized, and I am able to grow pulses and oilseeds also". I am saving by not using any type of input purchased from the market."

Yogambar is a 65-year-old farmer in Pulinda village, in the Dhar area of Uttaranchal. He joined a Navdanya-supported group in 1995. Like other farmers in the area, he had used chemicals on his farm. But for the last 9 years, he has used only organic practices on his 1.28 ha farm. Yogambar and his family work their fields themselves, though they will hire outside labourers for emergency field maintenance.

Organic farming gives good results on both irrigated and non-irrigated land. Yogambar compared two small fields: one irrigated field covering 250 m^2, and a rainfed plot of 167 m^2. In 2004–5, he earned Rs 1745 net from the irrigated plot (equivalent to Rs 69,800 per ha); the rainfed plot was actually more productive: it earned him Rs 1523 (equivalent to Rs 91,380 per ha).

Yogambar now earns more than Rs 70,000 a year net, and spends almost nothing on inputs. He has been able to save enough from his sales of organic produce to buy two taxis for his sons. Today he is convinced that only hard work and organic farming bring high returns.

Box 7 Neem victory

On 8 May 2005, the European Patent Office in Munich upheld a decision to revoke in its entirety a patent of W.R. Grace Company on a fungicidal property of neem, a tree indigenous to the Indian subcontinent. This decision resulted from a legal challenge mounted ten years before by Navdanya in cooperation with Greens in the European Parliament and the International Federation of Organic Agriculture Movements (IFOAM). Navdanya collected millions of signatures to support the case against biopiracy.

The challengers showed that the fungicidal properties of neem tree had been public knowledge in India for many centuries. Indian farmers use neem to treat various ailments, as well as to control pests in their crops.

This patent exemplifies how international law has been misused to transfer biological wealth from the South into few hands in the North. Revoking it was a victory for Indian farmers and their knowledge in the fight against biopiracy.

- Navdanya recognizes that organic agriculture is closely related to larger institutional and policy questions. It campaigns to build awareness and change policies on issues such as "biopiracy" (outsiders stealing local knowledge or varieties and claiming them as their own), genetically modified crops, and the preservation of indigenous crop varieties. For example, it has campaigned successfully to revoke claims by outside companies on centuries-old Indian intellectual property such as basmati rice and neem (Box 7).

Navdanya is based in Dehradun, Uttaranchal. Headed by internationally renowned scientist and environmental advocate Vandana Shiva, Navdanya now has more than 100,000 farmer members in 16 states of India. It works directly in about 2000 villages. Navdanya has trained more than 250,000 farmers, students, government officials and staff of national and international NGOs on biodiversity conservation and organic farming.

Navdanya uses the following approach in its working areas.

Identifying the key problem

Navdanya begins work in an area by identifying the most burning problem in agricultural production there. It uses participatory methods to help farmers identify the problems they face: pests, seed problems, storage difficulties, and so on. Staff visit each farmer to identify the scope and severity of these problems, using survey forms where possible. They also consult resource persons such as knowledgeable local individuals, members of the *gram panchayat* (village councils), and women's and youth groups. Because the villagers have profound local knowledge, they are often able to suggest the best solutions themselves.

Navdanya uses a holistic philosophy of biodiversity conservation and sustainable agriculture. So the question in a new intervention is "where to start?" rather than "where to go?" Ultimately, in all project areas, Navdanya introduces biodiverse organic farming, seed sovereignty and food sovereignty. Navdanya believes that a partial intervention will not address all the problems that small-scale, marginal farmers face.

Building awareness and advocating change

Navdanya staff, and farmers who are Navdanya members, begin to build the local farmers' awareness of the issues and mobilizing them to change. They invite the farmers to village meetings, hold rallies and make door-to-door visits to mobilize people on the following issues:

- Seed sovereignty and biodiversity
- Sustainability and food sovereignty
- Household food and nutrition security
- High costs and hazards of industrial farming
- Environmental degradation, pollution, eroding biodiversity and increasing health problems.

The erosion of genetic diversity and the extinction of seed varieties are now recognized as major threats to peoples' food security and survival. Farmers across India are committing suicide because they are so much in debt after buying expensive seeds and chemicals.

Navdanya's farmer members are important in persuading their fellow farmers to consider adopting organic methods. They do this work on a voluntary basis in their own villages and other places they visit.

The organization raises awareness about the policy issues by organizing protest marches, rallies, seminars, workshops, signature campaigns and public hearings. It submits memoranda to government at various levels: district, state or federal. If this does not work, Navdanya may even file a "public interest litigation" in the Supreme Court. It filed one such case to fight the biopiracy of basmati rice by Ricetec, an American firm. It has filed another to challenge a patent by Monsanto, a multinational seed firm, for a wheat variety based on a traditional Indian variety.

Navdanya uses fairs, seed rallies and protest marches to encourage farmers to conserve their own seeds and adopt sustainable practices.

Selecting and empowering innovative farmers

Navdanya works with a few innovative farmers to start the programme. These farmers are trained in different techniques of organic farming, composting techniques, pest and disease management using local plants, selection of seeds, and post-harvest management. Navdanya invites older farmers to act as resource persons during the training and to share their experiences.

Navdanya staff regularly check how the farmers are progressing in using organic techniques, and suggest solutions to problems they encounter at each stage of cultivation. The farmers are advised to start on a small plot, so they can learn and gain confidence before converting more of their land to organic production.

Planning, implementation, and follow-up

Navdanya uses participatory approaches in every phase of its activities, from planning to implementation. Staff follow up regularly to check on the impact of their work; this builds the confidence of both farmers and Navdanya's own field workers. Regional meetings of village coordinators are held every month, where the villages' participatory plans are synthesized into a collective plan to be implemented in the following month. These monthly meetings also allow Navdanya to follow up on progress in each village. The regional coordinator, subject specialists and senior staff also visit the project areas regularly. Regular visits by the specialists to the farmers' fields in the initial stage of the project also help the farmers solve their problems during the transition phase.

Exit policy

Navdanya works in an area for an initial 3 years. Then, depending on the local situation and on outside support, it may extend its support for 3 more years. When the local institutions and communities are self-reliant, Navdanya moves on to new programmes and activities.

Impacts

Before Navdanya's interventions, cropping patterns in the villages were shifting to chemically produced cash crops, leading to debt and nutritional deficiency. Local diets were shifting away from millets and pulses, to white rice and wheat. Through biodiversity conservation, seed saving and organic farming, families now use more vegetables, greens and millets, thus improving their household food security.

Industrial farming was eroding biodiversity, and farmers were losing control over and access to seed. Navdanya's intervention reverses these trends. With chemical farming of cash crops, food insecurity was growing; biodiversity-based organic farming assures food security throughout the year. More nutritious foods are also available for sale. Landless and daily wage labourers have more job opportunities in organic farming.

Farmers have minimized their dependency on external inputs. They conserve their own seeds, make their own compost and their own pesticides. They grow plants to use as fodder, control pests and make compost, so cutting the cost of cultivation. They have also started again using herbal medicines, so spend less on health care.

The farmers' purchasing power has improved: many now have telephones, television and gas stoves. Some have been able to buy their own vehicles.

The farmers' confidence in organic production rose when they found that it was a viable alternative to chemical farming. Their yields had been declining and input costs rising every year. Organic farming reversed the situation in just 3 years, returning their farms to profitability and cutting costs to negligible levels.

Income

Farmers' incomes have risen many times in the areas where Navdanya works. Sri Rajender Singh, a farmer in Pulinda village, is an example. By multiple cropping his 400 m^2 field, he was able to earn Rs 3060 from this patch of land in 2004–5, or Rs 76,500 per ha.

In adverse conditions, farmers who practise biodiverse agriculture get good yields – something impossible in chemical farming. Bharat Singh, another farmer in Pulinda, says that unusually heavy rains in the *kharif* (July–October) season of 1998 cut his yields of pulses, but the high yield of millets and rice compensated for these losses. In 2003, a dry year, he got 20% less rice but a very good yield of pulses. Bharat and his family are quite happy with organic practices, and he says he will never again use chemicals.

Time required for conversion

It is always better to reduce inputs (especially of fertilizers) step by step rather than suddenly. In the first 2 years of transition, yield often falls by 15–20%, or in the worst case by 40%, but in most cases the loss in yield is compensated by the money saved on inputs. Another option is to convert one field at a time, so the farmer can avoid facing an unacceptable loss in any one year.

Women's work and income

As elsewhere, Uttaranchal's women do much of the farm work. Navdanya found that in the Dhar area of Garhwal district, women worked an average of 14–18 hours a day, depending on the season. Navdanya's intervention reduced their working hours significantly.

Mahila anna swaraj (initiative for income generation) groups are formed to make the local women self-reliant. Typically, rural women in Uttaranchal work at home as well as in the fields, but the men sell the produce and spend the money. The *mahila anna swaraj* groups enable women to earn money by adding value to local products – money that they can choose how to spend.

Sustainable agricultural practices and biodiversity

Promoting traditional multiple cropping systems by encouraging farmers to grow more crops together instead of a monoculture results in greater biodiversity. Farmers are now growing up to 40 crops a year in one field. Greater biodiversity in the field means more income for farmers. This is just the opposite of what advocates of conventional farming tell farmers when they promote single crops.

When farmers see the benefits of multiple cropping, they are encouraged to grow more crops in their own fields. The pressure on the forest has also decreased in some areas because people have been able to start collecting animal feed from fodder plants growing in their fields.

Promoting good practices

Documenting good practices and indigenous knowledge

Documenting the farmers' knowledge is vital so it can be preserved and shared with other farmers. Navdanya documents local people's wisdom by interviewing groups of farmers, members of local institutions, and elderly farmers. Farmers also share their knowledge during training sessions. Navdanya's field and regional coordinators also document practices of innovative farmers. The field coordinators produce monthly reports documenting activities, field experiences, good practices and challenges.

The local communities document their biodiversity-based knowledge in "community biodiversity registers". These collect and document the local indigenous knowledge on insects, plants, animals living in the area (including wild animals). Information considered relevant is written down; examples include characteristics and behaviour, use of the species (for food, medicine, pest control), and the environmental conditions it needs. The best items are also published in the form of books or booklets, or in *Krishi Samachar*, an agricultural newsletter published by Navdanya.

Community seed banks

Conserving traditional varieties is an important aspect of Navdanya's work. It believes that conserving the valuable biodiversity represented by these traditional varieties is possible only through organic farming.

Navdanya encourages farmers to select and store different varieties of crops they grow in their own villages. Some traditional varieties, such as traditional millets and pseudo-cereals have almost disappeared. They have high nutritional value and are adapted to local conditions. Reintroducing these varieties is important.

Navdanya itself has conserved more than 2,500 rice varieties in different parts of India, as well as more than 1000 other crops and multipurpose plant varieties at its biodiversity conservation farm at Ramgarh, Uttaranchal. The conserved seeds include cereals, millets, pulses, oilseeds, medicinal plants, fodder plants and other multipurpose plants. The organization has also established about 40 seed banks across the country; many of these now run independently.

Promoting local resources and techniques

Navdanya encourages farmers to use resources available locally. Examples are plant extracts, cow urine, buttermilk, etc., used to control pests and diseases, as well as traditional tools and utensils for farm production, crop storage, and other aspects of daily life.

Installing water mills is another example: instead of taking their grain to the miller, local people can now make flour themselves. They give a small amount of flour to the mill's caretaker in return for using it.

Exposure tours

The best way to convince people is to show them how things work and what the benefits are. Exposure tours are a useful way of introducing other farmers to organic ideas. Navdanya arranges visits to successful farmers' fields and encourages the visitors to start experimenting with organic methods on their own land.

Other activities

Navdanya supports various other activities in the villages where it works, including fair trade marketing initiatives for organic products, and an education programme to teach schoolchildren about biodiversity and food. It has formed *Jaiv Panchayat* (living democracy) councils in several villages to strengthen the relationship between plants, animals and human beings and encourage farmers to conserve biodiversity.

Scaling up

Navdanya has trained other organizations in organic farming. These include women's organizations such as Mahila Samakhya in Uttaranchal, and Chinmaya Trust in Himachal Pradesh. These organizations each work in about 300 villages with more than 6000 farmers. Navdanya has also trained groups from Yuvacharya of Art of Living, an NGO working in about 5000 Indian villages. This organization aims to convert about 200,000 hectares of land to organic production within 3 years. Navdanya has also trained secretaries and extension officers of the Tibetan government-in-exile, and their settlements across the country are converting to organic production.

The Uttaranchal state government's declaration to make the state organic was a major success, and greatly supports Navdanya's efforts.

Challenges and opportunities

Two groups of people are difficult to convince of the benefits of organic farming: people trained by agricultural colleges (which teach only conventional farming), and large-scale farmers who have practised conventional farming for a long time. The latter are worried by the decline of yields during the 2–3 year transition period, and by the higher labour costs of organic farming.

It is important to build on the knowledge of elderly people: they are the ones who remember how things used to be done, but their knowledge is in danger of dying with them.

Some people oppose Navdanya because it promotes "un-modern" concepts such as biodiversity conservation and traditional crops. Navdanya members and staff are sometimes seen as narrow-minded and old-fashioned. It is difficult to deal with this widespread perception.

It is important to train organic farming trainers in a sound way to ensure that their recommendations will lead to success. Otherwise they will lose farmers' trust, and the message of organic farming will be less persuasive.

Box 8 Factors hindering and fostering Navdanya's work

Hindering factors

- It is difficult to convince farmers in a new area to consider organic farming if they already use chemicals extensively
- Government agencies, firms and development projects distribute free seeds, agrochemicals and financial support to farmers
- Trade liberalization lowers prices of agricultural products
- Markets are lacking for large quantities of organic produce
- Corporations control many aspects of farming and promote their agrochemicals and genetically modified crops
- Government policies support corporate farming – for example, a seed bill (now struck down) to restrict the exchange of seeds by farmers.

Fostering factors

- Farmers see how successful organic farming is, and copy it spontaneously
- Organic farming produces more income – which other farmers can clearly see
- Farmers who understand the value of organic farming press government agencies to stop distributing hybrid seeds and agrochemicals in their area
- Navdanya markets organic produce in some areas
- Seeds are available locally or through Navdanya's seed banks
- There is great potential to add value to produce, so improving farmers' incomes
- The debt burden of small-scale farmers, the poor quality of water and health problems caused by agrochemicals force farmers to seek other options.

Demonstration centres play a major role in promoting the speedy adoption of sustainable practices. Farmers want to see something before they adopt it themselves. If they see another farmer growing the same crop without using chemicals, they often do not hesitate to adopt the same practices.

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www.brot-fuer-die-welt.org

www.eed.de

The Pyalaram community gene fund

Deccan Development Society, Andhra Pradesh

"Mrs Gene Bank" is a well-known figure in the village of Pyalaram, in Medak District, Andhra Pradesh. Farmers from far and wide come to her small farm to fetch seeds they cannot find anywhere else: a local type of grain specially suited for nursing mothers, or traditional varieties that cannot be found in the market and that are close to dying out.

Balamma (Mrs Gene Bank's real name) is the seed collector and multiplier in the area. She collects seeds and grows them on her own 1-ha plot of land. She is now proud owner of more than 70 traditional varieties; at any time she might have 150–175 kg of good quality seeds stored in her house. She gives some to friends and neighbours, and loans the rest to other villages in return for more seeds, or for grain to eat or to sell. People repay their loans with double the amount after harvest, so creating a robust gene bank as well as providing Balamma and her family with food and income.

Balamma belongs to the lowest caste in Indian society. She used to be very poor, and most people just ignored her. Now she is well respected, and earns a good income from her seed conservation efforts. Other women have copied the idea, and now 60 of them also collect and store seeds.

The above illustrates how Balamma and other women could overcome the acute seed crisis, which led to food and nutrition insecurity in the area. Farmers in Pyalaram no longer have to rely on unreliable seed sources in the market.

Pyalaram

Many rural villages of Andhra Pradesh are poor, and subsistence farming is a mainstay. In Pyalaram, conditions are particularly difficult: prolonged drought mean that villagers have been forced to rely on government welfare for over 15 years. Traditional seed varieties had all but disappeared from the area. When rain does fall, farmers often had no seeds to plant: they cannot afford the high price of hybrid seeds. These seeds are anyway unreliable: they germinate poorly, need large amounts of water, and require lots of chemical fertilizers and pesticides, which poor Pyalaramans cannot afford.

In the government relief programme, rice and wheat were the only source of food. Serious malnutrition was the inevitable result, especially in children, women and elderly people. Most of the men went elsewhere in search of jobs, forcing the women and old people to fend for themselves. The severe drought between 1994 and 2000 made the conditions worse: farmers had no drought-resistant seeds.

Box 9 Seed security for food security

Seeds are **the** critical component in farming. The entire crop depends on how good the seeds are: the variety, whether it is suited to the area, and how well it germinates and stands up to challenges such as drought, pests and diseases. Besides seed quality, sowing at the right time plays a pivotal role in how the crop performs.

With the introduction of high-yielding hybrids and genetically modified varieties, production of seeds has become a technology-intensive activity. Farmers have become ever more dependent on outside sources of seeds. That is risky: the seeds they buy are not adapted to the particular soils, climate, pests and diseases in their area; they are expensive; they produce bland, tasteless yield that is low in nutrition and has poor storage qualities. Planting a single variety over a wide area lowers the biodiversity, making it easier for pests and diseases to attack.

It does not have to be so: Balamma and her friends show that a small group of poor but determined women can regain control over this crucial resource.

A group of 34 women farmers from Pyalaram asked the Deccan Development Society (DDS) for help. They wanted seeds so they could grow their own food instead depending on government handouts. DDS has considerable experience in sustainable agriculture in the region. It helped them start community gene banks so they could store seeds of locally adapted varieties, so assuring a steady supply of quality seeds. DDS advised each farmer to plant a range of traditional crops on her land, so building a robust seed bank for the community. It also helped the farmers bring back some neglected land into cultivation. As a result, the 34 families converted around 20 ha of fallow land into organic farming, allowing them to grow a whole range of crops and so improve their diets.

DDS has done similar work in some 75 villages, and has helped establish more than 65 community gene funds.

DDS and its approach

The DDS is a grassroots-level organization, some 20 years old, which has a vision of consolidating self-help and community-based organizations into vibrant organs of primary local governance and federating them into strong pressure lobby for women, the poor and marginalized. DDS has organized 75 *sanghams* (voluntary village-level associations) for economic and social empowerment. These groups are organized around health, natural resources management, community seed banks, creches, media, and other social and economic themes.

DDS bases its work in a village on the farmers' own understanding and practices. The organization respects and recognizes the importance of this knowledge for the villagers' own self-development, and acts merely as a catalyst and facilitator.

In Pyalaram, DDS brought all the women who were interested together and helped them form a *sangham*. The main aim of forming such a group is to empower the members to develop and maintain their own network of seed groups, both within and outside the village. DDS believes that a well-maintained seed bank can effectively counter the market by ensuring access to seed, and also revives the range of traditional crops and varieties, so ensuring food and nutritional security.

Figure 1 *DDS relies on the indigenous knowledge of local people to select healthy, viable seeds*

DDS and the *sangham* women identified villagers who kept seed and who knew about traditional seeds and storage methods. DDS conducted several participatory exercises with the group to ask them about the availability of seed varieties in the village and any gaps in supply. For crop varieties that were not available locally, DDS provided initial packages of seeds. People who received these packages had to repay double the amount of seed to the village *sangham* group at harvest time. These are then passed on to other *sangham* members, or are loaned to other farmers. The farmers who receive such seed loans also have to repay double the amount when they harvest their crop. And so the process continues.

Seed selection and collection

DDS does not introduce new ways of selecting, propagating or storing seeds. It relies solely on the knowledge of indigenous seed collectors. Traditional seed keepers have a good knowledge of how to select healthy, viable seeds. They know which seeds are free of wrinkles and fungus. They collect bigger, good-looking seeds from stronger stalks before harvesting for home consumption or for sale. They collect seeds from drought-tolerant crops such as millets, sorghum, beans, pearl millet (*bajra*), sorghum (*jowar*), cowpea, grams, cereals and other rare, local varieties.

Apart from drought tolerance, these varieties have other important characteristics: they are nutritious, local people like their taste, and they produce livestock fodder – unlike the government relief programme's wheat and rice. These varieties survive and perform well even

Box 10 Seeds in festivals

Seeds play an important role in traditional festivals in the Deccan region.

Dasara is the most important festival in the monsoon season. By this time most crops are ready for harvest, and the farmers are relaxed. Dasara also marks the end of one season and the beginning of another. Preparations are on for sowing the winter crops.

During the festival, women perform a fascinating ritual, focusing on the goddess and on seeds. The five most important seeds for the winter crop (wheat, winter sorghum, grass pea (*Lathyrus sativus*), chickpea, and linseed) are mixed with soil. All crops these crops need relatively little water, which is scarce in area. Local people reason that any crop that can grow without water should be worshipped.

The seeds for this ritual are brought from the village seed keepers. When the seeds sprout, village women visit each others' houses and check the seeds to see how well they have grown. They can see whose seeds germinate best, so they can get their seed supplies from that seed keeper.

During Endlagatte Punnami, a festival before the winter crops are harvested, women offer newly cut ears of grain to the village deity. They adorn the front of each house with a string of ears tied above the door. The villagers believe that the more types of grain displayed, the more their farm will produce.

DDS is reviving these traditions to focus interest on seeds as a source of prosperity.

without a lot of inputs, so they involve little risk in case of drought. Farmers grow many crops in the same field, using techniques such as companion cropping and intercropping. This minimizes the risk of total failure in case of drought or disease, guarantees food security, and ensures a balanced diet.

Seed storage

Farmers have themselves developed methods of selecting and storing seed over millennia. They use local materials such as earthen pots, gunny bags and baskets smeared with cattle dung and red earth to hold seeds, and use ash and neem leaves to repel insects. They dry the seed thoroughly in the sun, then mix it with ash. Farmers who store small amounts of seeds may keep several types of seed in the same container. They put some ash on top of each layer, then spread a cloth on top to separate the seeds apart from the next layer of seed. A typical farmer may keep 15–20 varieties of seeds, but the village seed keeper may have 70–80 varieties. The seed can be stored for 2–3 years, but must be turned and exposed to sunlight every 5–6 months during storage. Seed stored for longer is kept underground in pits.

Achievements and lessons

- The women's groups have demonstrated that once they organized and empowered, even the poorest farmers can feed themselves and their dependants, and conserve their environment, with a minimum of outside support.
- Keeping seed has a long tradition, so the women did not see it as a new thing to do. It just needed to be revived. The women eventually re-established their control and leadership over their own knowledge about seeds and varieties.

- It is possible to enable people to pull themselves off the government welfare system by encouraging and supporting groups like the Pyalaram women.
- Even in the most degraded areas, people do not need to rely on genetically modified seeds or multinational corporations to feed themselves.
- By storing seed, farmers were able to avoid unnecessary expenses and effort to search for seed. They were able to sow at the right time, which translated into better returns.
- The families' food and nutritional needs are now adequately met. They have a broader diet, fewer people are forced to migrate in search of work, and more fodder is available.
- Since seeds are in the women's own hands, they can now choose what to grow and when to grow it.
- The women have been transformed from seed borrowers to seed lenders. Their pride has risen and they are viewed with respect by people in neighbouring villages.
- A large amount of previously fallow land has been brought under cultivation. Diversifying cropping has boosted productivity, conserved soil fertility and improved the soil's biological and physical properties.
- Traditional festivals have been revived.
- The *sangham* enables the women to work together as a group.

Figure 2 shows how one member of the *sangham* benefited from the seed banking. She planted more crops, and got higher yields from her field because she was able to sow on time, applied silt from the village tank, manure and vermicompost to her field, and weeded on time.

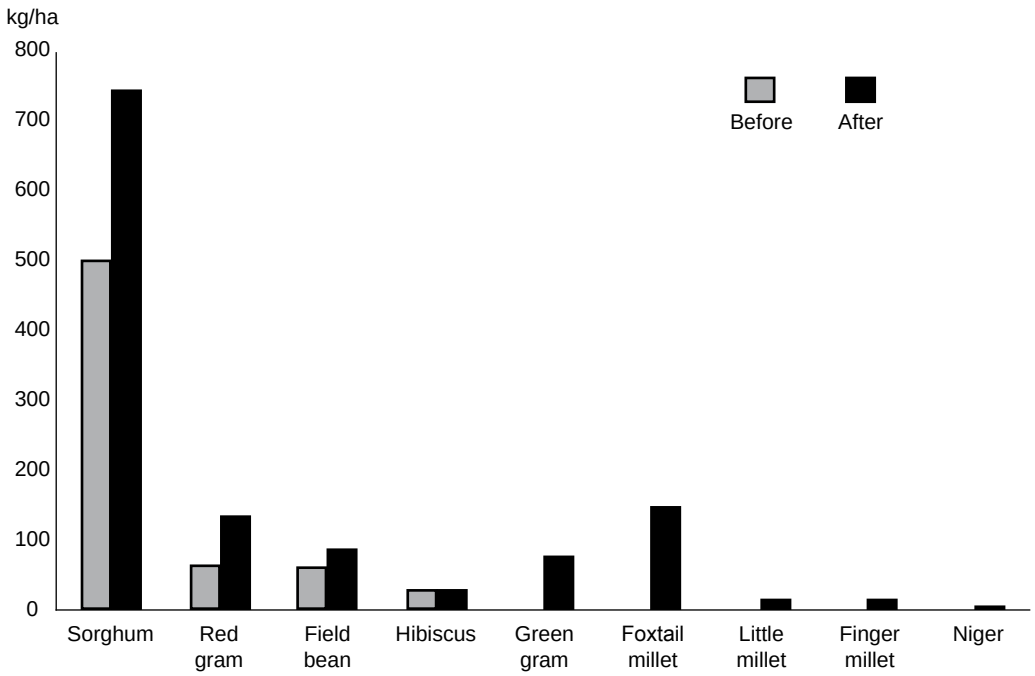

Figure 2 Yields obtained by a sangham *member before and after the project*

Challenges

The biggest challenge is to persuade the government to appreciate and support traditional crops that can enable the villagers to grow enough food to feed themselves instead of remaining as victims of market forces and continuing to rely on welfare handouts.

As the village now produces and stores its own seeds, demand for seeds has fallen. Some farmers may not continue to produce seeds.

Young people are attracted by modern agricultural practices. It is difficult to change their mindset so they appreciate the value of traditional practices and promote them to others.

Farmers may be tempted to grow commercial crops because these offer high returns. But they are risky: farmers must secure their own food supply first. It is easy for them to be attracted by advertisements for new crops and the farm chemicals, so abandoning organic production.

Farmyard manure is valuable as a fertilizer and to improve the physical and biological properties of the soil. It is necessary to keep enough animals to produce enough manure to support crop production.

Farmers want to sell surplus produce so they can earn money. It is necessary to ensure that markets exist for the local varieties they grow.

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The work of the Deccan Development Society is supported by Misereor.

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Redefining pest management in Punukula

Centre for Sustainable Agriculture, Andhra Pradesh

This is the story of how a village in Andhra Pradesh managed to rid itself completely of pesticides. Today, the villagers do not use any chemical pesticides at all. And they are inspiring other farmers all over the state to do the same.

Cotton has for many years been the major crop in Punukula, a small village 12 km from Kothagudem, Khammam district. It used to be grown as a monoculture, and farmers used a lot of chemical pesticides to protect their crops. Some sprayed their fields when they saw that there were a lot of pests on their plants. Others did not even check the crops for pests: they just sprayed anyway. But frequent spraying has two serious side-effects. It does not kill all the pests, and those that survive are more likely to develop resistance to the chemicals used. So the sprays become less and less effective over time. Plus, the sprays kill all the insects – including beneficial insects like ladybirds and dragonflies, as well as spiders that eat the pests. Without any of these natural enemies to keep pests in check, the numbers of pests can rocket soon after the farmer sprays a field.

So the chemicals worked less and less well. What could the farmers do? They increased the amount of chemical in the spray, and sprayed their crops more and more often. That only made the problem worse – and they had to spend huge amounts of money just to buy chemicals.

The pesticides also caused health problems. There were many cases of acute poisoning, killing people or leaving them permanently disabled and saddled with enormous medical bills. Mr Madhu, the Registered Medical Practitioner of Punukula, says there were at least 50–60 poisoning cases per season before 2000.

Box 11 The price of debt

Five years ago, Payakari Nageswar Rao, a farmer in Punukula, decided to take his own life. He drank the very pesticides that were supposed to assure him a high yield of cotton – the pesticides that were supposed to secure his income and livelihood.

But these chemicals had become like a stone around his neck – one that got heavier and heavier. They cost so much that he found himself deeply in debt. And they did not even control the pests on his crops. Threatened by moneylenders, and seeing no way out of his predicament, Payakari Nageswar Rao committed suicide.

Mr Rao's widow now leases out the couple's land. It is still in cotton production. And she still cannot repay her husband's debts.

Farmers also had to borrow money so they could buy pesticides. They would get credit from local "all-in-one" dealers who sold them seeds, fertilizers and pesticides. The dealers would sell these items on credit, then charge interest rates of 3–5% per month. The farmers were in no position to repay these loans, so would have to agree to sell their produce to the dealer. The dealer in turn would fix the price lower than the market value of the crop. The farmers had no choice but to accept this price, in the hope that the dealer would again support next year's investments. They were trapped in a vicious cycle of high costs, low produce prices and unpaid debts. They had no way out. They were truly on a pesticide treadmill.

People in Punukula recall with horror the clutches of the all-in-one dealer. The social stigma of indebtedness – especially when the moneylender put pressure for repayment, was unbearable for many.

Identifying the problem

In 1999, staff of a local non-government organization known as SECURE (Socio-Economic and Cultural Upliftment in Rural Environment) met with the villagers of Punukula to discuss problems they faced. The villagers complained about a lack of support for investment, the higher expenses each year, the lack of marketing support, indebtedness, and so on.

Figure 3 *Pesticides are supposed to solve pest problems – but in fact they lead to further pest problems, and to debt, poverty and despair*

The SECURE staff realized that cotton pesticides were the cause of many of these problems. So the organization decided to work on growing crops without pesticides in the village. Its work was supported technically and financially by the Hyderabad-based Centre for World Solidarity's Sustainable Agriculture wing (now called the Centre for Sustainable Agriculture).

Non-pesticidal management

Replacing chemicals with biological products would not alone solve the problem. A fundamental change in thinking about pest management was needed. The answer was "non-pesticidal management": an approach that rests on several major principles:

- A natural ecological balance will ensure that pests do not reach such critical numbers that they endanger the yield.
- Nature can restore such a balance if it is not meddled with too much – hence no chemical pesticides are used at all.
- Understanding the behaviour and life cycle of pests is important to manage them. It is not enough to spray in reaction to a pest outbreak.
- Prevention rather than control of reaction is the key element to non-pesticidal management.
- Crop diversity and soil health play an important role in pest management.
- Pest management is possible using local, natural materials.

Integrated pest management is a similar approach, but it still can use pesticides as a last resort. Non-pesticidal management, by contrast, gets rid of pesticides altogether.

Non-pesticidal management relies on the farmers' knowledge, skills and labour, and their work together as a community. It looks at the pest complex as a whole, rather than at individual insects. Farmers have to understand the many factors that influence pest numbers in their fields: the life cycle of the insects, the incidence of pests and diseases, predator–prey relationships among different creatures, the relationship between growing monocrops and the pest population, and the management of soil fertility.

Box 12 Organizations promoting non-pesticidal management

The Centre for Sustainable Agriculture (CSA, www.csa-india.org) is a Hyderabad-based agency working to promote local resource based sustainable agriculture. CSA used to be part of the Centre for World Solidarity (CWS), which has for 20 years promoted rights-based approaches to livelihoods.

Founded in 1991, SECURE is based in Polvancha, Khammam district (www.aea-india.org/secure.htm). It promotes sustainable tribal development through interventions focused on child development, women's empowerment, alternative income sources, preventive healthcare, and collective action through self-help groups.

The project was financially supported by Hivos, Netherlands (www.hivos.nl), and Action for World Solidarity (ASW), Germany (www.en.aswnet.de).

The Society for Elimination of Rural Poverty (SERP, www.velugu.org) is an Andhra Pradesh State Government initiative which coordinates women's self help groups. It is also known as Indira Kranthi Patham.

Farmers who employ non-pesticidal management use different practices to keep numbers below the level where they would reduce the yield significantly. They try to stop the pests from reaching the stage where they can damage the crop. They use natural and locally available resources.

Non-pesticidal management uses many different practices, including the following:

- Deep ploughing in the summer to expose the insect pupas so they dry in the sun.
- Using light traps and bonfires to attract moths.
- Placing yellow and white sticky boards in the field to attract insects that suck out the plant's juices.
- Hand-removing leaves on which many insect eggs have been laid.
- Setting pheromone traps (which use substances that attract insects) to check on the numbers of pests in the field.
- Using biological pesticides such as neem seed-kernel extracts and chilli–garlic extracts to control bollworms and sucking insects. There are also other locally available plants to make biological pesticides.
- Using an extract made from cow dung and urine to control aphids and leafhoppers (this extract also acts as a fertilizer!).
- Planting trap crops such as castor and marigold. Insects are likely to lay their eggs on these plants, where they can be picked off easily.

Starting slowly

The farmers were sceptical about the non-pesticidal technology at first. They were targets of persuasive marketing from the pesticide industry, so their doubts are entirely understandable. "How can I believe that the insects that aren't killed by highly poisonous pesticides can be controlled using neem – which I use to brush my teeth every day?" asked Hemla Nayak, one of the villagers.

But CWS and SECURE persisted. Many farmers were completely fed up with the situation that they were in. They were ready to check the alternatives. CWS and SECURE organized training for them.

In 2000, with a great deal of persuasion by SECURE, a group of farmers agreed to try out non-pesticide management. Two SECURE extension workers (a man and a woman) went into the fields to show the farmers how to use the non-pesticide technologies. They made neem and chilli–garlic extracts in front of the farmers, and then showed how to apply them. The women farmers were especially interested: they saw how easy it was to make the extracts. The farmers tried using these extracts, replacing the pesticides completely. To their delight, they found that they could even control cotton bollworm.

Demonstrating impact

By the end of the first year, the positive results from the new approach were apparent. In 2001–2, eight farmers in Punukula tried non-pesticide management on 6.4 hectares of cotton,

Table 3 Non-pesticidal and conventional management in cotton, 2001–2 (8 farmers in Punukula)

	Average yield (t/ha)	Cost of plant protection (Rs/ha)	Net income (Rs/ha)
Non-pesticidal management	1.56	4301	3420
Conventional management	1.47	8596	–5201

and another three farmers tested it on another 7 ha of pigeonpea. Farmers who had used conventional pesticides lost money, but the non-pesticide farmers made a profit (Table 3).

In the second year, more farmers who had seen these results first hand joined in. The NGOs arranged for farmers to go on exposure visits to other districts. There were more training workshops in the village. Slowly, word spread. Along with it spread the conviction that getting rid of chemical pesticides was the only way out.

By 2002–3, the farmers were trying out non-pesticide management on rice, pigeonpea, cotton and chilli. The number of participating farmers rose to 59, cultivating an area of 58 hectares. The farmers were happy when they found their incomes rising.

In 2003–4, the area under non-pesticide cotton went up to 480 ha in Punukula and the neighbouring village of Pullaigudem, and covered all the cotton area of Punukula. The average yield was 3 t/ha. Cultivation costs per hectare amounted to about Rs 21,400, leaving farmers with nearly Rs 52,600 in net income.

Cutting out pesticides also meant a great improvement in the quality of the chilli crop, so the produce fetched higher prices in the market.

Impacts

In 2004–5, for the second year in a row, nobody in the village went anywhere near a pesticide dealer. The village *panchayat* council passed a resolution stating that the village was pesticide-free, and would continue to be so. The *panchayat* requested pesticide dealers not to come into their village and market their products.

The village farmers were able to get rid of past debts in a couple of years. With no debt burden, they are now willing to try out more and more ecological approaches, on more crops. One farmer, Eerla Dhanamma, has bought two more acres (0.8 ha) of land after switching to non-pesticide management. Hemla Nayak says he has repaid his debts. Man Singh has been able to rent 2 acres of land so he can grow cotton without pesticides. SECURE field staff point out the various changes – including housing – in the village after pesticides have been removed from their agriculture.

The ecological balance in the fields has been restored. There are many more insects in the fields, but none reaching a "pest" stage of threat. Mr Dhanamma talks about spiders, wasps and beetles returning to their fields. Birds are returning to the village, the villagers report.

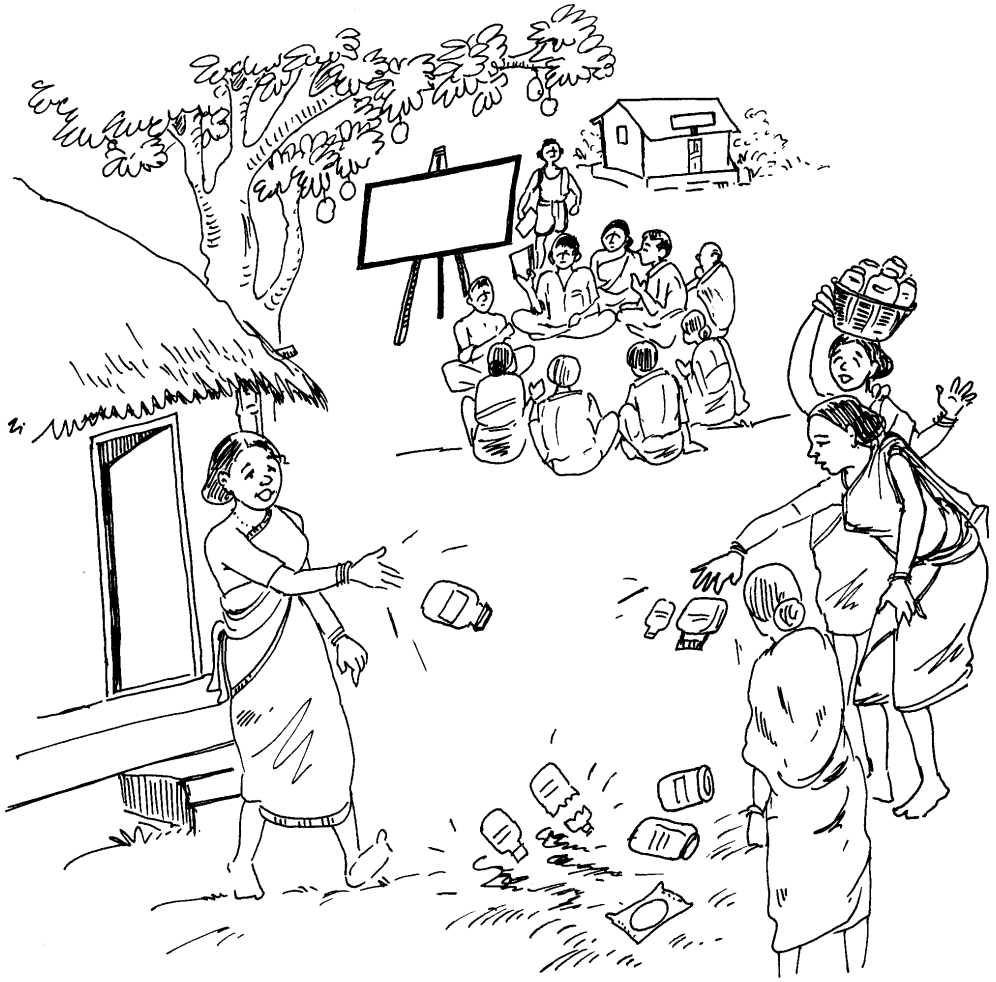

Figure 4 *By getting rid of pesticides, the villagers avoided having to borrow money, boosted their yields, made more profit – and improved their health*

The health of the farmers has improved too. There are no more any cases of acute poisoning from the village.

For the farm labourers also, things have improved on many fronts. Wages have gone up from Rs 25 to Rs 30 during this time. The workers are no longer exposed to pesticides, and have no medical expenses for pesticide-related illnesses. Some say there is even more work for the labourers – collecting neem seed, making powders and pastes, and so on. Farmers are renting in land and growing crops over a larger area, creating jobs for farm workers in the village.

In 2004, the women's groups in Punukula bought a machine to crush neem seed. They bought this through the *panchayat* with the help of a grant from the Centre for World Solidarity. Two women are employed full-time to run this machine.

Spreading the approach

One hundred and seventy-four farmers in Punukula, and another 120 from Pullaigudem, soon became experts in the new pest-management approach. They can explain to others the principles behind the approach and about how they benefit. Word has spread both in sporadic ways and in an organized manner. Punukula farmers themselves decided to go out to spread the message to nearby villages. Everyone who visits the village gets to hear about the transformation. Similarly, when Punukula farmers go to other places, they make a point of telling their story.

The Centre for Sustainable Agriculture/Centre for World Solidarity support various other organizations like SECURE to promote non-pesticide management in 92 villages (in 2003–4), spread across six districts in Andhra Pradesh. More than 5000 farmers participate in this programme, and use the non-pesticide approach on about 2400 ha. The farmers from these villages act as resource persons in training programmes organized by NGOs and government agencies.

The state Minister for Agriculture, Raghuveera Reddy, visited Punukula and was convinced about the approach. As a result of such activities, the state-run Society for Elimination of Rural Poverty decided to scale up non-pesticide management in 11 districts in Andhra Pradesh from 2005–6 onwards. It is collaborating with the Centre for Sustainable Agriculture and its partner NGOs in this programme. The programme is the first massive effort to wean people from pesticides and to promote non-chemical, environmentally friendly, local-resource-based approaches to farming.

The SERP/CSA programme includes various aspects:

- **Mass campaign** A state-level campaign on the problems of pesticides and alternatives to them uses posters, films and *kalajathas* (traditional folk media).
- **Establishing field experience** The *mandal* (block) is the local management unit for the programme. Three to five villages in each *mandal*, and around 30–35 farmers in each village, are covered in the initial year. Interested farmers pay a registration fee of Rs 20. They sign an agreement stating they will collect at least 60 kg of neem seed, attend all the training programmes, maintain a farm observation book, pay for input costs either directly or as a loan – and that they will not apply any synthetic pesticides at all.

  In each district, experienced NGOs have been identified and are associated with the

Box 13 Transgenic Bt crops: No solution

As the problems of chemical pesticides are becoming evident, the industry has come out with another technology in the form of insect-resistant genetically engineered crops such as "Bt cotton". These are portrayed as a panacea for controlling pests.

But the last four years (2002–5) of commercial cultivation of the Bt cotton in India, especially in Andhra Pradesh, show the devastating effects such technologies can have on farming communities. Bt cotton seed is four times the price of conventional seeds, and Bt crops often are not even completely resistant to the pests they are designed to combat. Plus, other pests still attack the crop, so chemicals are still needed. The first three commercial Bt hybrids released in Andhra Pradesh were withdrawn from commercial cultivation after reports of large-scale failures.

Continued...

Box 13 (continued)

Bt crops are genetically engineered to produce a toxin that affects insects feeding on the plant. The research on the production of this toxin has been done under carefully controlled conditions – not in the real-life conditions of farmers' fields. In real fields, the toxin production of the crop is extremely uneven.

The idea of Bt crops conflicts with the basic principles of rational pest management. The key points of rational pest management are:

- Management rather than control
- No pesticide use until the pest reaches the economic threshold level (non-pesticide management even avoids using artificial pesticides altogether)
- Judicious mix of all available control measures.

Major pest management strategies are designed to prolong the life of pest control measures by ensuring that insects do not rapidly develop resistance to the chemicals used to control the pests. Insect populations develop resistance to toxins through two major mechanisms:

- **Selection for resistance** Even if the majority are susceptible, a number of individuals within an insect population are likely to be naturally resistant to a given chemical. When chemical pesticides are sprayed, the susceptible insects will die, while resistant insects (and those that escape the spray) survive. Successive sprays amplify this effect. The resistant individuals are more likely to reproduce, and their offspring are more likely to share their parents' resistance to the chemical. In this way, chemical sprays (and plant-produced toxins) select insects for genetic resistance.
- **Induced selection** Even if the insect population contains no naturally resistant insects, high doses of a particular chemical are likely to encourage genetic mutations. Some of these mutations may confer resistance to the chemical. These resistant insects go on to multiply and spread.

These processes are well-documented for chemical pesticides. Transgenic Bt plants, which produce their own insecticidal toxins, have the similar effect. However, there is one key difference: unlike sprays, which become inactive after a short time, transgenic Bt plants are engineered to maintain constant levels of toxin for an extended period, regardless of whether the pest population is at economically damaging levels. The selection pressure with transgenic Bt crops will therefore be much more intense.

To prevent (or at least, retard) the emergence of insect resistance, pest management strategies aim to avoid the use of pesticides altogether, unless the pest population reaches the economic threshold. Secondly, pest management should ensure that pesticides are applied in optimum doses, depending on how severe the pest outbreak is.

The "indiscriminate" use (frequent, high doses) of pesticides has been held responsible for major "pest disasters", such as the many suicides of farmers in Andhra Pradesh in 1997–98). If this is indiscriminate, how about the application of high doses of toxins for extended periods, irrespective of the presence of insects? Is this not also "indiscriminate"?

The implications are uncertain, but we can expect these transgenic crops will help to create "super pests". They violate the scientific principles of sound pest management. Despite the claims of seed companies that transgenic Bt crops are a component of integrated pest management, Bt cotton and other similar transgenic crops have no place in rational pest management strategies.

The non-pesticide management approach shows anyway that sustainable agricultural practices can produce significantly better results, and that they also offer a range of social, environmental, economic and health benefits.

programme. Where there are no NGOs with experience in non-pesticide management, other NGOs that work on organic farming or natural resource management have been recruited.

- **Institutional arrangements** At the village level, farmer field schools (or similar bodies) have been set up with interested farmers. These have been given intensive support by village activists and *mandal*-level resource teams set up for the purpose. District-level monitoring teams and a state-level support team oversee the programme.
- **Equity concerns** While selecting farmers, it is mandatory that 90% should be small-scale and marginal farmers. Only around 10% may be others (mostly for strategic reasons, such as to spread the approach further). The majority of the participants must be women.
- **Training** Intensive orientation, training, monitoring and communication activities take place at different stages during the crop's growth. Suitable communication materials are being developed. A cadre of resource persons in being developed in each district; nearly 400 were trained in 2005. CSA is planning a 3-month certificate course on non-pesticide management for all farmer resource persons in the villages.

Initial results

While this scaling-up effort is still in its infancy, the results of the initial stages are encouraging. Non-pesticide management has been successfully established in all 11 districts. These districts include major pesticide users such as Guntur, Warangal, Kurnool, Khammam and Karimnagar. The technical capacities of 62 *mandal*-level resource teams and 11 district-level monitoring teams have been built.

Over 450 farmer field schools composed of interested farmers have been set up. These groups can take up other agriculture-related issues at a later stage. Up to 21,000 farmers have participated in these field schools; they have learned about pest management and changed their views on it.

A cadre of at least 200 farmer resource persons has been trained. These are practising farmers; their task is to facilitate farmer-to-farmer training and extension.

Farm-level data was recorded for all participating farmers, and a picture of the outcome will be analysed at the end of the season in terms of crop economics and performance. Such analysis is valuable for scaling up efforts elsewhere.

The state-level campaign has created widespread awareness about the ill effects of pesticides and the potential alternatives. A range of communication materials have been created and distributed.

Each participating farmer has saved Rs 2500–5000 per acre (Rs 6200–12,400 per hectare), averaged across crops and across districts on pest management expenses. The ecological and other benefits promise to be enormous. Initial estimates indicate that in the first year alone, farmers have already saved Rs 60 million on pesticides – equivalent to the amount spent on the project. With larger areas and more farmers coming into the programme, savings will be higher.

Self-help groups have set up nearly 30 village enterprises to make neem seed powder, and another 15 have established units to produce NPV (nuclear polyhedrosis virus, a biopesticide used to control bollworm).

Farmers have come to understand clearly the role of beneficial insects, and to manage pests without resorting to chemical pesticides. Neighbouring farmers who still use chemical pesticides and genetically modified crops continue to invest a great deal and get low net returns.

The initiative was planned to focus on pest management as chemical pesticides are a serious problem. Plans are to incorporate other initiatives gradually, such as organic nutrient management, seed management and so on.

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www.welthungerhilfe.de

Farming for self-reliance

Chetana-Vikas, Maharashtra

Many farmers in India are doubly exploited: once when they buy the inputs they need to plant their crops, and again when they come to sell their yield. At the beginning of the season, farmers pay through the nose for seeds, fertilizers and other chemicals. They take loans to pay for these inputs – loans that often carry exorbitant interest rates. If the rains fail – or if there is too much rain – the first planting may fail, and the farmers have to reach even deeper into their pockets to buy more seed.

Yet at harvest time, the farmers get low prices when they come to sell their crops – often to the same traders who have charged so much for the inputs. And the yields are often low: farming is anyway dependent on fickle weather, and repeated applications of artificial fertilizer and continuous growing of the same crops have depleted the soil, making it ever harder to produce enough.

The result: farmers are driven deeper and deeper into debt. Their families do not have enough to eat, and thousands commit suicide in desperation.

Escaping from the vicious circle

Chetana-Vikas, an NGO working in central India, is helping farmers find a way out of this deadly trap. It promotes an approach called "self-reliant farming". This differs from conventional high-external-input agriculture in two key ways:

- It uses resources from the farm itself rather than relying on purchased inputs.
- It aims to produce enough food for the family (plus a surplus to sell), even if the weather is bad, rather than growing crops mainly for cash.

In development-speak, self-reliant farming has "low external inputs, but high internal regeneration of inputs", and emphasizes "food sovereignty and nutrition security, and a resilient agro system with inbuilt insurance against seasonal adversities".

Self-reliant farming was developed by Chetana-Vikas's Alternative Agriculture Resource Centre in Wardha District, Maharashtra. This area consists mainly of rainfed dryland with gentle slopes. Almost all the 800–1000 mm of rain falls between June and September. May is the hottest month: the mercury can climb to 47°C for 1–2 weeks.

Farmers in the district typically own only 1–2 ha of land. The soil is average fertility, and the fields are not irrigated. The farmers have few tools or equipment, few cattle, limited labour and skills, and very little capital to invest. Any technology has to work given these stringent conditions.

Box 14 Intercropping saves lives

Janardhan's father had planted nothing but cotton on his 2.4 ha of dryland. That had landed him in debt. After his father committed suicide, it took Janardhan 10 years to repay the debt. But how could Janardhan avoid his father's fate?

The 2004–5 cropping season started out promisingly enough. The rains came on time, and Janardhan and other farmers in his village sowed his seeds. Then, a couple of weeks later, the rain stopped. Parched, the young plants withered and died. The farmers had to get more seed and sow again. Again the rain failed, so the farmers had to sow a third time. Certified seed ran short, and a black market sprang up. Many farmers could not afford to buy more seed, so killed themselves.

Janardhan was lucky. Advised by Chetana-Vikas, he had sown many different types of food crops in between the rows of cotton. When cotton failed to grow, he had to go to buy more seeds, like all his neighbours. The drought killed the young food plants too, but that was less of a problem: he had enough seeds at home to sow again – and again when the rains failed the second time.

The erratic rain and planting delays meant that all the farmers got low cotton yields. But Janardhan still had his food crops – he had planted 24 different types in all. His family had enough food, and he even managed to earn some money.

His conclusion: "If I had not been farming for self reliance then may be even I would had committed suicide this year".

What were the possibilities? Growing crops purely for cash is too risky – as so many farmers have discovered to their cost. Growing crops entirely for subsistence is also unrealistic, as it is not possible in a 6–8 month growing season to produce enough to feed a family throughout the year. Going for more sophisticated types of organic farming would also be inappropriate, at least to begin with, as the farmers had no knowledge or experience with this type of farming.

Combining food crops and cash crops seemed to be the best option. The food crops would provide the family with enough to eat for much of the year. The farmers could make enough money from the cash crop to buy food to tide them over the remaining months.

But which crops? And how should they be grown?

Developing farming technology

Chetana-Vikas asked a sample of small-scale farmers and their families in 10 villages what they ate each day, and what they spent on food and other items. The NGO staff were then able to calculate the amount and types of food a family needed each month and each year, as well as the money they needed to pay for things like clothes, education, medicine and travel.

The average family's budget amounted to about Rs 25,000 a year. Half of this was for food. The families named several dozen different crops, four-fifths of which the farmers could grow themselves without irrigation. These included cereals, pulses, vegetables and spices (Box 15).

To this list, Chetana-Vikas added cotton, soybean and pigeonpea (to be grown for cash) plus a few other crops such as sunn hemp (for fibre) and fodder crops. The NGO staff then

designed a cropping system – a combination of intercropping and rotation – that would enable the farmers to grow all of these crops. They decided to rely as far as possible on selected local and improved varieties so that the farmers would not be dependent on commercial seed suppliers.

The only outside input that was needed was farmyard manure to improve the soil structure and organic matter content. Farmers did not have enough cattle to produce sufficient manure, so they would have to buy it from other farmers. How much could they afford? They used to buy 125 kg of chemical fertilizer for a hectare of cotton, costing Rs 1500 a year. If they no longer needed fertilizer for their cotton, they could presumably use this money to buy manure. So the Chetana-Vikas staff developed and tested a cropping system that used Rs 1500 worth of manure a year.

Chetana-Vikas also field-tested various traditional seed varieties for yield, resistance to pests and diseases, and taste. The NGO ran demonstrations to introduce farmers to these varieties, and distributed seeds of the varieties they chose so they could multiply them.

The final element in the technology was contour bunds – low ridges made of soil, built across the slope. These bunds stop water from running off and causing erosion; the water pools up behind the bunds instead, so has time to sink into the ground. A barefoot "village engineer", trained by Chetana-Vikas, advised the farmers where to build bunds and gully plugs. The farmers could make the bunds easily by hand or using simple, locally made equipment pulled by rented bullocks. With the bunds in place, a crop can easily survive a dry spell of 35–40 days without damage.

Introducing the technology

Chetana-Vikas began research and development of the technology in the 1999–2000 season. The first tests were done at the Chetana-Vikas Centre, deliberately incorporating all the constraints that the farmers face: marginal land, no bullocks for ploughing or manure for use as fertilizer, and limited labour.

Starting in 2002–3, the NGO began to introduce the interventions on the farmers' own fields. It used various methods to introduce the technology: awareness raising, visit to dem-

Box 15 Crops for cash and food

Cash crops (3)	Cotton, soybean, pigeonpea.
Cereals (5)	Sorghum, rice, grain amaranth, pearl millet, maize.
Pulses (7)	Pigeonpea, green gram, black gram, rice bean, moth bean (*Phaseolus aconitifolius*), cowpea (2 varieties), chickpea.
Vegetables (15)	Cucumber, ridge gourd, bottle gourd, bitter gourd, ladies' finger, cluster bean, tomatoes, chillies, eggplant, beans (2 varieties), pumpkin, cowpea, yam, hibiscus (2 species for leaves and flowers).
Spices (5)	Turmeric, fennel, coriander, chillies, mustard.
Others (7)	Sesame, groundnut, linseed, sunn hemp, two fodder species, marigold.

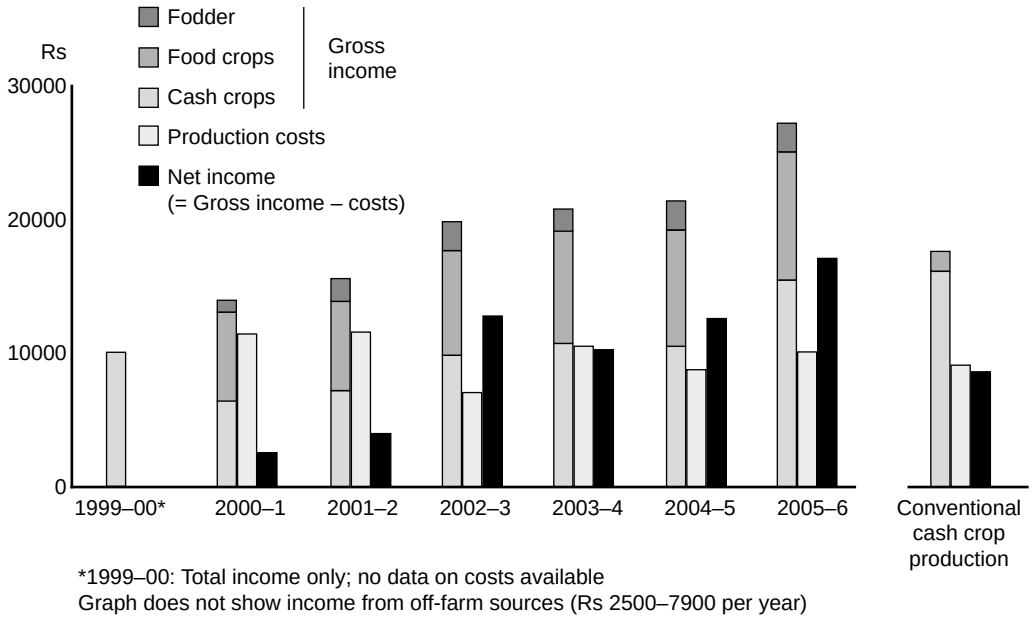

Figure 5 *Expenditure and income from 1 ha of land under self-reliance farming method, Wardha District, 1999–2005*

onstration sites, and 4–5 days of training for farmers who said they were willing to give the new approach a try. Chetana-Vikas provided these farmers with starter packs of seeds at a reasonable cost. Staff made one or two follow-up visits, and arranged for groups of farmers to evaluate each others' fields and discuss their experiences. No separate financial support to the farmers was provided.

Reaching self-reliance

Figure 5 shows that the farmers' incomes have risen steadily since the project began in 1999–2000. Production costs (expenditure on seeds, manure, hired labour and cultivation operations with bullocks) have fluctuated over the last five years and have declined slightly overall to about Rs 10,000 in 2005–6. Income from cash, food and fodder crops rose from under Rs 14,000 in 2000–1, to nearly Rs 27,000 in 2005–6. That gives a net income of around Rs 17,000: more than the Rs 7,500–9,500 earned by farmers growing cotton and pigeonpea using conventional chemical inputs.

The self-reliant farmers do not just get higher yields and incomes. They grow most of what they and their families eat (Table 4). That means they need to buy less from outside. This home-grown food is diverse, and provides a rich and varied diet throughout the year. The farm families are less likely to go hungry at any time during the year, and are less at risk from rising input costs or from fluctuating market prices of cash crops.

Of course, the self-reliant farmers cannot grow everything they need. Crops like wheat, potatoes, garlic and off-season vegetables cannot be grown in the area without irrigation.

Table 4 Degree of self-reliance achieved from one hectare of rainfed dryland; average of three years (2004–6)

	Family needs per year*	Production from one hectare	Self-reliance achieved (%)
Cereals (excluding wheat)	302 kg	245 kg	81
Pulses	80 kg	300 kg	374
Spices	27 kg	9 kg	33
Vegetables (for 3.5 months)	50 kg	63 kg	127
Oil seed (for 50 litres of oil)	120 kg	120 kg	100
Other food	10 kg	18 kg	183
Cash crops (cotton, soybean, pigeonpea)		700 kg	
Cash (from sale of cash crops and fodder, plus external wages)	Rs 12,263	Rs 11,789	96

*These figures reflect current living standards rather than an ideal situation. They do not include income from outside the farm.

The chemical-based farmers, on the other hand, grow little of their own food, so have to spend much of what they earn on basic foodstuffs. They achieve high yields only by depleting their soil fertility.

Conventional, chemical-based cotton farmers earn extra money from outside work. So do the self-reliant farmers: between Rs 2,500 and 7,900 per year during the seven years of the trial – about the same as for the chemical farmers.

The self-reliant farmers have not eliminated all external inputs. They still need to buy manure and hire bullocks for ploughing. Some who have their own draught animals have found that their costs are lower and profits higher than shown in Figure 5.

Figure 5 also shows that production and income have risen over time, as the soil fertility has increased and as farmers improve their management practices. The soil has become more porous, with more earthworms and fewer hard clods. There is less waterlogging in the wet season and less cracking afterwards. The soil retains moisture longer during dry spells. These should allow farmers to grow more (non-wheat) cereals and spices, making it possible for them to become completely self-reliant in these items.

Various practices have reduced attacks by pests and diseases, so reducing the need for chemical pesticides. These practices include the use of indigenous varieties of seeds, intercropping of different companion species, and crop rotations. Intercropping means that the plants cover the soil surface better, so are able to convert more sunlight into food and fibre.

Several more farmers in Wardha District have started practising this model of self-reliance. They have tried out different combinations of crops – from six to 25 in the first year. They are attracted by the low expenses, by the fact that they do not need to take out loans to pay

for expensive seeds, fertilizers or pesticides, and by the secure supply of food from the new model.

Finally, using weather forecasts has enabled the farmers to avoid crop losses by timing activities such as planting better.

Looking to the future

The self-reliance model can be improved further as farmers gain experience with it. For example, they could increase the amount of organic matter they use – by applying more manure or by recycling biomass. Such improvements may make it possible to increase the output of both food and cash crops. It becomes possible to eliminate artificial chemical completely, so going completely organic.

The self-reliance model offers millions of dryland farmers a real chance to escape from the debt trap, feed themselves and their families, while continuing to produce significant quantities of commercial crops.

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The work of the Chetana-Vikas is supported by Bread for the World.

www.brot-fuer-die-welt.org

Realizing the potential of organic agriculture

ORGANIC AGRICULTURE HAS HUGE potential in India. But it also faces many constraints. This section lists these potentials and constraints, and suggests changes needed if the potentials are to be achieved.

Potentials

The following points are ranked in order of importance (most important first).

- **Potential organic producers** All farmers in India have the potential to go organic. With full government support to promoting organic farming and assistance to help farmers bridge the 2–3 year transition period, it is estimated that about 25% of Indian farmers would change to organic agriculture within 5 years.
- **Organic by default** Many areas in India are farmed in a traditional way, untouched by chemical farming, so are organic by default. Most are subsistence farms in remote and marginal areas. They should be covered by a specific programme concentrating on organic agriculture to help farmers make themselves self-sufficient on a sustainable basis. By improving their livelihoods in this way, such a support programme would alleviate the need for social welfare programmes serving the same groups.
- **Research on traditional varieties** As most agricultural research has concentrated on high-yielding varieties of wheat, rice and other staples, traditional food crops have been neglected. Almost no attention has been given to local varieties of rice, wheat, millets, pulses and other cereals, while only 8–10 varieties are cultivated in 80% of all rice fields. Traditional varieties should be identified, improved and promoted.
- **Links to markets** Many smallholder farmers still have very weak links with markets for their produce. Specific emphasis on strengthening and improving such links would make it attractive for farmers and rural enterprises to improve the quality of their products. This would create new employment opportunities for local people. Many local products are produced with little capital investment but high inputs of labour, which is plentiful in India.
- **Certified organic agriculture** This is a niche market which offers premium prices to producers. For small-scale farmers to tap this potential, they must be connected to the potential markets. This will require improved organization (e.g., organizing as cooperatives or farmer associations), training, quality control, market information and facilitation (e.g., certification), and specific requirements for each commodity (e.g., storage).

- **National organic certification** At the moment it is still very difficult and costly for Indian farmer groups to organize certification for the national Indian market. Farmers wanting to sell their produce on the national market have to undergo a complicated, expensive process to comply with international standards. Creating a national certification standard, specifically designed and adapted to local conditions, would reduce the cost of this process and increase the number of smallholders who could take advantage of it.
- **Protecting farmers from foreign competition** Liberalizing trade rules creates new opportunities for Indian farmers to export. But it also creates the risk that cheap foreign food will sweep into the Indian market, cutting food prices drastically and pushing smallholder farmers out of business. While complying with the international agreements it has signed, India must also find ways to protect its many smallholder farmers from losing their only source of income.
- **Rising input prices** If the prices for energy and agricultural inputs for conventional farming continue to rise, labour-intensive agriculture will become more attractive even for larger-scale farmers.
- **Reducing risks through diversification** Organic agriculture has great potential to reduce farmers' risks. A single organically grown crop might yield less than if it were grown conventionally, but the total value of all the organic crops, in combination with drastically reduced input costs, gives farmers a similar (or even somewhat higher) profits. The organic farmer also is cushioned from price fluctuations of individual crops, bad weather and environmental degradation.
- **Traditional foods** Organic agriculture emphasizes traditional foods which have declined in popularity due to the shift to wheat and rice. Many of these traditional foods are highly nutritious, as well as being adapted to the local ecology and contributing to a diverse farm system. New markets could be created by developing delicious recipes based on traditional ingredients.
- **Rehabilitating watersheds** Both conventional high-input agriculture and unsustainable traditional types of farming seriously damage the environment, lowering soil fertility and causing erosion. This damage, and the high costs of rehabilitation, are not reflected in the costs of production. Sustainable organic agriculture would avoid these costs. It would be well worth supporting farmers to produce in a sustainable manner.

Successful experiences suggest that a framework for sustainable agriculture should be based on the following.

- **Integration of natural and regenerative principles** (nutrient cycling, nitrogen fixation, soil regeneration and natural enemies) into crop production. This can produce stable yields around the same level as from conventional farming. Because input costs are much lower, farmers make more money and are less likely to go into debt. With further measures, such as the use of beneficial insects that prey on or parasitize pests, the selection of seeds and the improved recycling of biomass, yields from organic agriculture even can exceed those from conventional farming.
- **Using local inputs, management skills and labour** instead of external inputs. Making productive use of the people's capacities to work together helps solve common management problems related to pests, watershed management, irrigation and forest

management. This can be further enhanced by training and on-farm research to improve the already available knowledge and techniques.

- **Adopting multifunctional technologies** that conserve and regenerate resources, such as composting and water conservation. This will improve several components of the farming system at the same time.
- **Providing credit on the basis of land**, rather than for particular crops. Farmers can now get credit for single crops such as cotton or sugarcane. They should also be able to get credit for a farm under biodiverse cropping systems. The system should allow for rolling loans with long gestation periods.

Constraints

There are many constraints to the spread of organic agriculture in India. Here are the main ones (in rough order of importance).

- **Bias towards chemical farming** Existing policies, research and extension activities all support high-external-input farming. Little attention is given to organic agriculture, and no resource materials are available.
- **Misappropriation of local varieties** There is a danger that local seed varieties will be patented by multinational companies. The Indian government should recognize the rich heritage which is the property if India and its local people. This property should be protected by law.
- **Hazardous chemicals** The government should ensure that hazardous substances which are banned internationally do not reach Indian farmers. Such chemicals are dangerous to people and the environment. Laws already regulate them, but they are not properly enforced.
- **Certification of organic farming** Policy support for organic agriculture is arriving, but it caters to big organic enterprises. The procedures and requirements are not suited to small-scale farmers.
- **Bias in incentives** The government provides many different incentives for high input agriculture. Equal attention should be given to sustainable agricultural practices.
- **Lack of research and extension support** to organic farming and on various aspects like traditional varieties.
- **Poor marketing** There is a lack of organized, appropriate marketing structures for small-scale organic farming.
- **Misinformation and market power** The pesticide industry provides misleading or false information to farmers. Its well-established marketing structures feed India's farmers with persuasive messages promoting high-input farming.
- **Lack of awareness** Farmers and consumers are still not awakened to the dangers of chemical farming and the continuing depletion of natural resources.

Changes needed to achieve the potentials of organic agriculture

Many changes are needed if India is to overcome these constraints and achieve its rich potential in organic agriculture.

- **Research and extension** Research is needed to improve the yield of local crop varieties. Research and extension systems should place more emphasis on developing indigenous crops and livestock.
- **Supporting small-scale organic farming** Specific attention should be given to improving local agricultural production by marginal farmers and smallholders who are still "organic by default" and frequently depend on public welfare programmes.
- **Protect livelihoods of rural poor** The deregulation of national food markets has been agreed on an international level. Within this framework, agricultural policy should develop new strategies to prevent small-scale farmers from being pushed out of the market and off their land into poverty.
- **Local control of land** Large areas of wasteland and forest land located close to villages should be supervised by village committees. This would increase their ability to rehabilitate and use these lands in a sustainable way.
- **Local enterprises** Village-level, farm-based enterprises need to be promoted, strengthened and linked to potential markets. This requires support structures that are rarely in place. The government should provide guidelines and support to improve transport facilities, access to information, training, local marketing systems, etc.
- **Education** Organic agriculture should become part of the agricultural curriculum. Professional degrees in organic agriculture should be offered at universities to meet the demand for qualified specialists.

Biodiversity-based sustainable agriculture

Navdanya, Uttaranchal (p. 24)

Rajender Singh's biodiverse field in the village of Pulinda

Bija Devi in a mixed cropping field

The Pyalaram community gene fund

Deccan Development Society, Andhra Pradesh (p. 34)

Balamma, "Mrs Gene Bank", harvesting millet

Traditional grain storage

A rich spectrum of local seed varieties

Redefining pest management in Punukula

Centre for Sustainable Agriculture, Andhra Pradesh (p. 40)

The effect of pesticides: this man mixed pesticides with his hands

Drying chilli: a cheap, safe, natural alternative to artificial pesticides

A healthy field of cotton – grown without pesticides

Farming for self-reliance

Chetana-Vikas, Maharashtra (p. 50)

Six different crops growing in the same field

Short-duration intercrops enrich the soil, produce food, and make way for long-duration cash crops

Empowering marginalized communities in Rayalaseema watershed

Krushi, Andhra Pradesh (p. 67)

A water absorption trench dug by the community in Rayalaseema

A low-cost percolation tank to recharge drinking water tubewells

The watershed association general body reviews its activities every four months

Building on indigenous knowledge in watershed management

Agragamee, Orissa (p. 75)

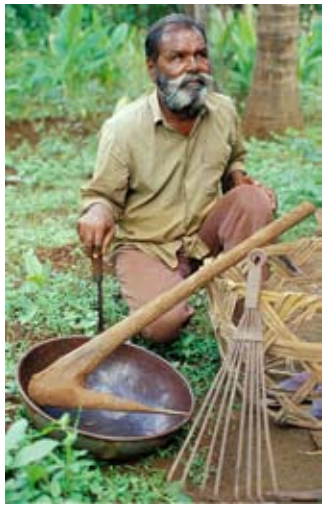
Contour bunding on a hill slope in Mankadamundi

A former gully developed for cultivation

High-value off-season vegetable cropping in Mankadamundi

A map of the Mankadamundi watershed on the wall of the village training hall, showing the locations of various watershed treatments

Watershed villagers harvesting jafra, a valuable natural dye and food colourant



Forest home gardens in Raigad District

Rural Communes, Maharashtra (p. 81)

"Aba" Krishnaji Narsingrao More in his forest home garden

Staggered trenches dug by local people in a future forest homegarden

Community-based watershed development in Bhipur

Cecoedecon, Rajasthan (p. 88)

A gully plug, or "anicut", to control erosion

Conserving soil and water raises the level of water in wells

Landshaping for better livelihood for the Sundarbans

Ramakrishna Mission Ashrama, West Bengal (p. 94)

After landshaping: a pond, upland bund and highland, with straw stacked for future use

A pond (larger than normal) has been excavated as part of a community landshaping activitiy

Working across levels in watershed management

Indo-German Bilateral Project (p. 100), and

Government–NGO collaboration in the Kinchumanda watershed

Vikasa, Andhra Pradesh (p. 108)

This spring has been developed to provide drinking water to local people

Newly constructed bunds to conserve soil and water

Mixed stand of cabbages, chilies and mango

Farmers harvesting pumpkin

Linking tea farmers with markets

Peermade Development Society, Kerala (p. 130)

A member of the farmers' consortium delivering tea leaves to the factory

Various tea products from Peermade. Leaf tea has the highest quality, powdered tea the lowest

Dryland sericulture

BAIF Institute for Rural Development, Karnataka (p. 138)

Feeding leaves to silkworms inside the rearing shed

Moisture-retention trenches across the slope. New trenches (left); being filled with biomass (right)

The biofuel hype: Chance or challenge for sustainable agriculture?

BAIF Institute for Rural Development, Karnataka (p. 144)

Five-year-old jatropha plants growing on marginal land

Immature jatropha fruit and empty fruit hulls (left) and seeds (right)

3
Managing land and water

Why watershed management?[1]

Agragamee, Orissa

Watershed management: a participatory, equitable and sustainable approach for judicious use of natural resources for sustainable development

Much of India's farmland is rainfed and prone to drought. And it is fragile. About 175 million hectares, nearly half the country's land area, suffers from varying degrees of degradation: erosion by wind and water, ravines, salinity, waterlogging, shifting cultivation and degraded forests. The tree cover has been depleted, soil erosion and damage have increased, the water table has gone down, droughts are becoming more severe, and ecological degradation of drylands has risen.

Less than 30% of the country's arable land has assured irrigation. And the rapid depletion of groundwater on one hand, together with waterlogging and salinity on the other, could shut down "thirsty", water-intensive farm practices in the coming decades. This environmental degradation translates directly into poverty, malnutrition and food insecurity.

India's national and state governments have spent large sums on fighting poverty. While these efforts have had some success, they have not been as effective as they should have been. In part this is due to the multitude of programmes and scheme that have been implemented, leading to overlaps and poor coordination among the various ministries and agencies responsible. The programmes fail to provide enough inputs, their operations are poorly matched to the needs, and they are implemented without the full participation of the people affected.

This has led to the concept of "community convergence". While the government can provide the funds and some of the expertise needed combat poverty, only the local people can convert these into activities which will raise their standard of living in a sustainable way. Voluntary agencies can be of immense assistance. But massive efforts, including a national campaign and strong policy advocacy are needed to achieve visible impact within a reasonable time.

Rural development is highly complex, though. A simple campaign would not work. Rather, changes in operational mechanisms are needed. The following are essential elements:

- All land, water and vegetation management components should be planned and implemented on a watershed basis, with coordination among the agencies involved.
- Programme implementation should be entrusted to the beneficiaries along with the implementation agency. Resources should be made available directly to the beneficiaries.

We are all part of nature and are dependent on it. To ensure sustainable development, we must ensure that we consider not only the needs of the current generation. We must also conserve our natural resources and use them wisely so they are available also for future generations.

1 Based on a manuscript by Achyut Das, Director, Agragamee

Why a livelihoods approach?

Unlike the conventional approach to watershed development, a "livelihoods approach" is based on a consideration of people's livelihoods. It tries to identify and build on people's strengths or "capitals": their financial, physical, human, political, natural and social capitals. It starts with the intended beneficiaries. It focuses on the causes of poverty, provides an understanding from the people's perspective, and seeks ways to improve the livelihood basis they depend on. This approach invites more people's participation, involvement and contribution, and improves the chances of long-term sustainability.

Major issues in watershed development

Technological interventions

The watershed approach aims to augment and stabilize farm production and productivity, minimize ecological degradation, reduce regional disparities, and open employment opportunities for poor people in rainfed areas. A similar approach has been adopted in other resource-poor areas, such as drought-prone areas, deserts and wastelands. Appropriate technologies in things like water harvesting, soil conservation, crop production, and so on, are key to the effective management of watersheds. These technologies may include a combination of modern techniques with traditional skills and indigenous knowledge. In many instances, it is better to adapt traditional technologies rather than trying to introduce complex, expensive new solutions.

Water-harvesting structures

Water is vital to India's food production and rural economic development. But massive deforestation and increasing population pressure are depleting the nation's water resources in an alarming way.

Not surprisingly, water conservation, development and use have become the main intervention in natural resource management. Such interventions aim not only to conserve natural resources; they also strive to improve the socio-economic life of the people and to secure their livelihoods. If they are to solve local problems, they should be based on the needs felt by the local landholders and villagers. These people may prefer certain types of water-harvesting structures for various reasons. Traditional structures are often more appropriate because they are cheap, easy to build and maintain, and benefit resource-poor families.

Water can be conserved and harvested in various ways and places: on the surface, through sub-surface water harvesting, as groundwater, and in the form of soil moisture. A wide range of engineering techniques exist: subsurface dams, gully plugs, pits, silt traps, mini-percolation tanks and water harvesting structures on drainage lines, as well as the more common contour trenches and contour bunds.

Strengthening linkages between conservation and production/livelihood systems

Enhancing rural incomes and long-term sustainability can only be ensured by developing natural resources. That means the natural resources in a watershed should be developed in accordance with their realizable potential and from the ridge down to the valley below.

At the same time, production and development activities must be undertaken on the treated lands using appropriate technologies. Soil and water conservation measures must be followed by appropriate farm production systems. Numerous crop-production techniques also conserve moisture; they include ploughing and planting along the contour, grass strips, mulching, cover crops, agroforestry, intercropping, planting crops that require little moisture, and so on. Various irrigation approaches also conserve water.

Both conservation and development measures should be implemented in accordance with a watershed plan. This plan must reflect the needs of individual farmers for private lands, user groups and the community as a whole for common lands and water sources, and the scientific input of subject-matter specialists.

Choice of technology

Rainfed areas are very diverse in terms of their geography and geology, socio-economic and agro-ecological conditions. That means the choice of technologies for conservation and production must be very flexible. The watershed users must be able to choose from a menu of technology options agreed by the implementing and funding agencies and the watershed users themselves. The implementing agency may have to add options, including low-cost, indigenous technologies, based upon specific local requirements. Production technologies should be evolved through a participatory technology development process involving implementing agencies and NGOs, innovative farmers, research and development institutions. It is important that mainstream production technologies be downsized and made easier and cheaper to use.

Convergence between watershed projects and crop production and rural development programmes

Watershed projects cannot hope to cover all the needs the people in a community identify. It is necessary to link with the regular production programmes of line departments – agriculture, horticulture, livestock, fisheries, energy and forestry – as well as with the rural development programmes of local government (*panchayati raj*) institutions. The watershed committee, water users' association and implementing agency should coordinate with these organizations (and vice-versa) to coordinate activities. In practice this is often not possible due to poor inter-departmental coordination, legal constraints, and a lack of political will and commitment of government officers. Government flexibility to enable such coordination is a crucial issue to be addressed and advocated at the policy level.

Marginal lands and legal issues

The areas treated and developed through a watershed approach often are marginal and have problem soils. Such lands are usually owned by poorer people. Developing such areas will enhance these people's production and productivity and improve their social equity.

Other land-ownership issues include land leased or proposed for mining, encroachment by rich and powerful people, and outdated land records.

To tackle these issues, cooperation and coordination are necessary among various agencies, which are controlled by different departments and governed by various laws and regulations.

Post-project maintenance of community assets and accountability

Watershed projects result in the creation of various community assets: water-harvesting structures, tree nurseries, *vikas kuteer* (training and meeting halls for the watershed users' associations), etc. Local people contribute money to a fund used to maintain these assets after the project is over. Here are some guidelines for maintaining these assets after the project finishes.

- Formally transfer all community assets created under the project to the watershed users' association.
- The association should use the watershed maintenance fund to maintain and upgrade the assets.
- The barefoot engineers trained during the project should look after the equipment. They may need refresher training after the project ends.
- During the project, it is important to generate a feeling of ownership and responsibility among local people for the community assets, to ensure that they maintain the conservation efforts and appropriate production techniques introduced during the project.

Transparency in project management

Transparency is important in managing a watershed project. Efforts to ensure this include:

- Preparing a watershed action plan in a participatory manner, bearing in mind local people's technical and economic capabilities, as well as the social acceptability of the measures and the degree of risk that the users are able to bear.
- Holding open meetings of the watershed users' association and community to approve the plan, the cost norms and ways to share the benefits.
- Posting the approved plan and a map showing the watershed after the treatment on a notice board at office of the watershed users' association. A prominent painting on the wall of the community hall can also remind local people what has been planned and agreed on.
- Reviewing the physical and financial progress of work through monthly meetings and periodic (quarterly) social audits during the project implementation.

Productive role of women

In conventional watershed development modes, women are organized into self-help micro-credit and savings groups. They are seldom involved in production and processing activities.

It is better to involve women in micro-enterprise activities, both in on- and off-farm production and in processing. They can so generate jobs and earn more money. Women are often the best people to manage grain banks, nurseries, kitchen gardens and vegetable cultivation, post-harvest handling of crops, the storage of food grain, etc. Such areas deserve further promotion and development.

Documenting and drawing on indigenous knowledge

Local people know a great deal about the area where they live, what works and what does not. They use a wide range of practices to conserve soil and water, manage forests and other natural resources, maintain biodiversity, manage social institutions, and so on. Many of these practices form a firm basis for future development. They should be documented systematically using a participatory approach involving farmers, scientists and NGO staff. Promising practices should be validated scientifically and published widely to allow them to be replicated and scaled up – of course taking account any intellectual property rights issues that may arise.

Education, advocacy and stewardship

There is a massive shortage of people who are aware of watershed issues and trained in watershed management techniques. Education must be a priority: in schools and colleges, as well as in training centres for barefoot watershed managers and engineers.

Because water is the key scarce resource in India's rainfed areas, watersheds should be the unit of development for all line departments and local governments, including the forest development agency. The inclusion of micro-watershed management in national and state water policies is essential to make them pro-poor.

Watershed-plus activities

Activities after a watershed project is over can help ensure that its objectives are achieved and are sustainable. These "watershed-plus" activities should include improvements to sanitation and drinking water supplies, rooftop water harvesting, and energy installations such as solar power units, gassifiers and micro-hydro electricity projects.

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Empowering marginalized communities in Rayalaseema watershed

Krushi, Andhra Pradesh

Many of India's marginalized communities – *dalits*, tribals, low castes or landless – have struggled during the last decades for empowerment and participation in the economic and social life of the larger society. Land rights are a major issue in this struggle: access to land is essential if the benefits of rural development and poverty alleviation measures are to reach marginalized communities. Without land rights, sustainable agriculture is an empty vision. Farmers who are not sure they will be able to farm their fields for many years are unlikely to invest in sustainable management. But assured rights on their own cannot alleviate poverty. They must be accompanied by measures as capacity building, access to other resources such as water and capital, and so on. Watershed area development projects provide an opportunity to combine large allocations of government funds to develop water and manage soil and natural resources with equity concerns.

Since 1991, Krushi, an NGO specializing in land rights, has worked in Chittoor district, one of four districts in the Rayalaseema region in southern Andhra Pradesh. Krushi has succeeded in getting land rights to marginalized communities in the district.

Small-scale, marginal farmers make up 80% of the marginalized communities in the area. Each family has an average of 0.5–1 ha of land. But without capital, they have not been able to invest in their land, so large areas are undeveloped and lack proper measures to conserve soil and water.

Krushi realized that land rights alone are not enough. Communities can benefit only if they can making their land productive. So Krushi searched for ways the farmers could improve their income. About ten years ago, several Krushi staff attended workshops and exposure visits on sustainable agriculture and development organized by Bread for the World, a German NGO. After this, Krushi started identifying areas for intervention and prepared plans with the local community to develop their land and adapt their farming techniques. It also began the search for funding to support this work.

The Rayalaseema Watershed Area Development Programme

At the same time, the Rayalaseema Watershed Area Development Programme (RWDP) evolved with support of a consortium of four donors: Bread for the World, Christian Aid UK, Oxfam (India) Trust, and the Hyderabad-based Centre for World Solidarity. RWDP approached Krushi and several other organizations working in Chittoor district to implement the project. There was a good match between Krushi's and RWDP's aims, and Krushi became an RWDP partner working in the Gerigelavanka watershed.

Box 16 Rayalaseema

The Rayalaseema region has an average rainfall of 820 mm and suffers from frequent droughts. It has broken hilly terrain with an uneven landscape. The soil varies from place to place, and includes red loam, sandy, black cotton and gravel soils.

Most people are disadvantaged, marginalized and poor. Most farmers have small parcels of land, usually 0.5–1 ha. Four-fifths of the land is rainfed. The major crop is groundnut, and sorghum (*bajra*), finger millet (*ragi*), field beans, red gram and green gram are grown as intercrops.

The land is eroded and overgrazed, and people have rooted out trees and plants for fuel. Rising population has increased the pressure on the land; even steep slopes have been brought under cultivation, further increasing erosion and reducing the protective cover of vegetation. In turn that means that people – especially women – find it harder to collect fodder and fuelwood.

The most marginalized people farm the poorest land on the upper slopes. These require a lot of investment to make them cultivable. Land in the many small valleys is controlled by dominant groups. There are number of streams and small rivers, but all are seasonal. Irrigation water comes largely from tanks, open shallow wells and tube wells.

This was Krushi's first experience in a watershed project. RWDP trained Krushi staff in watershed management, and the organization learned a lot while implementing the project. Krushi managed to combine its approach emphasizing rights and empowerment of marginalized communities with the technical aspects of the watershed project. This combination may be a model of how marginalized people can be empowered under a watershed project.

Participatory rural appraisal

Krushi conducted a participatory appraisal in each of the watershed's six hamlets, as well as one covering the entire watershed. The problems identified included:

- Scarcity of water in open shallow wells for irrigation: 24 of 54 wells totally dry.
- Migration of landless and marginal farmers to towns and cities for work; not enough work available in the village.
- Women paid less than men; no women's groups; women burdened with 16–18 hours of (mostly domestic) work per day.
- Low wages for farm work; no access to credit.
- Lack of sanitation and hygiene, causing health problems.
- Problems of families headed by single women.

Individual level planning

The farmers identified the boundaries of the watershed, and divided it into three mini-watersheds. They also identified 10–12 ha micro-watersheds, each cultivated by 10–15 farmers. Krushi team members visited each family to discuss their farm's individual needs and to help them prepare farm plans. These plans included these types of activities:

- De-silt open wells, prevent them from silting up again, and recharge them with water.
- Construct bunds to control runoff and erosion on fields.

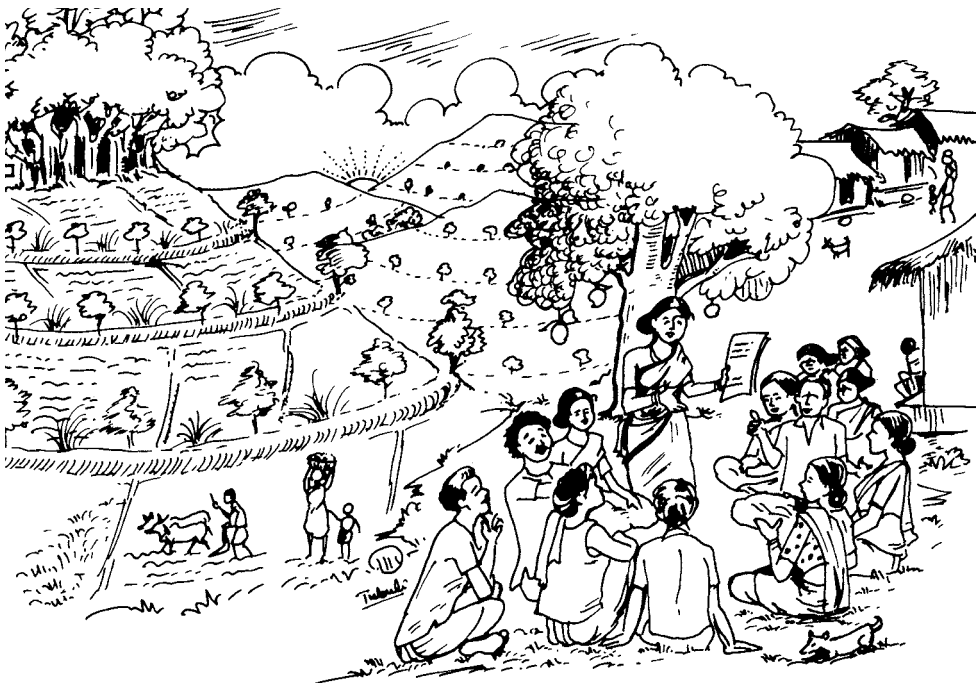

Figure 6 Groups of farmers planned how to manage the watershed

- Plant fruits trees such as *jamun* (*Eugenia jambolana*), mango, custard apple, sapota (*Manilkara zapota*) and papaya.
- Plant trees for fuel and timber.
- Plant fodder crops such as gliricidia, leucaena (*subabul*), stylo grass (*Stylosanthes hamata*), and local maize.
- Dig low-cost percolation tanks, farm ponds, sunken pits and other structures to structures to harvest and conserve water and increase the amount of moisture in the soil.
- Construct diversion channels, gully plugs, contour trenches, earthen bunds and weirs to combat soil erosion.

Community level planning

Krushi also organized a series of meetings with all the families in each hamlet. These meetings consolidated the individual farmers' plans, allowed the total costs to be estimated, and decided on community-level works such as:

- Building water-control and conservation structures on a stream to raise the water table in open wells and tubewells.
- Building a water percolation tank upslope to feed the wells.
- Planning the use of community-owned waste lands: planting them with trees to yield timber, fodder, fuel and fruit.
- Constructing percolation tanks to recharge open shallow wells for irrigation.

The meetings discussed with each of micro-watershed groups about how to solve their common problems, for example, by controlling erosion, digging channels to divert water, or treat streams.

The plans for all six hamlets were consolidated at the central level with representatives from each hamlet.

Community motivation and capacity building

Krushi held training courses for men and women in the community on the concept of watersheds and on the skills needed to manage them. It also organized exposure visits to successful watersheds assisted by Myrada, an NGO operating in Karnataka. A drama group focusing on watershed gave performances in the villages. Narayana Reddy, an organic farmer from Karnataka, visited the villages and organized discussions in the field. The Krushi team used every opportunity to strengthen the knowledge of both the farmers and of the team itself. Since this was a new venture for Krushi, the organization involved all its staff members from time to time to familiarize them with the process that was followed.

Institution building

Krushi has put a lot of emphasis on building watershed institutions at hamlet and central levels to ensure that marginalized people are represented and take on leadership roles. A series of meetings in each hamlet discussed the status of the watershed's natural resources, the causes for the current situation, and related issues and problems. These meetings discussed how a watershed approach could resolve these problems. All the families in the hamlet elected a committee of 3 men and 3 women to manage and implement the watershed activities.

At the central level, a watershed association was constituted. Its general body included one woman and one man from each family in the watershed hamlets. A central committee was elected, along with office bearers to execute the watershed activities. This association is registered as a society. RWDP funds were transferred to this association for it to use in implementing the activities.

Working groups

Local people identified unemployment and migration as crucial problems. Various watershed activities, such as constructing soil and water conservation works, are labour intensive, so help combat the unemployment problem. It was decided to form ten working groups to deal with these. These working groups had a total of 128 members, both men and women: landless farm workers, migrants and small-scale farmers. Their task was to construct the works. Krushi trained them how to build gully plugs, earthen bunds, weirs and other structures. The working groups could negotiate with the watershed association about their pay. Krushi informed them about the government's standard rates, the minimum wage, and the issue of unequal wages.

Women's savings groups

Discrimination against women is a major social problem in the area. There were no women's groups, and women were barred from participating in the village *panchayati* meetings (held to resolve local disputes). Women's problems were even dealt with by men at such meetings, with the women looking on as mere spectators.

Krushi has promoted 12 women's self-help groups, with over 180 members. The groups run savings-and-credit funds. Members have gained an opportunity to discuss issues among the groups, and have challenged problems such as discrimination and violence against women. They have been able to increase their access to credit by tapping their own group savings, a watershed revolving fund to support the livelihoods of landless and single headed families, the Mutually Aided Women Savings and Credit Cooperative Society, and banks. They have received this credit using social collateral (other group members ensure that an individual replays a loan).

People's contribution

In accordance with an agreement with RWDP, farmers have contributed half of the cost of work done on individual land. The watershed association decided to collect only half this amount from households headed by single women. Contributions could be in the form of labour or cash. In the case of community works, the user groups and farmers who benefited contributed one-quarter of the cost. All the structures were built by hand from earth or stones: no machines, cement or steel was used. The farmers relied on their own skills and knowledge; very few techniques were introduced from outside.

AFPRO (Action for Food Production), a Hyderabad-based technical service organization, helped build water-recharge structures, borewell mechanisms and low-cost latrines, and did water auditing.

The watershed association managed the maintenance of the works. It fined anybody breaking the rules – for example, people who ploughed bunds, broke gully plugs, or grazed cattle on planted areas. There were very such few cases: individuals and the community as whole have taken responsibility to maintain all the works.

The watershed association also manages a tree nursery. Farmers chose what types of seedlings to raise, collected seeds, contributed manure and labour, and in return got seedlings free of cost. They paid half the cost of fruit trees bought from the market. This nursery was at first maintained by two tribal women, who were trained in nursery maintenance. After the project was closed, the nursery was taken over by an 8-member women's group (including these original caretakers) as a way to earn money.

Krushi and AFPRO have trained a paraveterinary worker to treat cattle, sheep, goats and chickens. This paravet charges for his services.

Farmers make compost and vermicompost, and apply green manure and tank silt as fertilizer.

Leadership

Dalits and marginalized groups hold important positions in the watershed association and have played a major role in decision making. They have faced various difficulties in establishing this position because of political machinations by the dominant castes. The process of mobilization and motivation in each hamlet, the practice of ensuring representation of each hamlet, and the equal representation of women in leadership roles, meant that marginalized communities gained power in the watershed institutions. People from the dominant caste did not feel comfortable with this, and they were not interested in participating.

But Krushi kept the process open and transparent. After a year, small-scale and marginal farmers from the dominant communities also started coming to the meetings and joined in the activities. By this time, leaders from the marginalized community had established their influence and authority in the association. Since the dominant community is in a majority in the area, one association post was allocated to them. The people chose a good, cooperative individual to fill this position. A pattern of good cooperation among the communities was slowly established in implementing the project.

Although the project officially closed in 2003, local people continue to run the association on their own, under the leadership of the marginalized communities. The working committee meets regularly and follows up its decisions diligently. The association's fund contains Rs 280,000, which is used to support the livelihood development of association members and to maintain the watershed structures.

Linkages

The local women have been linked to the women's forum at the *mandal* (cluster of villages) level, which works against the violation of women's rights, atrocities and domestic violence against women. The members of the working groups, farm workers and marginal farmers are linked to the *mandal* agricultural workers' union, which is registered under the Trade Union Act and promotes rights and economic development of its members through negotiation and advocacy with government and other agencies.

Impact

Through the project, the villagers treated 100% of the marginal land with soil and water conservation measures. All 54 shallow wells now have water for irrigation; the water table has risen and the wells contain water throughout the year. There was no drinking water problem even in the 5 continuous drought years between 1998 and 2003.

The villagers can collect fodder and fuelwood close by, from the bunds on their farms and from community-owned lands. They are spared the time and drudgery of fetching them from far way. Crop production has risen: for example, production of groundnuts rose from 675 kg/ha to 1375 kg/ha. More intercropping produced more pulses, a greater variety of food, and better nutrition.

Small-scale and marginal farmers have brought an extra 16.4 ha into irrigated cultivation. They lift water to their fields with pumps and scoops. They have also brought 36 ha of fallow land

back into cultivation after treating it with proper soil and water conservation measures. The farmers consumed most of the grain they produced, but grew vegetables and fruits to sell.

People have stopped migrating in search of work. They can find enough work in the village itself, for example in brick making, construction work, or farming land as tenants.

Discrimination against women has fallen. Women have formed self-help groups, have engaged in income-generating activities as groups, and now earn equal wages. Their workload has fallen because there is more vegetation to use as fodder or fuel, and they can fetch water from close by. Men help out more with domestic chores. Women have joined village decision-making groups such as mothers' committees and education committees, and have taken leadership roles such as ward member in the village *panchayat* council.

The number of livestock has risen, and the animals are in better health. For example the number of Jersey cows has gone up from 14 to 63, sheep and goats from 530 to 1560, and chickens from 201 to 2560. A trained paravet visits the farms to attend to the animals' health.

One hundred watershed associations from four districts have formed into a federation named Rayalaseema Watershed Associations Samakya. This federation aims to expand watershed approaches to more areas and to focus on issues of water and rainfed farming.

Lessons

Krushi's combination of a rights-based approach with watershed management has led to several useful insights.

- Marginalized people should have control and leadership in watershed institutions if they are to benefit from the project.
- Links to other organizations and networks such as farm worker unions, women's forums, cooperatives and watershed association federations provide solidarity, support and confidence for landless farm workers, small-scale and marginal farmers and women to realize their rights. These links give access to information, knowledge, resources and capacity building. They also help sustain the local organizations and avoid capture by elite groups.
- Addressing equity issues increases the involvement of marginalized people and their ownership of the project. This supports the democratic functioning of the institutions, transparency, accountability and sustainability of work done.
- Watershed development, used as a tool to address equity issues, has changed the lives of marginalized communities: it has increased their sense of identity, promoted their leadership, fostered women's leadership, and enabled these groups to appropriate 100% of the benefits from the project. The empowered community has been able to resolve many social issues. Such an approach can also be used in other natural resource development projects.
- Links to various government departments are essential to ensure that government resources converge for the holistic development of the people in the watershed.

Scaling up

All the RWDP partner NGOs, along with representatives from the local community, shared and reviewed their experiences in implementing the watershed project every 6 months. The heads of relevant government units were invited to these review meetings. As a result, the Chittoor District Water Management Association chose Krushi to implement 12 further watershed projects. The National Bank for Agriculture and Rural Development also selected Krushi to implement another four projects.

A major factor in this success was Krushi's emphasis on ensuring that marginalized communities played the leading roles in the watershed associations. This was possible because representation in the association was based on the number of households in each community. Some 80% of the households were marginalized, while the remaining 20% of dominant groups normally occupied the most important positions and controlled all the community institutions. Krushi managed to reverse this: in all 16 watersheds currently managed by Krushi, marginalized communities account for 76% of representation in the committees and 74% of the office bearers.

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The work of Krushi is supported by Bread for the World.

www.brot-fuer-die-welt.org

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

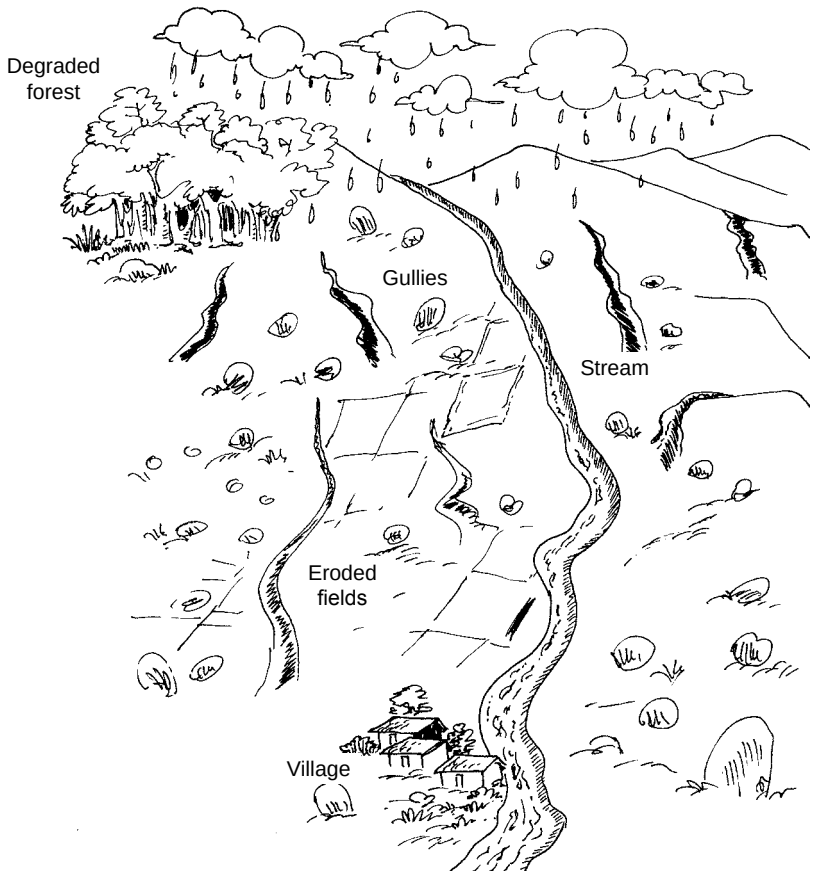

Figure 7 Before the project: gullying and erosion on the slopes

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.

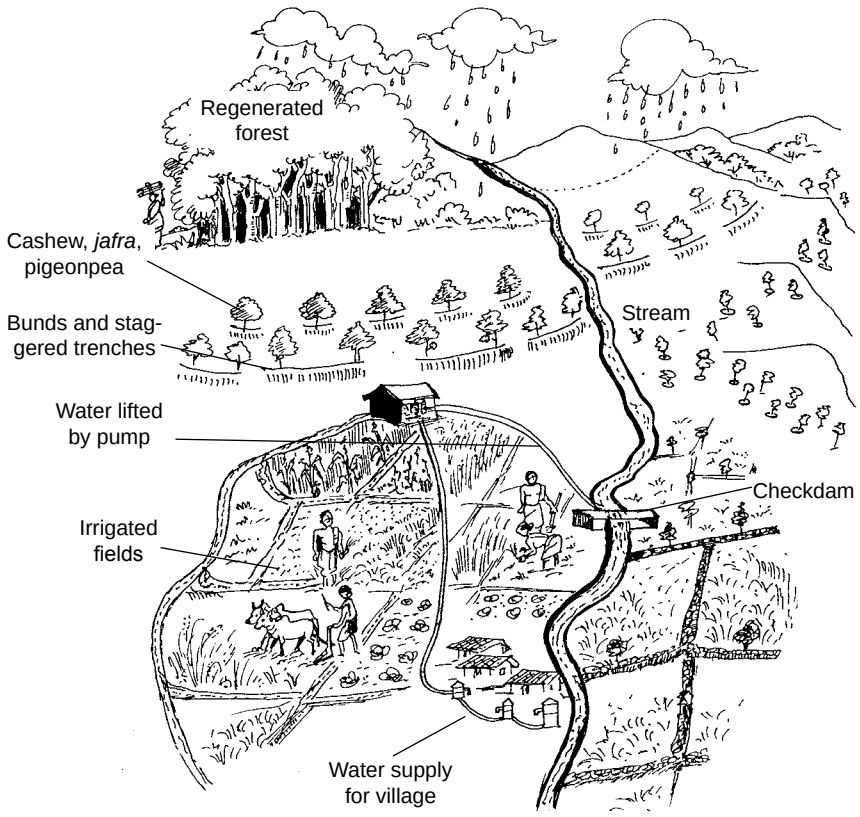

Figure 8 After the project: checkdams on the river, with a pump to lift water to the fields

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.

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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,

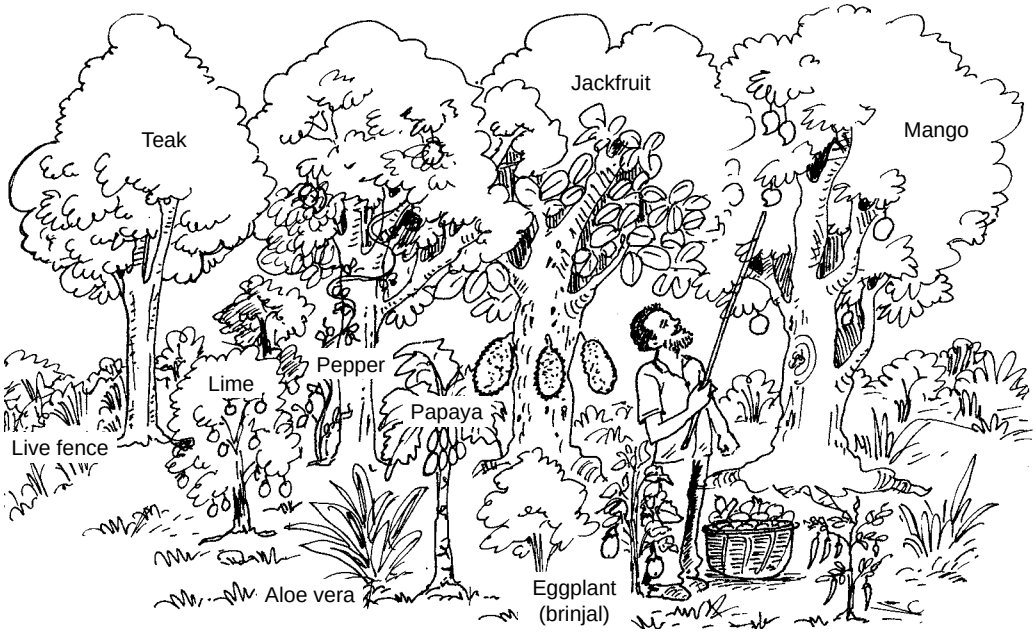

Figure 9 Aba's garden produces a wide range of fruit, vegetables, spices and wood

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.

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The work of Rural Communes is supported by Misereor.

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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.

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The work of Cecoedecon is supported by Misereor and ICCO.

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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.

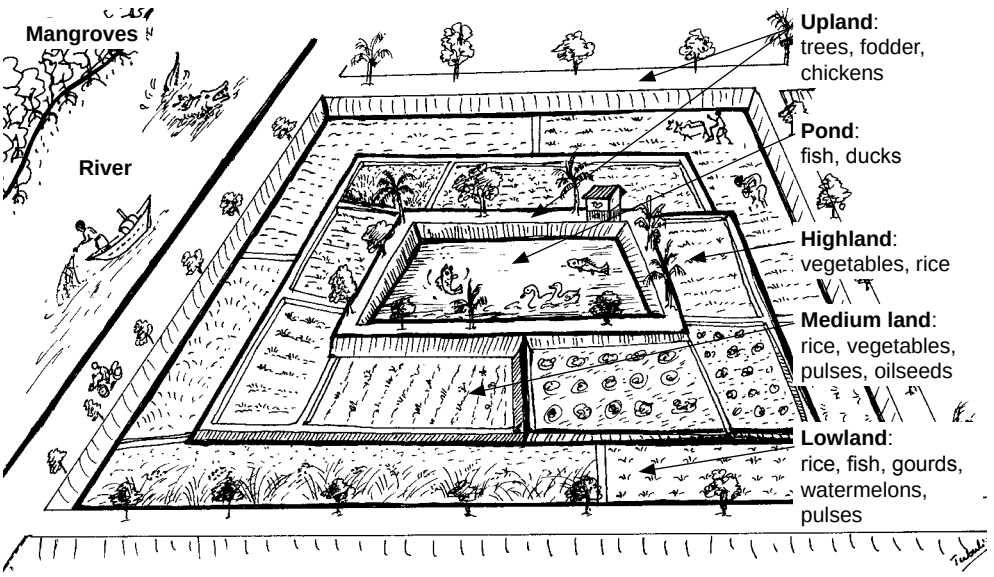
How much does this cost? For 0.2 ha, the cost is about Rs 15,000, of which about two-thirds is for labour, and the rest for inputs and training.

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.

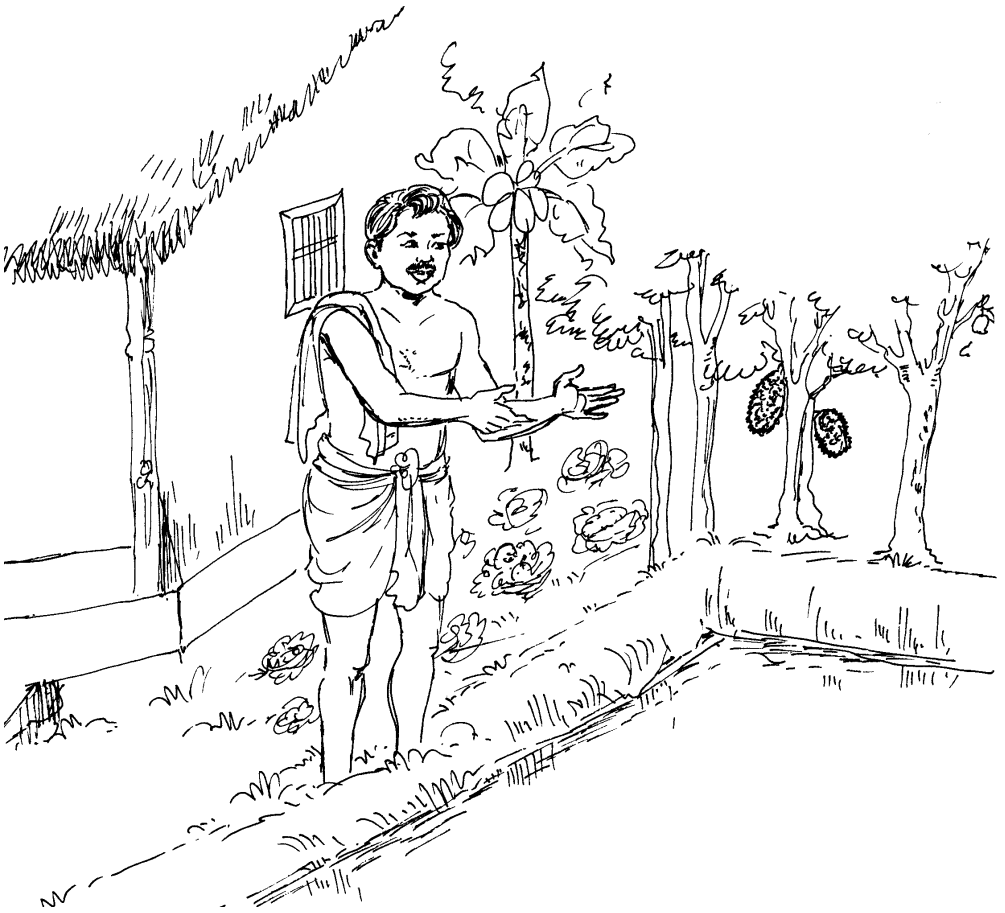


Figure 10 Lakshman Das can harvest a range of crops as well as fish from his landshaped farm

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.

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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

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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.

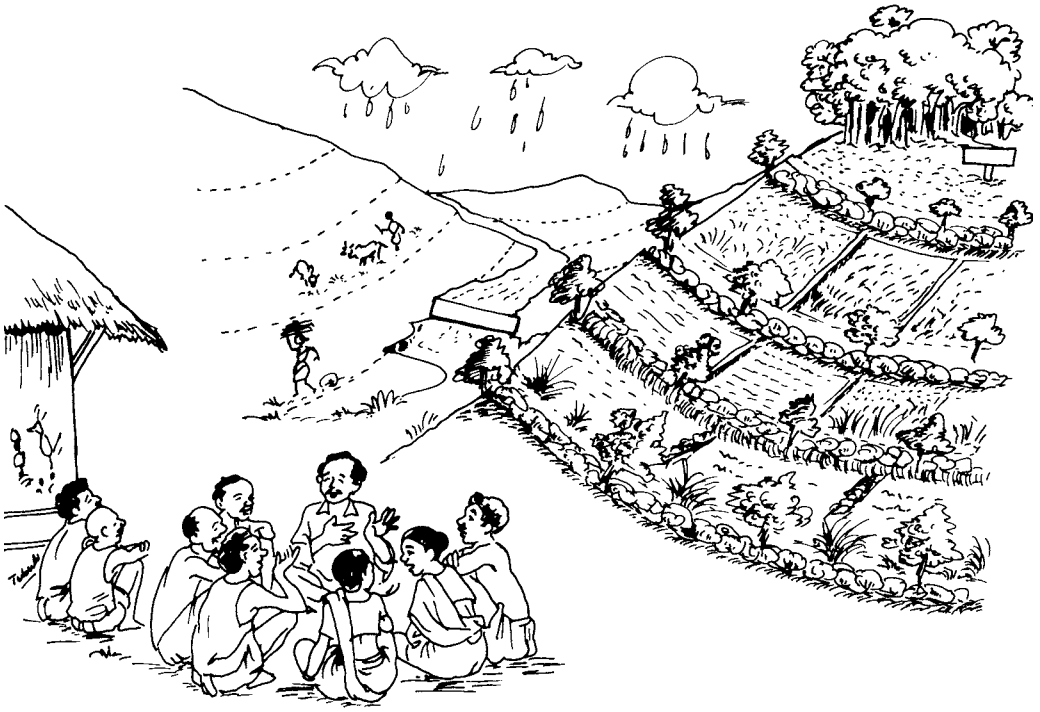

Figure 12 Village institutions are key to sustainable development

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.

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www.gtz.de

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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

"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

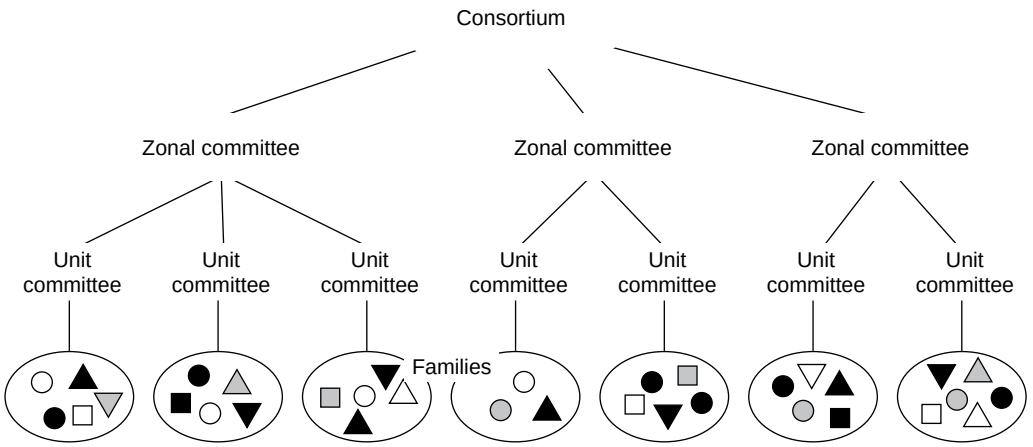

Figure 14 Structure of the Sahyadri Tea Farmers' Consortium

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.

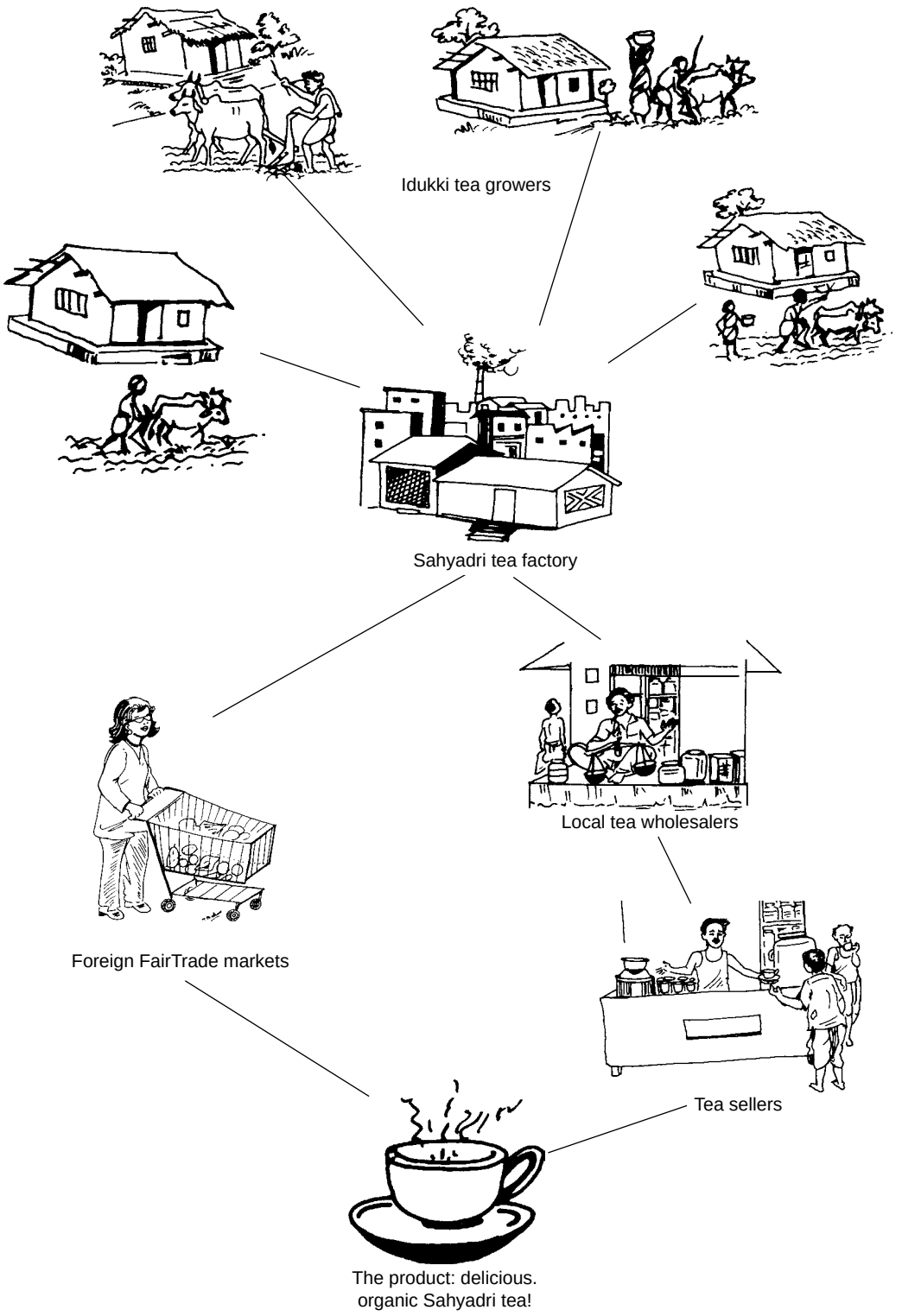

Figure 15 *The Sahyadri Tea Farmers' Consortium processes and markets tea produced by farmers in Idukki District*

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.

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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.

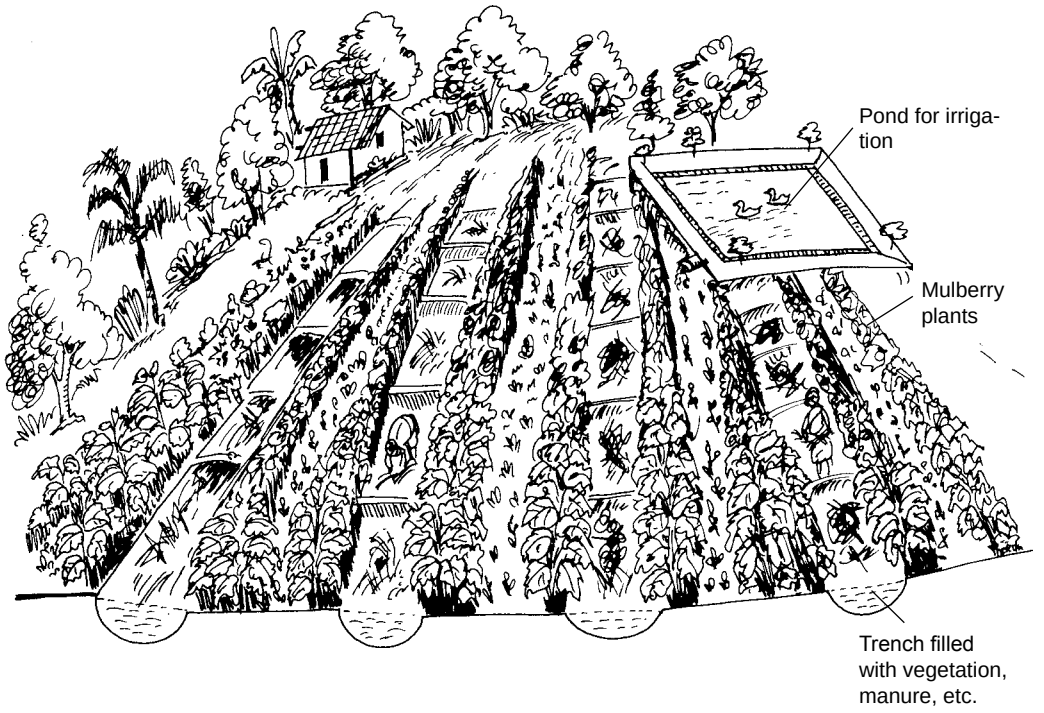

Figure 16 The biomass-filled trench system

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.

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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%.

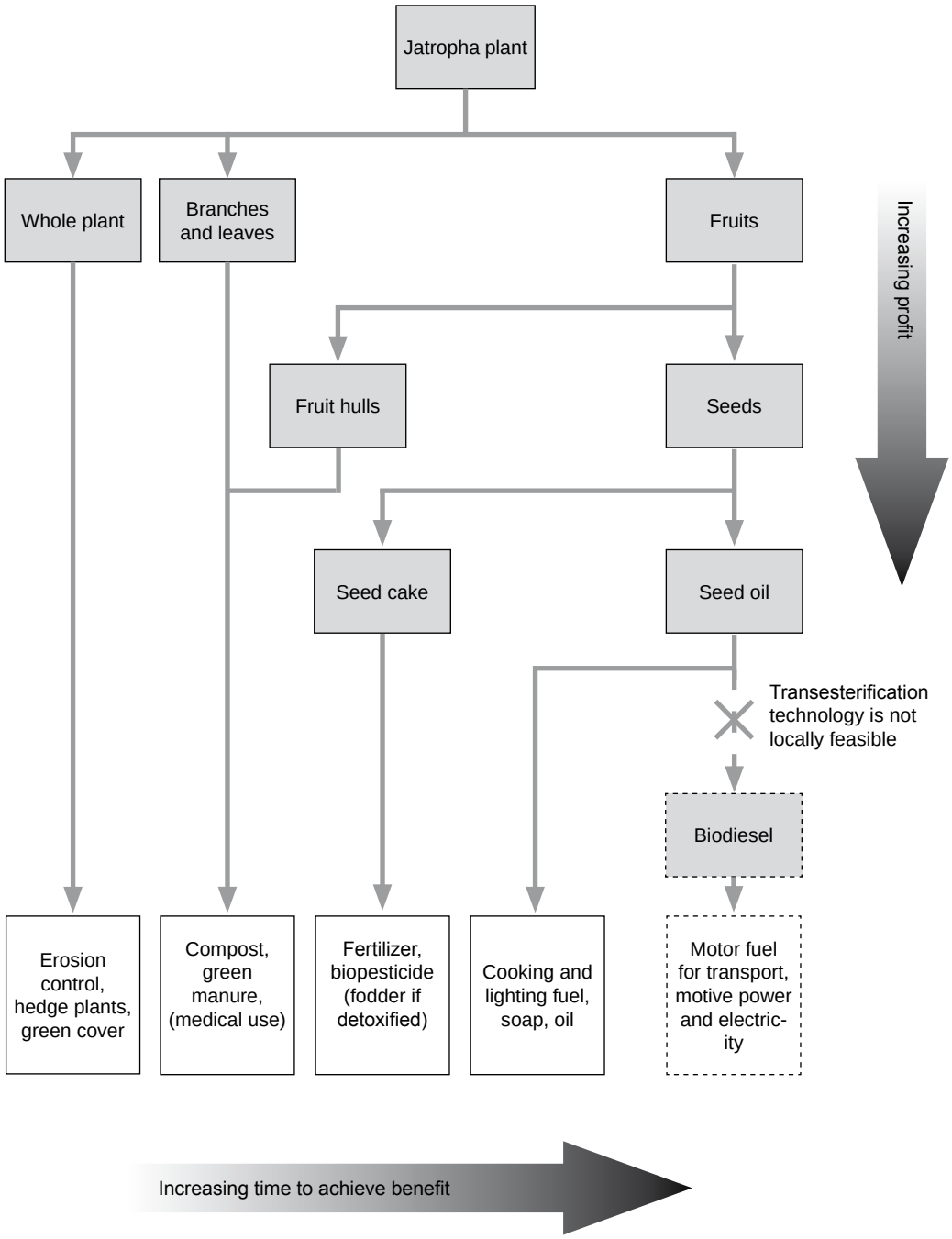

Figure 18 *Products of* Jatropha curcas *grown by small-scale farmers*

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 Rs	High estimate 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.

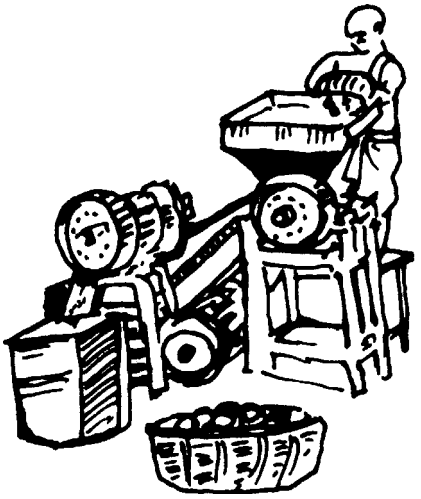

Figure 20 *Processing jatropha locally into oil and seedcake can boost farmers' profits*

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

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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

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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.

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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.

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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.

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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.

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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.

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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.

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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.

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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.

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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)

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