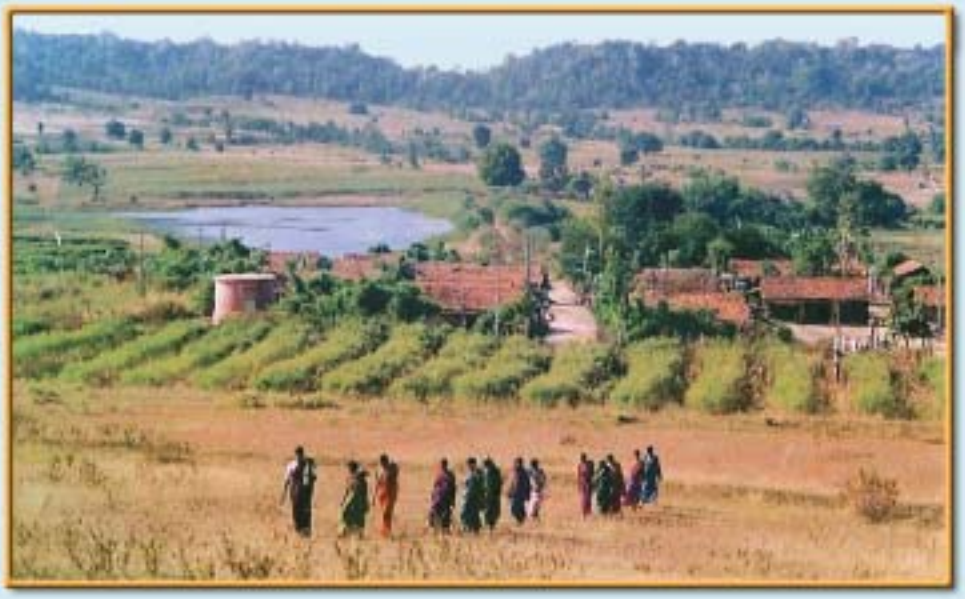
Global Theme on Agroecosystems

Report no. 11

The Making of New Powerguda

Community Empowerment and New Technologies Transform a Problem Village in Andhra Pradesh



International Crops Research Institute for the Semi-Arid Tropics

Comprehensive Assessment of Water Management in Agriculture

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Abstract

Public participation in government programs and empowerment of women has been the corner stone of state policy in Andhra Pradesh, India. The creation of half a million hamlet-level thrift groups headed by women, known popularly as self-help groups (SHGs), has empowered local communities and served as an important social instrument in the fight against poverty. Public investment in watershed management and new agricultural technologies are helping to transform the livelihoods of poor farmers, and in particular indigenous communities. This case study documents the transformation of Powerguda, a village of 32 families in Adilabad district, Andhra Pradesh. As a result of watershed management, new agricultural technologies and community empowerment, average household income increased by 77% over three years. The report identifies the key drivers of economic, social and institutional growth in the village, which offer possibilities for replication in other parts of the semi-arid tropics where 350 million people live in poverty. The growth drivers include community empowerment, local government support and financial linkages to leverage community savings into productive public investment.

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Contents

Introduction

Low variable rainfall, poor soils, high financial risk, and poor physical and social infrastructure characterize the semi-arid tropics. Some 350 million poor people in 48 developing countries live in these fragile ecosystems on a budget of one US dollar or less a day. While the number of absolute poor living in the irrigated areas of India declined by 20% (from 37 million to 30 million) between 1972 and 1993 the figure has remained fairly constant in the rainfed areas between 75 and 80 million (Fan and Hazell 1999). Improving the productivity of land through sustainable management and efficient use of natural resources requires crop intensification and diversification. These steps are essential to improve the livelihoods of the poor and pull them out of the poverty trap. Watershed development is one viable option to manage the available natural resources sustainably in the rainfed areas (Wani et al. 2003).

A watershed is a catchment area from which water drains into a common point, making it an attractive unit to manage water, soil and other natural resources (Shiferaw et al. 2002, Wani et al. 2002). A large number of watershed projects are being implemented in India under the aegis of the federal, state and local governments. In the mid-1990s, the annual budget for watershed projects exceeded US$500 million (Farrington et al. 1999). In the past, much of the work done and funds used focused on the technical aspects of watershed management, in particular the building of physical structures and land development. Insufficient attention was paid to the social and economic issues relating to the sustainability of investments. The focus on land development often gave projects a male orientation. Even though government guidelines encouraged greater participation of women in watershed groups, women were often not recognized as members of the watershed committee in their own right; they were viewed as being there to fill the quota required under the guidelines (Seeley et al. 2000).

The potential for watershed management is huge in India. Of the geographic area of 329 million ha, 175 million ha in the country are regarded as 'degraded'. Most of this area is rainfed and drought-prone. Powerguda village in Adilabad district, Andhra Pradesh is one such village. India has vast experience in implementing watershed projects. While in the early years the emphasis was on technical construction, the social experiments in Sukhomajri, Haryana and in Ralegan Siddhi, Maharashtra in the 1970s established a new paradigm of development which stressed people's participation in watershed planning and implementation.[1] Over the years, the technology used in treating watersheds was simplified; so most work could be done by local people with few skills and no sophisticated implements. These included percolation tanks, check-dams, contour trenches, field bunds and gully plugs. Federal government guidelines prepared in 1994 helped to standardize technologies and costs to ease implementation. Most watersheds are small (micro-watersheds) covering areas of about 500 ha.

The use of an integrated ridge-to-valley approach has meant that both common lands and privately owned farms are treated with soil and moisture conservation measures. The average watershed cost per village is about Rs 4,000 ha^{-1}, or Rs 400,000 per year spread over four to five years[2]. The watershed funds allocation per unit is among the highest of any public works undertaken. The returns from this investment are often immediate and visible in the form of higher crop yields due to collection of water runoff in the new watershed structures. Hence, watershed development, particularly on private lands, is very popular.

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1. The village of Sukhomajri came into prominence in 1974 when it formed a water users' association to ensure the long-term sustainability of its water catchment and charged a small fee for every hour of water drawn by its members. For details, see Patel-Weynand (1997).
2. At the time of writing, the exchange rate was Rs 45 per US dollar.

To overcome the social and gender equity concerns of the past, a new approach was adopted in 2000 in Adilabad district under which the responsibility for planning, constructing and maintaining watershed structures was entrusted to community-level women's groups with technical guidance provided by local government staff.[3] Known popularly as self-help groups (SHGs), these women's groups replaced private contractors in building percolation tanks, check-dams and other watershed structures under a project funded by the International Fund for Agriculture Development (IFAD). This participatory approach gave local people a sense of ownership in the creation of community assets and enabled women's groups, which served as project implementers, to retain the profit margin built into public works contracts.

The involvement of community-level institutions in project design and implementation is an important innovation in watershed development. In Andhra Pradesh, women's groups are a force to reckon with. Nearly half of India's 1 million SHGs are found in this state involving 5 million women who have mobilized about US$240 million in savings and loans.[4] The SHGs involved in implementing watershed works have been able to increase their group savings two to three times compared with SHGs without involvement in watershed management. In the case of Pittabangaram watershed village, the savings ratio is six times that of neighboring non-watershed village Bhattaguda (Table 1). Both villages are located in Indervelly mandal of Adilabad district.

Table 1. Savings (Rs) by two self-help groups in two villages with and without watersheds in Andhra Pradesh, India.

	Pittabangaram watershed village (Jangubai Group)			Bhattaguda non-watershed village (Maruti Group)		
Year	Personal savings	Savings from watershedworks	Total savings	Personal savings	Savings from watershed works	Total savings
2000	8,400	-	8,400	1,200[1]	-	1,200
2001	5,200	10,035	15,235	2,880	-	2,880
2002	4,800	14,537	19,337	2,880	-	2,880
2003[2]	1,200	1,721	2,921	480	-	480
Total	19,600	26,293	45,893	7,440	-	7,440

1. From October 2000.
2. For the period January–March 2003.
Source: D'Silva et al. (2004).

A combination of strong community institutions, participatory approaches, technical support and standardized watershed technologies has the potential to lift the landless poor and small farmers living in rainfed areas out of the poverty trap. As the case study will show, the new watershed approach – with some complementary investments – offers the possibility to double (even triple) incomes in some rural areas.

Powerguda village was selected for the case study because it suffered from many social, economic and natural resource problems. The village comprised indigenous people who lived in poverty. The productivity was low on agricultural lands. Therefore, people migrated to nearby towns in search of work. Bouts of alcoholism among some of the people compounded social problems in the village. At the same time, the community desired to overcome their problems by working with the local

3. Messrs. Navin Mittal and Basre Nagnath of the Integrated Tribal Development Agency (ITDA), Utnoor, Adilabad district, Andhra Pradesh, India deserve credit for this pioneering approach. For details, see Mittal (2002).
4. Source: www.andhrapradesh.com

government to try a new watershed approach. Thus, Powerguda was selected for assistance under the IFAD-funded Andhra Pradesh Participatory Tribal Development Project. The Integrated Tribal Development Agency (ITDA), Adilabad district requested the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, Andhra Pradesh to provide technical support for increasing agricultural productivity in the village to complement the public investments in watershed development so that Powerguda could serve as a demonstration model.

Powerguda: Its History and Culture

The village

Powerguda is located in Jainoor mandal of Adilabad district, about 30 km east of Utnoor town (Fig. 1).[5] The original Powerguda village, comprising Gond and Kolam tribes, had existed for over a century. However, since 1990, social conflicts within the village began to surface as a few heads of households attempted to dominate the village. One source of conflict was alcoholism, which led to frequent brawls. In 1995, thirty Gond families decided to establish a new hamlet a short distance away. They purchased 0.4 ha of agricultural land to build new houses and named the new habitation Kotha Powerguda, or Powerguda-K. (*Kotha* in Telugu, the local language, means new; *guda* in Gondi, the tribal language, means hamlet.) The old village is known as Old Powerguda or Powerguda-O.

It was a rough beginning for the pioneers of Powerguda-K. Their hamlet lacked access to drinking water, road and electricity. There were no regular jobs and income was meager. The residents worked

Figure 1. Location of Powerguda in Adilabad district, Andhra Pradesh state of India.

5. A mandal is a small administrative unit of a district. Adilabad has 52 mandals.

on other people's farms; roamed in the nearby forest to gather fruits, nuts and berries; and often migrated to nearby towns in search for work. They received no help from government agencies, or local non-governmental organizations (NGOs). "In fact, women used to hide inside the houses and peer through the door whenever an outsider came to the village," recalls B Nagnath, Assistant Project Officer, ITDA. The local residents were afraid of moneylenders and government officials.

The villagers struggled for five years after the establishment of the hamlet. Help arrived in January 2000 when ITDA, implementing an IFAD project, began to conduct participatory rural appraisal (PRA) exercises as a prelude to undertaking soil and moisture conservation works as part of watershed management.[6] Powerguda-K was one of the villages selected for watershed treatment.[7] The transformation of Powerguda-K began with this intervention, but the hamlet's success has much to do with the unique characteristics of the Gonds and their community-level institutions. This case study documents Powerguda's transformation and analyzes the important drivers that led to the remarkable changes.

The Gonds

The Gonds are numerically the most dominant tribe of India. According to the Anthropological Survey of India, the Gond population was 7.39 million throughout the country in 1981 and 1.69 million in Andhra Pradesh. By the end of 1998, the Gond population in Andhra Pradesh increased to 2.31 million, or by about 37%. "No aboriginal people of India [have] attained greater prominence on the political scene of past centuries than the large group of tribes commonly known by the generic term Gond" (von Fuerer-Haimendorf 1979).

The derivation of the name Gond is not known. The early history of the tribe does not figure in the chronicles until the 14th century when Muslim writers first mentioned campaigns and political developments in an area described as Gondwana. In Adilabad district, the first reference to the Gonds was made in 1803 when the important taluk Rajura was added to the dominion of the Nizam, the Muslim ruler of Hyderabad.[8]

The character of a Gond village as a social unit was shaped at a time when land was plentiful in relation to population. While there is no such a thing as a "typical" Gond village, or *nar*, a few common social characteristics still prevail. There are the secular headman (*patla* or *patel*) and the village council (*panch*), the religious priest (*devari*) and the spiritual guardians of the village *Aki Pen* and *Siwa Marke*. Traditionally, Gonds were free to move about from one Gond village to another only if they were accepted by the *patla*. This mobility has now been greatly limited by the scarcity of cultivable land.

The Gonds have a rich tradition of participation in village affairs – both religious and secular – which makes it easier to involve them in watershed management. Residents have an obligation to attend the sittings of the village *panch*, help the headman to implement the decisions of the council, and contribute in kind appropriate quantities of food required for offerings to the gods (von Fuerer-Haimendorf 1979).

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6. Participatory rural appraisal refers to "a growing family of approaches, behaviours, attitudes, and methods to enable people to analyze and share their realities to plan, act, monitor, and evaluate" (Chambers 1997).
7. Powerguda, in this case study, refers to Powerguda-K and not to Powerguda-O.
8. A taluk is a small unit of district in several Indian states. In Andhra Pradesh, mandal has replaced taluk.

Powerguda Baseline

Powerguda is spread over 423 ha, of which watershed covers 222 ha and forests 201 ha. The hamlet is located at 78°52' to 78°35' E and 19°22' to 19°25' N (see Appendix 1). The average annual rainfall is 1,100 mm; the maximum temperature is 47°C (usually in May) and the minimum temperature is 9°C (usually in December). The land slope is about 5.6%; therefore, a lot of water runs off the slope. The soil type in the upper part is Alfisols and in the lower reaches is Vertisols. The main crops grown are cotton, sorghum, mung bean and pigeonpea during the rainy season and sorghum and chickpea during the postrainy season.

In 2000, before watershed works were undertaken, 32 families (or a total of 148 people) lived in Powerguda, most of them in poverty. An informal baseline survey was conducted by the local government in June 2000 with the help of local people using PRA techniques.[9] However, this survey did not contain any socioeconomic information, such as income and employment levels of families. The focus of the PRA was to build the people's confidence and to involve them in the watershed management program in the district initiated by the local government with funds from IFAD.

Extensive field work was conducted toward the end of 2003 for the purpose of this case study. A detailed village-wide survey revealed that during the financial year 1999–2000 when watershed management commenced, family incomes in Powerguda averaged Rs 15,677, just above the poverty threshold of Rs 12,000. About 5.5% of the income was derived from non-timber products from the adjacent forest. The balance 94% came from agriculture – partly from people working on their own farms and the rest from employment outside the village. Of the 65 adults in the village, 57 adults migrated outside the village temporarily – three to six months in a year – because of insufficient work in Powerguda. At least four families owned no agricultural land and 92% of local residents were illiterate.

The baseline PRA survey and subsequent discussions with villagers helped to identify several factors responsible for low agricultural productivity, which translated to low crop yields and income for farmers:

- Poor germination of seeds and low plant population because seeds and fertilizer were mixed together during planting (Fig. 2);
- Absence of inter-cultivation because of mixed cropping systems;
- High levels of waterlogging, soil erosion and runoff;
- Texture of Vertisols which make field operations difficult when soils are wet or dry; and
- Inadequate nutrient management practices.

Figure 2. Farmers use a traditional method of planting in which seeds and fertilizer are mixed together.

9. Participatory rural appraisal refers to a family of approaches and methods to enable people to share, enhance and analyze their knowledge. The methods used include visuals and role reversals where outside experts listen and learn from local people who become the experts, analysts and mappers (Chambers 1997).

Watershed and Agricultural Interventions

Following the baseline survey, ICRISAT staff completed a topographic survey of the watershed after which discussions were held with ITDA staff and local residents to finalize a series of actions in watershed and agricultural development:

- Community-based soil and water conservation measures: These included 3,871 m of staggered contour trenches, a 2.4-km drain to divert runoff from a hillock to an irrigation tank, 290 gully control structures, 162 m of graded bunds, and 30 percolation tanks and masonry structures of 200–1,000 m^3 of water storage capacity.
- Farm-based soil and water conservation measures: Farmers and scientists joined hands to test new technologies in a 30-ha micro-watershed. These included broad-bed and furrow (BBF) (Fig. 3) landform for improved drainage; use of tropicultor to combine planting, fertilizing and covering seed in one operation; and the introduction of improved varieties of sorghum, soybean, pigeonpea and chickpea either as intercrop or sequential crop (Figs. 3 and 4).

Figure 3. Broad-bed and furrow landform for improved drainage.

Figure 4. Tropicultor used for planting, fertilizing and covering seeds in a single operation.

- Integrated nutrient management: Farmers followed a cereal-legume intercropping system. Cuttings of *Gliricidia sepium* (a legume shrub) were used to serve as a biological source of nitrogen and organic matter.
- Integrated pest management (IPM): IPM was integrated with soil, water, crop and nutrient management to optimize crop productivity. *Helicoverpa armigera*, a major pest of chickpea, pigeonpea and cotton was monitored by using pheromone traps and controlled by indigenous methods (eg, shaking off pod borers from pigeonpea stems). Bird perches were installed in the field to encourage birds to feed on *Helicoverpa* and *Spodoptera* larve.

All these technologies had positive impacts on agricultural productivity and consequently on family incomes in Powerguda. ICRISAT developed a new watershed management model (see box on p. 7).

Government Investment

ITDA, a government agency, has invested over Rs 3.1 million in various activities in Powerguda between 2000 and 2003, excluding staff time. This works out to Rs 96,875 per family or Rs 20,945 per capita. The investment was equivalent to 3.5 years of family income in 2003, a substantial amount by rural standards. The government invested in watershed management, agricultural development,

income-generating activities and building social networks (Table 2). There was some complementary investment from local residents in their farms and houses, and in education and health. Local banks also offered loans for income-generating activities. However, public investment dominated total investment in Powerguda.

ICRISAT approach to watershed management

The key components of ICRISAT's approach to watershed management in the semi-arid tropics are given below:

Farmers' participation in all activities starting with the identification of the problem, planning and implementing a series of actions; community participation is achieved by ensuring financial benefits to individual farmers.

Holistic approach by making watershed management an entry point to deal with livelihood issues.

Partnerships among various organizations and stakeholders to address problems and enhance benefits to local communities.

Cost-effective and environment-friendly management to ensure wider adoption of interventions.

Improved soil, water, crop, nutrient and pest management to raise the carrying capacity of rainfed systems and reduce the gap between the potential and achievable yields.

Upfront demonstration by developing a micro-watershed and conducting on-site research in partnership with farmers for wider dissemination of technologies.

Capacity building to enhance the capacity of farmers and local organizations.

Empowerment of community, institutions and individuals for successful implementation of watershed activities.

Involvement of youth, women and the landless through income-generating activities to improve livelihood opportunities.

Continuous monitoring and evaluation by researchers and local beneficiaries to assess overall performance of watershed management.

Table 2. Type of public and private investments in Powerguda, 2000–03.

Category	Activities	Sources of funds
Watershed management	Construct percolation tanks, contour trenches, check-dams, vegetative barriers	IFAD, ITDA
Agricultural development	Introduce high-yielding seeds, new technologies, integrated nutrient and pest management systems	ITDA, IFAD, ICRISAT
Income generation	Setting up oil mill, tree nursery, organic composts, fishery	ITDA, IFAD, local community
Social networks	Forming self-help groups (SHGs), *Vana Samarakshna Samithi* (VSS); establishing SHG federations	IFAD, World Bank
Complementary investment	Investing in new seeds, planting trees as hedgerow; building new houses; purchasing farm equipment	Local banks, local community

Watershed management

Most of the public investment, ie, Rs 2.3 million or 42% of the total amount was spent for watershed development activities, mainly construction of percolation dams and check-dams and establishment of a tree nursery of pongamia, tamarind, bamboo and other species. Besides percolation tanks and check-dams, diversion drains, contour bunds and other physical structures were built (Table 3).

Some trees were planted along the bunds of farms; others served as vegetative barriers on hill slopes. Investments in watershed management are very popular in India because of the potential for immediate payoff to participating farmers (see section Financial Analysis). On account of an appreciable reduction in runoff and soil erosion, ICRISAT has estimated that about 20% of the seasonal runoff was stored in the watershed structures, thereby increasing the availability of groundwater in four open wells in the village. Farmers used this water for irrigating chickpea and other crops. Vegetables such as cabbage, cauliflower and peas were grown for the first time in Powerguda (Fig. 5).

Table 3. Public investment in watershed works in Powerguda, 2000–03.

Type of work	Unit of measurement	Physical work done	Amount spent (Rs)
Vegetative barriers	m^3	6,476	300,000
Diversion drain	km	2.4	37,000
Stone checks	number	271	442,100
Graded bunds	ha	162.5	2,600
Percolation tanks/check-dams	number	30	952,700
Tree nursery	number of saplings	40,000	544,200
Total			2,278,600

Figure 5. Cauliflower grown for the first time in Powerguda with irrigation.

Agricultural development

The introduction of improved land management practices such as BBF and bullock-drawn tropicultor, along with high-yielding cultivars increased agricultural productivity. Chickpea (ICCC 37) grown sequentially after mung bean or rainfed rice increased production by 20–24%. Soybean yields increased two- to three-fold over existing, traditional practices (Table 4). Pigeonpea, when grown with soybean, increased yields by 350% over two years in deep black soils and by 50% in medium deep black soils. When compared with traditional technology the application of one irrigation to chickpea at planting yielded additional 144 kg seed ha^{-1} while improved technology with three irrigations yielded additional 396 kg seed ha^{-1}.

Table 4. Seed yield (kg ha^{-1}) of some crops in Powerguda.

	Traditional technology		Improved technology	
Cropping system	2001	2002	2001	2002
Soybean	825	550	2100	1570
Soybean/pigeonpea intercrop				
Soybean	550	335	1270	700
Pigeonpea (ICPL 87119)	470	420	845	780
Soybean + chickpea sequential crop				
Chickpea (ICCC 37)	670	727[1]	1020	871[1]
Chickpea (ICCC 37)	-	1123[2]	-	-
Chickpea (ICCV 2)	-	-	790	-

1. One irrigation for crop establishment.
2. Three irrigations during cropping season.

Powerguda farmers, particularly many women, learned new techniques in planting, land preparation and intercropping. Many of them grew vegetables for the first time. Over three years, there was a remarkable change in cropping patterns. The area grown to cotton decreased by 61% from 20.4 ha in 1999 to 12.8 ha in 2002; the share of cotton declined from 50% of total agricultural income to 25% (Table 5). On the contrary the importance of soybean increased substantially during the same period from 1.2 ha to 23.6 ha and from 3% of agricultural income to 49%. Sorghum was replaced as a staple crop by paddy as farm incomes increased. The relative importance of pulses declined slightly.

Income generation

Additional investments were made by ITDA in an oil extracting machine (worth Rs 375,000) to support income-generating activities in the community. Seeds of pongamia, neem and other trees are crushed in this machine to extract oil that is sold in the market. The oil mill has become an important source of income to Powerguda. For example, farmers earn Rs 2 kg^{-1} pongamia seed crushed in the village. The plant has a capacity to crush 50 kg seed h^{-1}, but this level has not been reached because of limited availability of oilseeds in the area and frequent breakdown of the machine. However, with about 8,500 pongamia trees planted in 2002 and 2003 and an additional 10,000 saplings planned for 2004, the oil mill would be active for several years to come (Fig. 6).

Since October 2003, Powerguda has discovered a new income-generating activity in tree nurseries. The community decided to invest in a pongamia nursery Rs 30,000 received from the World Bank as part of environmental service payment. The nursery will have a capacity for 20,000 saplings of which

Table 5. Changes in cropping patterns and in agricultural incomes, 1999–2002.

Crop	Year	Area (ha)	Production (t)	Yield (kg ha^{-1})	Change (%) in yield	Income[1] (Rs)	Share of total income (%)
Cotton	1999	20.4	10.2	497		152,250	50.16
	2002	12.8	9.3	722	45.23	143,244	25.22
Sorghum	1999	22.8	17.8	780		68,800	22.67
	2002	8.8	9.5	1072	37.50	47,610	8.38
Rice	1999	1.2	1.3	1082		5,200	1.71
	2002	7.4	10.4	1405	29.79	46,276	8.15
Pigeonpea	1999	9.4	2.8	297		28,000	9.23
	2002	4.4	2.0	442	48.74	28,980	5.10
Black gram	1999	7.2	3.2	442		28,300	9.32
	2002	4.2	1.8	427	–3.39	20,608	3.63
Chickpea	1999	0.6	0.5	750		4,500	1.48
	2002	0.4	0.3	750	0	2,760	0.48
Mung bean	1999	2.8	0.8	267		7,400	2.44
	2002	0	0	0	0	0	0
Soybean	1999	1.2	0.9	750		9,000	2.96
	2002	23.6	25.2	1067	42.33	278,208	48.99
Total	1999	65.6				303,450	100
	2002	61.6				567,686	100

1. The incomes have been calculated in constant rupees using 1999–2000 as the base year. Incomes for 2002 were adjusted for inflation at the rate of 4% per year.

Figure 6. Women of Powerguda prepare polyurethane bags to establish pongamia saplings. (Note: The pongamia nursery has become a new income-generating activity in the village.)

10,000 are to be planted on community land and the rest sold to nearby villages and to the forest department. The proceeds from the sale will be plowed back into the nursery investment. With the formation of a forest protection committee [*Vana Samarakshana Samithi* (VSS)] recently, public investment in the local forest is expected to increase and the local nursery will remain a viable business.

Social investment

A key investment made by the government has been in the area of social capital development. The investment was made in terms of time, money and local capacity. ITDA staff helped to set up SHGs under an IFAD project; they provided training in organizing groups, holding meetings and keeping accounts. Under one World Bank project, the SHGs were federated at the village, mandal and district levels. Under another, the Community Forestry Management project, a VSS has been established. The linkage with financial institutions, arranged by ITDA, enables Powerguda's SHGs to leverage their savings to obtain credit on favorable terms for agriculture and other purposes.

Government investment in building social networks in Powerguda appears to have paid off. Powerguda is now regarded as a 'model village' and is included as an important destination for other villages, NGOs and government officials to study successful working of SHGs. A recent documentary film on federating women SHGs highlights Powerguda as a success story.[10] The village has received some important dignitaries. The National Institute for Rural Development (NIRD), Hyderabad included the village for a field trip in June 2002. More recently, representatives from the World Bank and the United States Agency for International Development visited the village to see the impact of women's empowerment.

Financial Analysis

Investment and savings

The government invested Rs 3.1 million in Powerguda between 1999 and 2002. This investment translated into jobs and income for local people; 45% of the public expenditure on the village comprised wages. A high wage component in public works is part of government policy. Since all watershed works were done by local residents, they were able to keep in their group accounts the built-in profit margin that normally went to government contractors. On average, the SHGs that got government contracts were able to save Rs 582,600 or 18% of the total expenditure. The total village savings over three years amounted to Rs 582,600 (Table 6). Household annual savings averaged Rs 6,068 or about 22% of income in 2002–03. This is an impressive achievement considering that the idea of thrift is a new concept to most tribals. Four years ago, no one from Powerguda had stepped inside a bank. Now, the villagers are able to leverage their savings to secure favorable interest rates on bank loans!

Table 6. Total savings in Powerguda through self-help groups (SHGs), 2000–03.

Name of SHG	2000–01	2002–02	2002–03	Total
Durgabai	228,000	41,400	40,000	309,400
Jangubai	75,012	10,000	15,000	100,012
Laxmi	-	57,500	20,000	77,500
Awwal	43,188	27,000	25,500	95,688
Total	346,200	135,900	100,500	582,600

10. Source: "We have a dream", documentary directed and produced by Minnie Vaid (2003), Little Doc Production, Mumbai, India.

Household income

Average family income was Rs 27,821 in 2002–03 compared with Rs 15,677 in 1999–2000 before the government invested in watershed development (Table 7). This represented an increase of 77% over three years, or about 25% per year, an impressive gain. About 95% of the total income was from agriculture and 5% from forests. The increase in household income was from productivity gains in agriculture (ie, higher yields due to use of improved technology) rather than increase in area. Though yield increases varied from crop to crop and depended on a number of factors, these gains averaged 14.3% per acre per year.

Table 7. Changes in household income in Powerguda, 1999–2003.

	Income[1] (Rs)			
Particulars	1999–2000		2002–03	
Agriculture income	14,793	(94.36)	25,874	(93)
Forest income	884	(5.64)	1,947	(7)
Total income	15,677	(100)	27,821	(100)
Change in total income (1999–2003)			12,144	(77.46)

1. Percentage is given in parentheses.

Migration

For almost five years after the formation of the hamlet in 1995, Powerguda faced hard times. To make up for lack of regular jobs and income, the residents often migrated to nearby towns in search for work. Prior to commencement of watershed works in 1999, 57 of the 65 adults in the village migrated for three to six months during summer. Village leaders recently noted with pride that not a single person went outside to work. Government investments in watershed management and agricultural development had put an end to seasonal out-migration from the village. Powerguda's experience is repeated in neighboring villages (eg, Kommuguda) where similar public interventions have occurred. Seasonal migration from villages has ended totally, or is negligible. It appears that watershed and agricultural development, complemented by other investments, have provided sufficient employment and income opportunities for the rural people to escape poverty and to stay in the village.

Returns on investment

Public investment in watershed management is popular among politicians, bureaucrats and local people because of possibilities of immediate payoff. Investments in percolation tanks can often be amortized within four years, as indicated by the experience of Pittabangaram village (Table 8). In Powerguda too, farmers are able to plant a second crop using water from the nearby well. As a result of watershed management, water table in the four nearby wells has increased by 2 m, according to local residents.

The local government believes that every rupee of public investment has a multiplier effect of 5.[11] In other words, every rupee invested in watershed management and agriculture development can attract an additional four rupees from other sources (eg, personal savings of SHGs and agriculture loans from local banks). Powerguda has not reached this threshold yet. However, because of their top credit

11. Source: Navin Mittal, former Project Officer, ITDA, Utnoor, Adilabad district (personal communication).

rating (Category A), the hamlet's four SHGs enjoy an enviable 4:1 debt to savings ratio from local banks. Having already crossed the poverty line, and enjoying financial leverage with financial institutions, Powerguda is on the road to financial sustainability. One indicator of financial success is the decision of Powergudans to build new brick houses on their own (Figs. 7 and 8).

Table 8. Public investments in watershed works in Pittabangaram Village, Adilabad district 2001–02.

Works undertaken	Expenditure (Rs)	Estimated benefits (Rs)	Pay-back period (years)
Percolation tanks (9)	240,000	60,000	4
Rock-filled dams (109)	200,000	3,270 to 5,450 from crops + variable income from pongamia trees	30
Graded bunds (2,000 m)	16,000	Difficult to estimate	
Diversion drains (11,000 m)	20,000	Difficult to estimate	
Total	476,000		

Source: D'Silva et al. (2004).

Figure 7. Thatched houses in Powerguda in 2001.

Figure 8. New brick houses in Powerguda in 2003.
(Note: The houses were built by local residents by combining their own funds with government grants indicating a level of self-confidence and financial maturity.)

Social Analysis

The new Powerguda rose from the social conflicts of the old Powerguda. Attempts at social domination by a few individuals and frequent brawls arising out of alcoholism were the frequent sources of conflict in the old village. However, since 1999, Powerguda has charted a new path of development using watershed management as the growth engine, women's SHGs as institutional anchor, and a total ban on the consumption of alcohol in the village as a social platform. These steps have enabled Powerguda to march ahead of the old village and other neighboring hamlets. Powergudans, specially the women leaders, are very proud that they have been able to outperform other villages in social, financial, institutional and environmental development.

Powergudans consider the regular visits to their village by other villagers, state and national visitors, and international dignitaries as an important sign of success. In 2003, Powerguda received two important awards. The first award was given to Subadrabai, leader of the Durgabai SHG, by the Andhra Pradesh Chief Minister in recognition of her leadership. She received a silver plaque and a check for Rs 10,000. The second was an international certificate for environmental leadership given by 500 PPM, a German environmental group, on the occasion of Powerguda selling carbon credits equivalent to 147 t of carbon dioxide to the World Bank. The certificate was signed by the Director of the World Bank's Agriculture and Rural Development Department (see section Environmental Analysis).

What distinguishes Powerguda from other hamlets is the strong leadership provided by women through SHGs. Three of the four SHGs are run by women who dominate most of the development activities in the village. In Powerguda, it is the women who pay men for the work done. Men are paid the same wage as women, except for a few specialized tasks in which men excel. Men have accepted the role reversal. They admit women are better managers of money, more transparent in financial dealings, and more successful in getting new work for the village. So long as there is sufficient work, and they are paid a decent wage, men are unlikely to complain. So far, the village is basking in the sun and proud of its many successes. It remains to be seen if men, the traditional wielders of power, would feel left out or be resentful, if there is a financial downturn in the village economy.

Over the past four years, Powerguda has done well in building social capital, a term that refers to collective functioning based upon trust, norms and networks within a society.[12] Social capital is an important input into social processes that can determine the sustainability or otherwise of development outcomes at local levels. Trust, social cohesion, a sound local leadership and democratic functioning of local institutions are among the features of social capital (D'Silva and Pai 2003). The SHGs in Adilabad have relied on voluntary participation, trust and long-term self-interest for achieving success. A study of social capital and collective action in forest protection and watershed development has ranked Powerguda at the top of three villages in Adilabad district. Powerguda scored 5.5 on a scale of 6 compared with 5.2 for Behroonguda and 2.2 for Kishtapur village (Table 9). It scored high marks for strong local leadership, active role of women, accountability and transparency in the functioning of SHGs, and trust within community. These factors have contributed to the social, financial and institutional empowerment of Powerguda and would help in achieving long-term sustainability.

12. Social capital refers to a "set of resources that inhere in family relations and in community social organizations" and to features such as "trust, norms, and networks that can improve the efficiency of society by facilitating coordinated actions" (Putnam 1993).

Table 9. Measuring social capital in three villages in Adilabad district, Andhra Pradesh, India.

Social capital indicators[1]	Behroonguda	Powerguda	Kishtapur
Social cohesion[2]	5.5	5.5	1.5
Education/literacy achievement[3]	2.5	4.0	5.0
Local leadership[4]	5.5	6.0	2.0
Active role of women[5]	5.0	6.0	3.0
Supportive role of officials[6]	5.0	6.0	3.5
Accountability and transparency of local institutions[7]	6.0	6.0	1.0
Collective action in conserving resources[8]	6.0	5.0	2.0
Trust within community[9]	5.5	6.0	1.5
Keeping long-term interest of village[10]	6.0	5.5	2.0
Democratic functioning of local institutions[11]	5.0	5.5	1.0
Total	52.0	55.5	22.5
Average	5.2	5.5	2.2

1. The indicators are ranked on a scale of 1 (lowest) to 6 (highest).
2. Presence or absence of hierarchy; if present, how rigid or flexible.
3. The more literate a society, the greater the social capital built.
4. Strong or weak leadership and rotation of leaders.
5. Women in leadership positions of *Vana Samarakshana Samithi* (VSS), self-help groups (SHGs) or other institutions.
6. Facilitative role in establishing and supporting SHGs and VSS.
7. In managing funds, accounting for expenditures and making decisions.
8. Commitment of community to protect its public resource.
9. Indicated by absence of conflict, or managing conflicts.
10. Willingness to sacrifice personal gain for greater community benefit.
11. In selecting leaders, consensus in decision-making.

Source: D'Silva and Pai (2003).

Institutional Analysis

Public participation in government programs and empowerment of women is the cornerstone of state policy in Andhra Pradesh. Hamlet-level thrift groups, known popularly as SHGs, serve as an important social instrument in the fight against poverty. While men control the resource-based groups, women tend to dominate the thrift groups. The four types of institutions existing in Powerguda are described below.

1. Self-help thrift groups:

Women SHGs are modeled on the lines of Grameen Bank's credit groups in Bangladesh. Andhra Pradesh has half of India's 1 million SHGs with a membership of 5 million women. In Adilabad, around 19,500 SHGs with a membership of about 200,000 women have mobilized over Rs 200 million (US$4.25 million). Powerguda has four SHGs, three of them run by women. In the past, the main function of SHGs was to garner family savings, generally at the rate of one rupee a day, or a day's wage per month. Most SHGs were formed under various government programs such as watershed management and joint forest management. While all groups continue to mobilize savings, a few have attempted to deliver services previously rendered by the government (eg, forest nurseries, building check-dams and generating electricity). Women are considered better managers of money as women SHGs are more transparent and accountable than informal groups dominated by men (D'Silva et al. 2004).

2. *Vana Samarakshana Samithi* (VSS):

Of the nearly 1,700 villages in Adilabad district, 1,008 formed forest protection committees (or VSSs) as part of joint forest management. Nearly half of the forest area is covered by the VSSs, but

the coverage is uneven. While some VSSs have done a fairly good job in protecting forests, many others have not done so for various reasons ranging from a lack of local leadership to inadequate support from local forest officials (D'Silva 2003). Men dominate the VSS. Women head barely 5% of the VSS, though by law at least half of the executive committee should comprise women. Powerguda did not have a VSS until January 2004, though local residents protected their neighborhood forest.

3. Watershed committee:

All farmers in the watershed are generally members of the watershed association, registered as a sovereign body to decide activities in the watershed. The executive body of the association comprises the watershed committee headed by a chair person elected unanimously by farmers. A secretary maintains minutes of discussions held.

4. Panchayat:

Unlike SHGs and other informal groups, the three-tier form of panchayat (local government), called the Panchayati Raj, is democratically elected and has a legal basis under India's Constitution. Under the 73rd Constitutional Amendment, most rural development activities have been brought under the purview of local government. But panchayats lack fiscal autonomy and a capacity to deliver public services. To overcome these limitations, user groups were formed, often with external funds. The relationship between these groups and panchayats is still not clear and, at best, can be described as evolving. The district administration is now attempting at "convergence" of several services involving various institutions at the hamlet level.

Powerguda is unique in that the women SHGs are the dominant institutions in the village. These SHGs have gone farther than thrift. They now deliver some of the services which previously were the responsibility of government agencies. For example, the village runs a pongamia nursery with a capacity for 20,000 saplings. Also the SHGs have replaced private contractors in implementing some of the public works. For example, all the watershed structures in the village have been built by local residents under the management of SHGs. These activities have helped to build the confidence of the SHG leadership while also increasing the coffers of the group. In the watershed contracts, there is an opportunity to save between 18% and 25% of the cost of the structures.

In recent years, the government has been supporting efforts to federate the SHGs at the village, mandal, and district levels to increase their bargaining power as also financial and political leverage. These federations can serve at least four useful functions (D'Silva et al. 2004). First, they provide a forum for women to discuss common problems. SHG members consider the unity and solidarity among women to be one of the most important benefits of SHG membership. At the mandal-level federation meetings, women of different castes and class come together. This solidarity enables them to share their problems and seek help. Second, by standing guarantees for SHGs, the federations can help the SHGs to borrow money from financial institutions at lower interest rates. These loans are particularly useful for value-added services such as pongamia oil and soybean processing. Third, the federations can take over responsibility for bookkeeping and training functions of SHGs. According to bankers, bookkeeping is a serious problem that often thwarts the ability of SHGs to secure larger quantum of funds from financial institutions. Fourth, the federations can invest in cluster-level economic activities (eg, procurement of lac resin in Pittabangaram) or other value-added services (such as marketing pongamia oil in Powerguda).

From savings mobilization to service delivery over a period of seven to eight years is a big change in Adilabad. In Powerguda, this time period has been shortened to four years. Women have learned not only to save money but also to leverage their savings with financial institutions. Consequently, the SHGs have improved their access to credit and quantum of loans, and are able to get better terms on loans.

The economic success of SHG is now spilling into social areas. Government officials and NGOs report increase in household expenditures on education of children and health of families. According to one program evaluation, 23% of the loans from SHGs were used in human capital formation (Galab and Chandrasekhara Rao 2003). Literacy among SHG members is increasing gradually as illiterate women first learn to sign their names and then begin to attend literacy classes. In Powerguda, SHG leaders can now sign their names (Fig. 9). They hired a local educator to teach them to sign their names by paying him 1.5 kg of rice per person.

Figure 9. Ms Subadrabai (President, left) and Ms Mankubai (Secretary, right) of the Durgabai SHG sign papers confirming the sale of an equivalent of 147 tons of carbon dioxide to the World Bank.

Local government agencies, in particular, the ITDA, played an important role in enabling and supporting the growth of SHGs in Powerguda and other villages. ITDA helped Powerguda's women to form SHGs and provided training in holding meetings, managing funds, analyzing incomes and expenditures, and resolving conflicts. The agency also channeled development funds through the groups (instead of contractors) for building watershed structures. This helped to build self-confidence among women and enabled them to escape the poverty trap. Not surprisingly, the people of Powerguda gave higher marks to ITDA officials than to the community for the success of their SHGs.

Despite the attempt of the district administration at convergence in human, institutional and financial resources, there is still a risk of conflict between SHGs and Panchayati Raj Institutions (PRIs) as they both compete for the same development space. The three-tier SHG Institutions are similar in hierarchical structure to PRIs and often perform overlapping functions. Hence, suggestions have been made for convergence in programs and development initiatives between PRIs and SHGs at the planning and implementation levels (Bandhyopadhyay et al. 2002). SHGs could be co-opted into the various standing committees of PRIs to serve as pressure groups, project implementers and watchdogs of public interest.

Environmental Analysis

The building of watershed structures has helped to recharge aquifers and raise the water table in Powerguda. Though no formal study has been done to estimate the increase in groundwater availability as a result of watershed development, local officials and residents estimate that the water level in the four village wells has increased by 2 m. This increase has enabled many farmers to grow second crops after the monsoon. Similarly, the digging of continuous contour trenches and the planting of over 40,000 trees to serve as vegetative barriers have helped to minimize soil erosion along slopes. ICRISAT has estimated that 20% of the rainwater runoff was stored in check-dams, gully structures, minor irrigation tanks and diversion drains built as part of the soil and moisture conservation measures.

Changes in cropping patterns have accompanied watershed management. Cotton is slowly being replaced by soybean. Cotton requires high inputs substantial quantities of fertilizer and chemical pesticides. It takes up to seven months to grow and drains nutrients from the soil. In contrast, soybean takes three months to grow, adds nutrients to the soil, and requires lower amounts of inputs. The intercropping of soybean with pigeonpea or sequential cropping with chickpea has helped to increase agricultural productivity and thus, incomes to farmers. Lately, a few farmers have experimented with the use of pongamia oilcake instead of chemical fertilizer. One farmer, Mankubai, Secretary of Powerguda's Durgabai SHG, reported substantial increase in her cotton and sorghum crops but this increase has not been quantified.

Mankubai's intuition has been borne out by chemical analysis of pongamia oilcake. The pongamia oilcake is rich in nitrogen and micronutrients, according to ICRISAT scientists conducting the analysis. The nitrogen content varied between 3.95% in the oilcake produced in Powerguda's own oil mill and 4.6% in a private mill in nearby Jainoor town. The phosphorus content ranged between 0.52% and 0.54% and potassium content was 0.42 to 0.56% (Table 10). As a result, Mankubai and other farmers are slowly switching over to pongamia-based fertilizer and becoming organic farmers by default. More on-farm tests of pongamia cake will be tried on various crops in Adilabad. Local agricultural officers believe that pongamia cake, which is rich in nitrogen, could be combined with chicken manure, which is rich in phosphorus and potassium. Other fertilizer combinations will also be attempted in field trials by ICRISAT in 2004.

Table 10. Chemical composition of pongamia oilcake and other fertilizers analyzed at ICRISAT, Patancheru, India.

Type of fertilizer[1]	Nitrogen	Phosphorus	Potassium
Pongamia (P)	3.95	0.52	0.42
Pongamia (J)	4.60	0.54	0.56
Jatropha curcas	4.44	2.09	1.68
Neem	5.00	1.00	1.50
Castor	4.37	1.85	1.39
Cow manure	0.97	0.69	1.66
Chicken manure	3.04	6.27	2.08
Diammonium phosphate (DAP)	18.00	20.00	0
Urea	46.00	0	0

1. Source of pongamia oilcake: P = Powerguda; J = Jainoor town.

In October 2003, Powerguda became an environmental pioneer when it sold the equivalent of 147 t of carbon dioxide in verified emission reduction to the World Bank. The emission reduction was calculated on the basis of 51 t of pongamia oil substituting for petroleum diesel over 10 years (Table 11). Therefore, Powerguda had planted 4,500 pongamia trees in 2002. The World Bank paid US$645 to Powerguda to neutralize the emissions from air travel and local transport by international participants attending its international conference in Washington, USA held on 19–21 October 2003. This was the first time that the multilateral agency made a direct payment to an Indian village for exporting environmental services.

People's knowledge of the natural environment has increased substantially by participating in watershed activities, protecting local forest and planting pongamia trees (Table 12). Prevention of soil erosion, conservation of moisture, replenishment of water in wells, mitigation of climate change and preservation of medicinal plants are some of the environmental services known to the people of

Table 11. Carbon calculations for Powerguda village, 2003–2012[1].

Year	Oil yield (kg)	Trees	Total oil yield (kg)	C (t)	CO_2 eq (t)	Value (US$)	Discount value (at 3%)	NPV
2003		3,600	410	0.3198	1.1737	6.7158	1.00	6.7158
2004			494	0.38532	1.414124	8.09172	0.97	7.848968
2005			590	0.4602	1.688934	9.6642	0.94	9.084348
2006	0.5		1,125	0.8775	3.220425	18.4275	0.91	16.76903
2007	1		3,600	2.808	10.30536	58.968	0.88	50.71248
2008	1.5		5,400	4.212	15.45804	88.452	0.85	51.89184
2009	2		7,200	5.616	20.61072	117.936	0.82	96.70752
2010	2.5		9,000	7.202	26.43134	151.242	0.79	119.4812
2011	3		10,800	8.424	30.91608	176.904	0.76	134.447
2012	3.5		12,600	9.828	36.06876	206.388	0.73	150.6632
			51,219	40.13282	147.2874	842.7892		644.3214

1. Carbon emission reduction from fuel switch (from petroleum diesel to pongamia oil) is 78%.
Carbon value is calculated at US$21 t^{-1} of carbon, or US$5.722 t^{-1} of CO_2 equivalent.
Present values are discounted at 3%.
Pongamia trees planted in June 2003 will produce oil from 2006.
Survival rate for plants is assumed at 85% of 4,500 trees (planted in 2002), ie, 3,600 trees.
Oil yields in 2003, 2004 and 2005 are extracted from pongamia seeds collected in nearby forest.

Table 12. Awareness of environmental services in Powerguda.

Environmental factors	Public awareness
Hydrological functions	Substantial awareness as watershed management has increased the water table in village wells.
Soil erosion	Some knowledge because of contour bunding along slopes to minimize soil erosion.
Medicinal properties of trees	Most people are aware of the medicinal uses of some trees, in particular, *Pongamia pinnata* and neem.
Biodiversity	Limited knowledge of the importance of multiple tree species.
Reducing chemical fertilizer and pesticide use	Public awareness increasing with the introduction of integrated pest management. Pongamia oilcake is replacing chemical fertilizers.
Mitigating climate change	Increased awareness of carbon sequestration and carbon emission reduction since the sale of carbon to the World Bank.

Powerguda. The pioneering work in extracting oil from pongamia seeds and exporting environmental services to the World Bank has given the people a sense of pride in the village and put Powerguda on the map of the world. Powerguda's action has inspired several other neighboring villages to plant pongamia trees on a large scale.

Conclusions

The experience from Powerguda has demonstrated that a judicious mix of community empowerment, new technologies and institutional linkages can help to alleviate rural poverty. Public investment in watershed management and agricultural development provided the technology edifice. Building hamlet-level SHGs and federating these groups at higher levels built the community's self-confidence and increased their bargaining power with local merchants, politicians and bureaucrats. The linkages with financial institutions helped to leverage the groups' savings to get bank loans.

It is remarkable that the people of Powerguda were able to get out of the poverty trap in three years and increase their household income by 77% to Rs 25,874. It is equally remarkable that the village women who had not stepped inside a bank four years ago now enjoy favorable credit terms from local banks compared with other customers. The key 'drivers of growth' contributing to the transformation of Powerguda are highlighted below.

Social cohesion. The people of Powerguda belong mainly to the Gond tribe, which has a rich tradition of participation in village affairs – both religious and secular – which makes it easier to involve them in watershed management. Members of the tribe have an obligation to participate in village affairs, help the *patla* (or headman) to implement the decisions of the elders, and make appropriate contributions for offerings to the gods and to the welfare of the village. Social conflicts are rare in Gond communities and when they do arise these are amicably settled within the settlement. Powerguda enjoyed these unique characteristics which made it easier for ITDA to implement its watershed initiatives.

Government support. Local government support, through the ITDA, was an important driver of development. ITDA officers worked tirelessly with the women of Powerguda providing them with financial and moral support to build their self-confidence. They helped to create the SHGs, trained them to organize meetings, reach decisions, and manage accounts, and finally linked the SHGs to local banks and federation of SHGs. The inhabitants of Powerguda have acknowledged the help received from ITDA by giving the agency higher score than themselves for the success of their SHGs.

Community empowerment. The SHGs have been a key instrument in empowering women and mobilizing their talent and resources for increasing community welfare. The ability of some 500,000 SHGs in Andhra Pradesh to mobilize US$240 million is an untold development success story. This story has played itself out well in Powerguda where women have successfully managed new businesses and have motivated other women to follow suit.

Leveraging savings. From the success in implementing watershed management and agricultural development, Powerguda households have been able to collectively save Rs 582,600, or about 22% of their annual income in 2002. This is a remarkable achievement for people who did not know the meaning of the word 'saving' four years ago. Even more remarkable is their ability to leverage their savings with local banks to get agricultural loans. While savings as an 'entry-level activity' has become a part of government schemes in Andhra Pradesh, converting savings into investment by providing bank linkage to local communities would put them on a sound financial footing.

Rural technologies. The role of technology as driver of economic growth is well recognized. However, new technologies often fail in the absence of sound social systems and institutional support. Watershed management and new agricultural technologies introduced by ICRISAT worked in Powerguda, in large measure, because of community participation through its SHGs. Planning and implementing watershed plans in a participatory way is important for the success of these plans.

Complementary investment. While the local government has provided most of the initial investment in Powerguda, this needs to be complemented by local private initiative funded through community savings and bank loans. The local government's expectation that every rupee it invests would attract four additional rupees from other sources is sound. Though additional investment has been slowly coming in Powerguda thus far, there is little doubt that it will begin to flow in the years ahead.

Future investment. Powerguda has identified oil processing as a key growth area. The village already has an oil mill to process pongamia oilseeds. Oil from the 4,500 pongamia trees planted in the village is worth Rs 835,222 over ten years in net present terms. The pongamia nursery with a capacity of 20,000 saplings should meet its needs and produce a surplus, which can be sold to the forest department as part of community forestry management.

Watershed management, accompanied by sound agricultural practices, participating community institutions and supportive government policies offer the best hope for poor people in the semi-arid tropics. Powerguda has shown the way forward for other poor people around the world.

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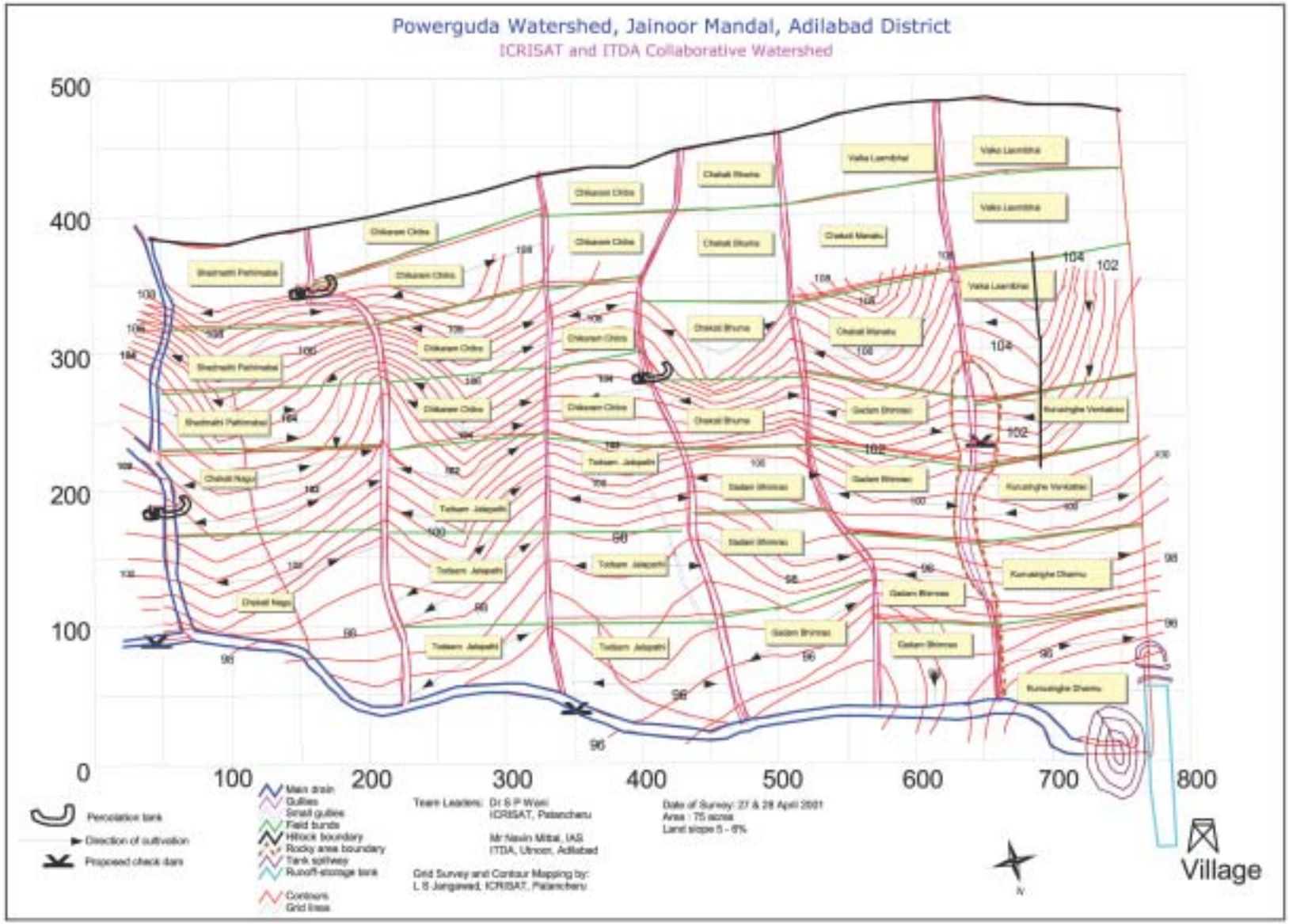
Appendix 1. A Watershed Plan Prepared by ICRISAT Scientists and Local Farmers



About ICRISAT

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a non-profit, non-political, international organization for science-based agricultural development. ICRISAT conducts research on sorghum, pearl millet, chickpea, pigeonpea and groundnut – crops that support the livelihoods of the poorest of the poor in the semi-arid tropics encompassing 48 countries. ICRISAT also shares information and knowledge through capacity building, publications and ICTs. Established in 1972, it is one of 15 Centers supported by the Consultative Group on International Agricultural Research (CGIAR).

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