The Role of Watershed Projects in Developing Rainfed Agriculture in India

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Prepared for
The Indian Council for Agricultural Research
The World Bank

September 1, 1998

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Acknowledgments

The authors wish to thank numerous people who helped them in conducting this study, who include many more people than can be included in this list.

The data collection team included the following people: BP Biradar, D Katolkar, Kalyan, Youvraj Kate, V Bansode, Jadhav Samrut, Athoiba Singh, Manisha Birmal, K. Sangeeta, K., Niels Matthew, Vranda Vase, Ashok Chawan, Abraham Samuel, Pardeshi Kishore, Sonawane Dutta, Viswa Mytri, Vijaya Barathi, Suresh Kumar, K. Manga Sri, B. Satyavathi, K. Ravindra, Hari Babu, Nikhil Raj, P. Adhiguru.

The data entry team consisted of the following people: Nikhil Raj, Gitesh Sinha, Mr. James, SP Sharma, Mr. Pandey, P Adhiguru.

Shri Anna Hazare hosted the data collection team at the training center in Ralegaon Siddhi; he also offered numerous insights that were helpful in designing the study.

The Secretary, Department of Agriculture, and the Secretary, Department of Rural Development, kindly provided permission to collect data from both villages and government agencies in all five states. The Directors of Watershed Development in Karnataka, Rajasthan and Orissa also provided assistance.

Representatives of the watershed agencies and respondents from all of the study villages kindly provided their time and insight to make the study possible and offer various insights; they also provided meals for the field workers and places for them to sleep.

Many other people also provided assistance, including, but are not limited to, Anna Hazare, Peter Hazell, Derek Byerlee, Dayanatha Jha, N.K. Sanghi, Dr. Ramakrishnaiah, Mr. S.P. Tucker, Mr. K.R. Kishore, Mr. Prabhakar Reddy, Mr. Mahalle, Mr. G. Sriramappa, Mr. Deshmukh, District Soil Conservation Officers, Pune and Ahmednagar, Oscar Neidecker-Gonzales, Barbara Adolph, Kimberly Chung, John Farrington, Amanda Feve, R.S. Deshpande, Deepak Ahluwalia, G.B. Singh, Mruthyunjaya, Narender Kumar, Jacqueline Julian, Beryl Hackett, John Pender, T. Haque, Benoit Blarel, Mark Pitt, and Nancy Clements.

Ganesh Pangare worked on the project under the auspices of the Indian Natural Resource Economics and Management Foundation, Anand. Vasudha Lokur Pangare worked under the auspices of OIKOS, Pune. PJ George worked under the auspices of Farming Systems International.

Numerous others provided assistance but are not listed here.

Executive Summary

This report presents findings, conclusions and recommendations about future investments in watershed development based on a pair of background studies, one by Kerr et al (1998) and the other by Kolavalli (1998). These studies were conducted under the ICAR-World Bank Research Project on Sustainable Rainfed Agriculture. Kerr et al conducted a detailed quantitative survey of 86 villages in Maharashtra and Andhra Pradesh covered by a wide variety of watershed projects. They focused on how agricultural productivity and natural resource conditions are determined by watershed projects and a variety of other factors operating in the villages. Kolavalli reviewed the literature on watershed projects and conducted a field study using rapid rural appraisal techniques in 21 watershed projects in Karnataka, Rajasthan and Orissa. He focused more on the specific approaches taken by different projects and their implications for sustainability and replicability. Together, the two studies provide evidence regarding past experiences and current approaches, laying the groundwork to search for a way forward for future projects.

Two main hypotheses guided the background reports. One is that watershed projects cannot succeed without full participation of project beneficiaries and careful attention to social organization. This is because the costs and benefits of watershed interventions are location-specific and unevenly distributed among the people affected. The second hypothesis is that a variety of factors determine the incentives for people to manage and protect natural resources and invest in increased agricultural productivity. These factors may have as great an impact as the efforts of a watershed project in determining the outcomes that projects seeks to achieve.

A major component of the research was the development and collection of data on various indicators of performance in natural resource conservation, agricultural productivity, and equitability of the distribution of project benefits. These data were collected through direct observation, group discussions, and published records. Quantitative data were also collected on the background characteristics of the projects, villages, households and plots covered under the study. Some of the village-level information came from public sources, but most of it was collected from group and individual interviews in each village. In addition, qualitative data were collected regarding the natural resources people use to earn their livelihoods, the social institutions that govern access to those resources, and any changes in access to them resulting either from changes in their quantity or changes in social institutions. This information was collected in open-ended discussions with members of specific interest groups in each village, such as farmers with irrigated land, farmers with rainfed land, landless people, herders, and women.

Performance indicators for evaluating watershed projects reflect the diversity of objectives of different projects. These include, among other things, raising rainfed agricultural productivity, recharging groundwater for drinking and irrigation, raising productivity of nonarable lands, reducing soil erosion, skewing benefits toward poorer members of society, creating employment (directly and indirectly), promoting collective action, and building or strengthening social

institutions. Almost all of the projects surveyed share most of the objectives on this list, but they may differ greatly in their relative emphasis.

On the whole, villages with projects operated by nongovernment agencies (NGOs) or in collaboration between NGOs and government agencies performed significantly better than those with purely government projects, which in many cases did not perform better than control villages with no project. Project variables tend to show greater impact on performance than infrastructural variables. Some measures of infrastructure appear to be positively correlated to better performance, but the evidence is limited.

The major lesson to be learned from this study is that most government watershed development investments have yielded disappointing results given the vast resources allocated to date. Lessons learned from early projects have been put to good use in more participatory approaches on a relatively small scale, but expanding them to a large scale remains uncharted territory. The new MRAE guidelines represent an attempt to scale up participatory approaches, but progress has been slow and there have been many pitfalls. The new guidelines represent a very favorable development, but it is unrealistic to think that they can be successfully implemented on a nationwide scale very quickly.

A strong argument can be made that watershed investments should slow down, focusing on experimenting with innovative participatory approaches, until there is sufficient capacity among government staff to work in a more decentralized, participatory way. However, given that large watershed budgets have already been put in place, the focus should be to use project funds to encourage such government reform. This could be done by disbursing funds only when state and district governments show that they are making progress in adopting more participatory approaches. The MRAE is already taking this approach. If it can help encourage bureaucratic reform it will represent an important spillover benefit that will offset slow progress in the actual watershed development objectives.

Management characteristics that facilitate adoption of participatory approaches

Successful programs that have adopted participatory approaches share the following characteristics:

- They devote significant resources to social organization
- A high proportion of staff members have experience and skills in social organization
- Project leaders are fully committed to participation and, in most cases, donors or senior officials place pressure to adhere to participatory approaches
- Project monitoring explicitly checks whether social organization is pursued
- Staff members have an incentive to undertake participation
- Communities being organized have some capacity to influence how the field staff work

All of the bilaterally funded projects visited (Danida, SDC and the Indo-German Project) and most of the NGOs share these characteristics to varying degrees, whereas most of the government projects, including those supported by the World Bank, share none of them. Conditions appear to have improved in projects under the new guidelines of the MRAE, but this depends on the particular implementing agency.

Bureaucratic constraints to adopting participatory approaches in government projects

Bureaucratic constraints to adopting participatory approaches have been discussed above; they are summarized here.

- There is a predominant attitude that villagers lack knowledge and are unable to contribute to project objectives
- There is inadequate funding and lack of qualified staff to promote social organization.
- Field staff have little or no incentive to make the effort to pursue participatory approaches
- Strict orientation to achieving physical targets discourages field staff from taking the time to promote social organization
- The hierarchical institutional culture and pre-established, inflexible project guidelines reduce learning from experience or taking advantage of lessons learned.
- Government staff have subcontracted all work related to participatory processes to NGOs without developing any internal capacity.

Priorities for bureaucratic reform

An overall strategy for mainstreaming participatory approaches could be to subject the bureaucracy to conditions favorable to adoption of participatory approaches. Broadly they are to provide opportunities and incentives to adopt participatory approaches, improve monitoring and create demand from the communities for a greater role for them. All of the suggestions listed here can be tested on a pilot basis, and others can be implemented everywhere.

- Provide opportunities and incentives to encourage participation:
  - Set more realistic targets which give them ample time to organize communities
  - Provide resources to buy training to acquire skills
  - Decentralize decision-making
  - Provide resources and freedom to buy assistance to organize communities
  - Require substantial contributions from farmers to force greater interaction

- Hire staff with skills and experience in social organization

- Make departments dependent on project funds for which they need to compete with NGOs and communities.

- Improve monitoring to address the approach to participation, not just the technical work undertaken by the project.

- Create the capacity for project participants to influence staff:
  - Give them the right to jointly control (or at the very least monitor) the project budget
  - Inform them of their rights through a major public awareness campaign
  - Create a mechanism for airing grievances about how project staff operate
  - Invite them to participate in project evaluations

A key feature of these recommendations is that they focus on improving the incentives and capability of the bureaucracy and the ability of participating communities to demand better service and participate in governance. NGOs and the private sector may play a role in providing training or operating pilot projects, but scaling up is not dependent on them.

Measures that can be implemented immediately in all government projects

Several steps can be taken by all government projects; in fact most of the following have already been adopted under the new MRAE guidelines.

- Make budgets known to beneficiaries and give them joint control over the funds.
- Leave the choice of treatments and technologies to communities while continuing to offer advice and technical assistance.
- Insist on cost-sharing and improve access to credit to help finance farmers' share.
- Withhold financial input until after proof of social organization.
- Work in villages where people have demonstrated the ability to work together.

Some steps can be taken on a pilot basis even if there is insufficient capacity to adopt them universally:

- Initiate community managed evaluations
- Initiate pilot schemes to test different institutional arrangements
- Give contracts to well known NGOs to provide training and disseminate information to beneficiaries to facilitate greater participation and accountability.

1. Background

In recent years watershed management has become the focal point of agricultural and rural development efforts in rainfed areas of India. Development projects managed under various government ministries as well as by the nongovernment sector increasingly fall under the label of watershed projects. Not surprisingly, a watershed project means different things to different people; projects vary in their focus on introducing improved rainfed agricultural technology, recharging groundwater, conserving soil, rehabilitating degraded nonarable lands, and creating employment.

This report presents findings, conclusions and recommendations about future investments in watershed development based on a pair of background studies, one by Kerr et al (1998) and the other by Kolavalli (1998). These studies were conducted under the ICAR-World Bank Research Project on Sustainable Rainfed Agriculture. Kerr et al conducted a detailed quantitative survey of 86 villages in Maharashtra and Andhra Pradesh covered by a wide variety of watershed projects. They focused on how agricultural productivity and natural resource conditions are determined by watershed projects and a variety of other factors operating in the villages. Kolavalli reviewed the literature on watershed projects and conducted a field study using rapid rural appraisal techniques in 21 watershed projects in Karnataka, Rajasthan and Orissa. He focused more on the specific approaches taken by different projects and their implications for sustainability and replicability. Together, the two studies provide evidence regarding past experiences and current approaches, laying the groundwork to search for a way forward for future projects.

The literature on watershed development in India is growing rapidly, but most of it is confined to qualitative descriptions of success stories. Some of these contain excellent insights into the social processes that contribute to successful watershed development, but there is little frank discussion of less successful projects. The few quantitative studies available tend to be based on a small number of heavily supervised projects, with no information about long term impacts. Benefits after the first year or two were typically assumed and, not surprisingly, cost-benefit findings were almost always favorable. At the same time, the vast majority of projects were never subject to evaluation and there were good reasons to suspect that most of them had little impact (Kerr and Sanghi 1992).

With this background, the current research was commissioned to analyze the determinants of agricultural productivity, natural resource management and poverty alleviation under a wide range of watershed projects. The Kerr et al study takes primarily a quantitative approach, explicitly examining the effects of non-project factors such as infrastructure, access to markets, social institutions in the villages, agroecological conditions, etc. This broad framework not only controls for the effects of these factors but also enables identification of other policy-relevant determinants of improved natural resource management and economic development. The Kolavalli study is more qualitative in nature; it focuses more on the approaches taken by different projects in order to understand the essential elements of successful projects and make

recommendations for the future. Together the two studies answer three related questions: 1) which projects perform the best, 2) what approaches enable them to succeed, and 3) what additional characteristics of particular villages support the objectives of improved natural resource management, higher agricultural productivity and reduced poverty. Since the Kerr et al and Kolavalli reports address separate issues and were conducted in separate states, they are addressed separately in this report, with a common set of conclusions presented at the end. The Kerr et al findings are presented in the main text, and the Kolavalli findings are in Appendices F and G.

Two main hypotheses guided the background reports. One is that watershed projects cannot succeed without full participation of project beneficiaries and careful attention to social organization. This is because the costs and benefits of watershed interventions are location-specific and unevenly distributed among the people affected. The second hypothesis is that a variety of factors determine the incentives for people to manage and protect natural resources and invest in increased agricultural productivity. These factors may have as great an impact as the efforts of a watershed project in determining the outcomes that projects seeks to achieve.

1.a. Watershed Management as a Social Organization Problem

A watershed (or catchment) is a geographic area that drains to a common point, which makes it an attractive planning unit for technical efforts to conserve soil and maximize the utilization of surface and subsurface water for crop production. A watershed is also an area that contains socioeconomic administrative and plot boundaries, lands that fall under different property regimes, and farmers whose actions may affect each others' interests. Socioeconomic boundaries, however, normally do not match biophysical ones. In watershed management projects, mechanical or vegetative structures are installed across gullies and rills and along contour lines, and areas are earmarked for particular land use based on their land capability classification. Cultivable areas are put under crops according to strict principles of contour-based cultivation. Erosion-prone, less favorable lands are put under perennial vegetation. This approach aims to optimize moisture retention and reduce soil erosion, thus maximizing productivity and minimizing land degradation. Improved moisture management increases the productivity of improved seeds and fertilizer, so conservation and productivity-enhancing measures are complementary.

Excess surface runoff water is harvested in irrigation or percolation tanks while subsurface drainage recharges groundwater aquifers, so conservation measures in the upper watershed have a positive impact on productivity in the lower watershed. Reducing erosion in the upper reaches of the watershed also helps to reduce sedimentation of irrigation tanks in the lower reaches. The watershed approach enables planners to internalize such externalities and other linkages among agricultural and related activities by accounting for all types of land uses in all locations and seasons. This systems-based approach is what distinguishes watershed management from earlier plot-based approaches to soil and water management.

Socioeconomic relationships between people in a watershed can complicate efforts to introduce seemingly straightforward technical improvements. This is because, as mentioned above, a watershed contains multiple decision-makers who are not affected equally by watershed development technology. When a watershed project is introduced, often the bulk of the work is done in the upper reaches while the benefits accrue primarily in the lower reaches. For example, an integral element of efforts to revegetate the upper reaches is to ban grazing and felling trees so that plants can establish. As a result, the people who utilize the upper watershed -- typically relatively poor people with little or no land -- bear the brunt of the costs of watershed development, which mainly benefits wealthier farmers in the lower watershed. If those who are made worse off by a watershed project refuse to go along with it, they can undermine the project's efforts. Herders, for example, might refuse to abide by grazing bans and trespass on the common lands if they are able to. In general, watershed technologies are likely to fail if they divide benefits unevenly but require near-universal cooperation to make them work. In this case, equity becomes a prerequisite to efficiency (Sanghi 1989).

While early watershed projects failed to recognize the social dimension of watershed development, this has changed significantly in the last decade. In recent years there has been a growing appreciation of the need to organize communities to work collectively, make sure that beneficiaries have an interest in the work that is done, and ensure that everyone benefits from the project. Today every project is designed to include the "participation" of local people. However, while virtually everyone agrees that this a good idea, different people define participation in different ways.

Two extremes help characterize the experience to date with participatory watershed management. One extreme is based on the view that people will accept watershed technology prescribed by outsiders once they are made aware of its benefits; this requires a mechanism for project officials to explain to watershed inhabitants what the work involves, how the various recommended practices operate, and why it is important to adopt and maintain them. Taking people's involvement a step further, in such projects local committees are established to mobilize laborers for moving earth and planting vegetation, and to facilitate communication within the village to improve the management of common lands.

The opposite extreme is based on the view that people know best how to take care of their land and simply need outside assistance to help organize them and gain access to resources, including funds and social services. Under this approach, project officials develop mechanisms for local people to organize themselves, work collectively, and explain their priorities for external assistance.

Approaches to participation are discussed in detail in Appendix A (for projects in Maharashtra and Andhra Pradesh) and Appendix F and G (for projects in Karnataka, Rajasthan and Orissa). Implications of different approaches for project outcomes are revealed by the analytical findings

presented in sections 3, 4 and 5 and Appendix F. Based on these findings and on the various approaches observed in the projects reviewed under this study, recommendations for how projects should pursue participation in the future are presented in section 6.

1.b. How Economic Forces Can Determine Project Outcomes

As mentioned above, performance in improving agricultural production, natural resource management, and human welfare depends on economic factors beyond the control of a watershed project. In fact, it is possible that economic factors could be as important as watershed projects in obtaining desired outcomes. This perspective on the role of watershed projects can be best understood by taking a step back and considering the global evidence on examples of successful agricultural development and natural resource management.

Throughout the world, both today and historically, it is easy to find areas with a broad range of performance in agricultural growth, natural resource management and poverty alleviation. For example, evidence abounds of areas in India with stagnant agricultural production, low real incomes, and environmental degradation. On the other hand, both the literature and folk wisdom are full of examples of places in India where villagers manage their natural resources particularly well and the local economy is unusually vibrant. What determines why some areas are more productive than others?

A widely cited study of Machakos district of Kenya helps to answer this question (Tiffen and Mortimore, 1994). In the 1930s, Machakos' hilly lands were marked by erosion, deforestation, low productivity and pasture degradation. People were poor and population was considered greater than the land could support. By 1990, however, incomes were higher, the resource base had recovered, and the real value of agricultural output per capita had risen by 300%, even though population had quintupled and agriculture had spread to even more marginal lands. According to the study's authors, increased population density made land more scarce, raising the incentive to improve its quality in order to maintain per capita production levels. Good roads offered access to the large Nairobi market for agricultural products, increasing the returns to agriculture, and off-farm income provided resources for land improvements such as terraces, trees and hedges, organic matter applications, etc. Local institutions also developed as rules emerged for managing communal resources.

Induced innovation theory helps explain the circumstances under which agricultural development will take place along paths that degrade or conserve natural resources. Induced innovation theory holds that over time, technological innovations and institutional changes take place to economize on scarce resources and utilize abundant ones. The theory helps explain why traditional farming systems have evolved differently in different places. For example, in sparsely populated areas traditional farming systems were bush-fallow, with forest land being cleared and farmed for a few years before being left for 20 to 30 years of nutrient-restoring fallow. On the other hand, in

land scarce areas such as the intensive rice growing areas of southeast Asia, elaborate terraces, irrigation systems and nutrient management systems enabled continuous cultivation without land degradation.

In India, farmer-led agricultural intensification is also widespread. In semi-arid areas the most obvious example is that of private irrigation investments, which are typically accompanied by land leveling and application of substantial organic matter. On rainfed lands the successes are less dramatic, but evidence shows that private tree planting has grown steadily in recent years (Chambers et al 1989), and that many farmers invest in indigenous soil and water conservation measures independently of special project efforts (Kerr and Sanghi 1992). Likewise, some villages have designed social institutions for managing common property resource lands in ways that raise their productivity and protect against long term resource degradation.

Several exceptional case studies have been well-publicized in India, but the common perception is that they remain just that: exceptional. Success is often attributed to the efforts of a particularly charismatic leader or some other set of social conditions that would be difficult or impossible to replicate on a wide scale. There is undoubtedly a great deal of truth in this perception, but to date there has been little systematic effort to examine the extent to which policy-relevant factors have played a role in causing some areas to be characterized by better resource management and higher agricultural production than others. Leaving aside the exceptional success stories like Ralegan Siddhi and Sukhomajri, are there village-level or regional differences in natural resource conditions, agricultural productivity and household incomes that can be explained by the induced innovation theory?

From the perspective of the induced innovation framework, assessing the performance of watershed development projects requires examining the effects of such factors as market access, population density and the economic policy environment. Induced innovation theory suggests that if market access is favorable and population density is high, people will be more receptive to projects seeking to conserve soil resources and intensify agricultural production. In fact, even in the absence of a special project, the economic environment may be sufficient to induce farmers to adopt resource-conserving, productivity-enhancing technologies. On the other hand, even a well-designed watershed development project might be unable to achieve long-term success if enabling conditions are lacking. In such a case, farmers would have insufficient motivation to adopt and maintain practices needed to promote sustainable agricultural intensification.

2. Approach to Analysis of Projects in Maharashtra and Andhra Pradesh

The study by Kerr et al (1998) examined the performance of various indicators of agricultural productivity, natural resource management, and human welfare. Data on performance indicators were collected at the level of the village, the plot and the household. The data come from a survey of 86 villages that are covered by a variety of project approaches and include control villages with no project. Quantitative data collected at the village, plot and household level provided the basis for analyzing the determinants of changes in pre- and post-project conditions.

Open-ended discussions provide further qualitative information on the impact of projects on people from various interest groups. This report presents a combination of tabular, econometric and qualitative analysis of the determinants of improvements in natural resource management, agricultural productivity, and human welfare.

2.a. Project Categories Covered in the Analysis

All categories of projects operating in Andhra Pradesh and Maharashtra are covered by the research. They include the following:

C ***Ministry of Agriculture (MOA):*** projects that focus primarily on technical aspects of developing rainfed agriculture. These include the National Watershed Development Project for Rainfed Areas (NWDPRA), the Indian Council of Agricultural Research's Model Watershed Projects, and the World Bank-assisted Pilot Project for Watershed Development in Rainfed Areas. (The more recent World Bank-assisted Integrated Watershed Development Project (IWDP) does not operate in either Maharashtra or Andhra Pradesh, so it is not covered in the quantitative analysis. But its projects were visited in Rajasthan and Orissa, so it is is covered under qualitative analysis.)

- ***Ministry of Rural Development (MORD):*** Engineering-oriented projects that focus on water harvesting through construction of percolation tanks, contour bunds, and other structures. These fall under the Maharashtra Department of Soil and Water Conservation projects (Jal Sandharan) and the Drought Prone Area Project (DPAP). (In 1995 the DPAP guidelines were restructured under radical new, participatory guidelines. Also, the MORD has been renamed as the Ministry of Rural Areas and Employment (MRAE). However, only pre-reform DPAP projects are included in the quantitative research. The new guidelines are addressed in the study or Karnataka, Rajasthan and Orissa, and some findings are presented in Appendix F and in section 6.)

- ***Non-government organizations (NGOs):*** projects that typically place greater emphasis on social organization and less on technology relative to the government programs.

- NGO-Government collaboration: projects between government and non-government organizations (Indo-German Watershed Development Project (IGWDP), Adarsh Gaon Yojana (AGY)) that seek to combine the technical approach of government projects with the NGOs' orientation toward social organization. These projects are found only in Maharashtra.

- ***Control:*** villages with no project.

All of these project categories are discussed in detail in Appendix A.

This research was originally designed to examine only completed projects where the staff had withdrawn. However, despite the large literature on watershed development in India, the number

of projects in which work has actually been completed is quite small, so the intended approach was not feasible. Instead, the study covers mainly well-established projects, with a few that have been completed.

Selection criteria under each project

The criteria by which each project selects participating villages is of critical importance to the present analysis. If, as argued above, numerous factors can determine a village's performance in agricultural production and natural resource management, then it is important to know how these factors are distributed across villages in different project categories. Otherwise, if villages in different project categories vary in their endowment of factors that can affect performance, then it is difficult to know whether to attribute differences in performance to project activities or to the effects of pre-existing village characteristics. For example, Pitt et al (1993) describe a case in Indonesia that showed that villages covered for several years under a major family planning program actually had higher fertility rates than those outside of the program. One could jump to the conclusion that the family planning program had failed miserably, but Pitt et al explain that the difference was not surprising given that the program consciously worked in programs where fertility had been higher to begin with. In the absence of the family planning program, the difference in fertility between the two sets of villages might have been even greater.

Two possible lessons apply to the present study. One is that as in the case described by Pitt et al, if a given project category systematically works in villages where conditions are unfavorable, performance might actually lag behind that of the control villages. The second lesson is the mirror image of the first, i.e. that some projects may (intentionally or unintentionally) select villages with more favorable conditions and thus perform better. There are good reasons to believe that either or both of these scenarios may arise in the present study.

This section presents a brief characterization of each project and its rules for selecting villages. Much greater detail is provided in Appendix A. In sections 3 and 4, data are analyzed to assess the extent to which different projects adhere to the guidelines discussed here and to identify any other factors that may characterize villages under each category. Also, project selection rules have important implications for statistical analysis and this is discussed further in section 4.

While all projects advertise that they work in relatively unfavorable areas with low rainfall and low irrigated area, NGOs favor the most remote villages in order to work with the poorest, most marginalized people. On the other hand, the NWDPRA intentionally selects easily accessible villages. This reveals the NWDPRA's orientation towards planning and supervision by people located outside the village, as well as an optimistic view that visibility will lead to dissemination of practices introduced by the project (NWDPRA 1991). More subtly, the approach also leads to an apparently unintentional bias in selection of project sites towards more densely populated areas with better access to transport and markets. Since these conditions may be especially favorable for the promotion of rainfed agriculture, the project's technical interventions may complement other features of the project sites.

NGOs and the NGO/government collaborative projects (the AGY and the IGWDP) attach great importance to pre-existing social institutions in the villages, while the government projects ignore them. The most revealing factor here is that the AGY and IGWDP, along with some NGOs in Maharashtra, require that participating villages conduct community voluntary labor (*shramdan*) on a regular basis and ban grazing and tree-cutting on common lands. *Shramdan* is intended to foster a spirit of self-sufficiency and self-dependence; it may also be an indicator of a village's propensity for collective action, which may be necessary for successful protection of common lands. If the premise is correct that social organization is a prerequisite for watershed development, then these villages are self-selected for success. This is because villages unwilling to undertake *shramdan* will not join the project.

Another important factor is that many projects take advantage of work done by earlier projects. First, virtually all projects in Maharashtra work in villages already treated with soil and water conservation investments in the 1980s by the state level Comprehensive Watershed Development Project (COWDEP). For NGOs this makes sense as their work in social organization is complementary to earlier technical inputs. Second, the start-up phase of the IGWDP, which is covered by this study, was restricted to well-established NGOs that were already familiar with the community in which they initiated the project, and many ongoing activities were simply brought under the flag of the IGWDP. These facts about pre-project history are important to keep in mind for two reasons. First, project impact must be jointly attributed to both the new and old project, and second, impact is likely to come more slowly when these projects expand to areas not previously covered by an earlier project.

2.b. Data

Evaluating watershed projects requires baseline and monitoring data for comparison of pre- and post-project conditions, but unfortunately no such information was available. As a result, the quantitative analysis is based on some secondary data available for both the pre-project period (1987[1]) and the present (1997), primary data of current conditions based on interviews and visual assessments, and primary data of past conditions based on recall by local inhabitants. Inevitably there are weaknesses in the data that limit the study's analytical power.[2]

A major component of the research was the development and collection of data on various indicators of performance in natural resource conservation, agricultural productivity, and equitability of the distribution of project benefits. These data were collected through direct observation, group discussions, and published records. Quantitative data were also collected on the background characteristics of the projects, villages, households and plots covered under the

[1]Work in the World Bank and ICAR project villages began in 1986, so in villages under these projects the baseline period was the year before the project began.)

[2]Clearly, India must make a serious commitment to systematic monitoring and evaluation in order to ensure that resources allocated to watershed projects are invested productively. This issue is taken up in detail below.

study. Some of the village-level information came from public sources, but most of it was collected from group and individual interviews in each village. In addition, qualitative data were collected regarding the natural resources people use to earn their livelihoods, the social institutions that govern access to those resources, and any changes in access to them resulting either from changes in their quantity or changes in social institutions. This information was collected in open-ended discussions with members of specific interest groups in each village, such as farmers with irrigated land, farmers with rainfed land, landless people, herders, and women.

Villages, rather than watersheds, were selected for analysis of community level indicators of natural resource management and economic performance. The village was selected rather than the watershed because most projects in the sample worked at the village- or sub-village level, and because the village is a much more straightforward unit of analysis due to the fact that people are organized around villages and secondary data are recorded at the level of the village. In some cases, particularly in Andhra Pradesh, villages are disaggregated into hamlets, in which case primary data were collected at the hamlet level.

Performance Indicators

Performance indicators for evaluating watershed projects reflect the diversity of objectives of different projects. These include, among other things, raising rainfed agricultural productivity, recharging groundwater for drinking and irrigation, raising productivity of nonarable lands, reducing soil erosion, skewing benefits toward poorer members of society, creating employment (directly and indirectly), promoting collective action, and building or strengthening social institutions. Almost all of the projects surveyed share most of the objectives on this list, but they may differ greatly in their relative emphasis. These differences are described in section 2.

As mentioned above, many indicators of performance are difficult to measure. This is particularly true for natural resource conditions, but measuring improvements in household welfare and agricultural productivity also raises complications. The difficulties arise for two reasons. First, for some indicators precise measurement is very costly and difficult, so less expensive and less precise proxies must be developed. Second, measuring the change in performance indicators resulting from a watershed project would require baseline data against which to measure current conditions. However, such baseline data are not available, so making before-and-after comparisons requires assembling baseline data on the basis of published records and the recall of local inhabitants. This approach has strong limitations, because published records are available for only a few variables, and recall is prone to error. Some important baseline indicators, like the extent of soil erosion, are impossible to collect in a way that would facilitate comparison across villages, so they are analyzed in a purely cross-sectional framework. Clearly, a systematic, on-going data collection framework must be put in place if learning from the experience of watershed projects is to be taken seriously in the future. Recommendations for developing such an approach are presented in section 6.

Table 1 presents an overview of the performance indicators used in the current study. They are discussed in more detail in Appendices B and C.

Determinants of project performance

Village level: Data collected at the village level are based on a survey covering background information such as access to markets, land use patterns, natural resource management practices, and description of social institutions operating in the village. Most background information is available for both 1987 and 1997. A village-level survey was conducted to obtain most of this information, and additional background variables were obtained from the 1991 census. Performance indicators at the village level include some variables from the village survey, but also visual observations of natural resource conditions from village level transects covering a cross-section of broadly representative land types and uses. Village level data are discussed in detail in Appendix B.

Plot level: A plot-level survey was conducted to collect data on agricultural productivity and adoption of improved technologies and practices. This provides information about changes resulting from the watershed projects and other determining factors. The sample includes both irrigated and rainfed plots, and both plots covered and not covered by watershed projects. The plot survey was conducted in villages covered by as the village survey, so village information related to the plot is available from the village survey. Some household-level information for each plot's operator was also collected as a part of the plot survey. Plot-level data are discussed in detail in Appendix C.

Household level: A household-level survey supplied detailed information about household characteristics and changes in household welfare. This provides indications of how watershed projects and changes in a variety of village- and household-level conditions have affected household welfare. The household survey was conducted using a different set of respondents from the plot survey, but in the same villages. Household data are discussed in Appendix D.

Interest group level: A fourth set of interviews focused on different interest groups within the village, such as farmers with irrigation, farmers without irrigation, landless people, and women. The information provided by these interviews offers a qualitative assessment of project performance from the viewpoint of the intended beneficiaries, and it provides further insights, both qualitative and quantitative, about how project benefits and costs are distributed across different groups of people within the village. In the case of women, this approach enables the analysis to be disaggregated to the sub-household level. Findings regarding the role of women in watershed projects are summarized in section 5 and discussed in more detail in Appendix E.

Sampling

Sampling villages for data collection was a major undertaking in itself. The situation in Pune and Ahmednagar districts of western Maharashtra provides a good example of the difficulties. Despite widespread publicity about the success of the watershed approach to agricultural

development, hard data is quite limited. A few widely known success stories are easy to locate, but others are not. This is the case for two reasons. First, the 1991 Census lists over three thousand villages in the two districts, but the famous success stories account for no more than a handful. Second, a complete list of villages where projects have operated does not exist. The most active watershed agency in the area, the Maharashtra Department of Soil and Water Conservation, keeps good records of the villages where work is currently underway, but lists of villages where work has been completed are archived and can be accessed only with difficulty. Some government programs, like the NWDPRA, maintain lists of project locations only at the taluka level. NGOs maintain their own lists, which can be obtained by visiting the head office. As a result, simply identifying project villages requires a great deal of leg work. The resulting list of project villages must then be checked against the complete list of all villages from the national census so that nonproject villages can be selected as a control against which to compare project performance. Even then, there is a reasonable chance that a village selected as a "control" will prove, upon further inspection, to have had a watershed project in the past. This is because the poor quality of data on project status makes it nearly impossible to identify all project villages without actually visiting each village and asking about project history.

Based on available knowledge about project status of villages, the sample was selected at random, stratified by the project categories listed above. A small amount of resampling was done to replace villages incorrectly classified as "control" after visits to the villages revealed that watershed projects had operated there in the 1980s.

As shown in table 2, a full set of quantitative and qualitative data at the village, household and plot level were collected in 13 villages in Maharashtra and 16 villages in Andhra Pradesh, for a total of 29. Village level data were collected in an additional 57 villages in Maharashtra. The village-level analysis is confined to the 70 Maharashtra villages, while the plot-level analysis covers the 29 villages from both states where more detailed data were collected. The qualitative data cover primarily these same 29 villages. The Maharashtra villages are all concentrated in Pune and Ahmednagar districts in the western part of the state, where there is a relatively high concentration of watershed project sites. In Andhra Pradesh the projects are less concentrated, so the sample villages cover 4 districts, Ananthapur, Medak, Mahbubnagar and Ranga Reddy.

Teams of 5 to 7 village investigators spent 4 days and nights in each of the 29 villages where they collected the full set of quantitative and qualitative data. In the remaining 57 villages in Maharashtra where only village-level data were collected, teams of 3 to 4 investigators spent 2-3 days.

3. Descriptive Analysis of Projects in Maharashtra and Andhra Pradesh

A combination of descriptive and econometric analysis is presented in this report. The descriptive analysis presents mean values of variables of interest, showing the bivariate association between performance indicators and factors hypothesized to affect them. The descriptive analysis is easy to understand and helps establish the basis for the econometric analysis. However, the descriptive analysis cannot identify causal relationships when

performance is determined by multiple factors. The multivariate econometric analysis is useful for this purpose.

Descriptive statistical relationships between performance indicators and plot and village characteristics are summarized in this section, with detailed tables presented in Appendices B and C. Econometric analysis is presented in section 4 for a sample of the indicators in order to examine causal relationships in greater depth.

3.a. Summary of Findings of Village-Level Descriptive Analysis

The village-level descriptive analysis reveals very little in the way of favorable project performance. For most of the indicators addressed none of the project categories are significant, and usually the control villages perform at least as well as some of the other project categories. The AGY/IGWDP category had the best scores on many counts, but usually they were not significant. Performance indicators were also measured against other village-level characteristics like access to infrastructure and agroecological conditions, but these were rarely significant either.

The results for each village-level performance indicator can be summarized as follows. It is important to note that unless otherwise mentioned, the differences across project categories are not statistically significant. The tables on which these findings are based are presented in Appendix B.

Characteristics of villages under different projects in Maharashtra: Descriptive statistics presented in table B4 suggest that the projects do in fact follow the principles laid out in their guidelines (discussed above). NGO and NGO-government collaborative projects tended to have the lowest levels of infrastructure in the pre-project period, while NWDPRA villages had the highest. Conditions in control villages were similar to those under the NWDPRA. All of the NGO-government collaborative project villages practiced *shramdan*, as did 75% of the NGO villages. Less than half of the remaining villages practiced *shramdan*. None of the projects had a significantly lower percentage of area irrigated than the control villages, but this is because virtually all villages in study area have relatively little irrigation, and also because the government projects target their work based on the level of irrigation at the taluka level, not the village level. As mentioned above, nearly all projects take advantage of work done by the COWDEP project in the 1980s. Only three project villages in Maharashtra — one each under the NWDPRA, DPAP and NGO categories — were not previously treated under COWDEP.

Characteristics of different project villages are examined in more detail using econometric analysis below, in section 4, in order to gain further insights.

Drinking water: All projects that promote water harvesting through small tanks and dams directly or indirectly try to increase the level of water in wells for drinking water. In Maharashtra, this includes every project except the NWDPRA. Many villages have additional drinking water schemes, so the analysis controls for this. Excluding villages with additional

drinking water schemes, table B7 shows that the AGY/IGWDP projects had the largest increase in the percentage of villages with adequate drinking water and, surprisingly the NWDPRA had the second-highest increase. Control villages had higher improvements than either NGO or Jal Sandharan villages.

Increase in village-level percent irrigated area: Table B8 shows that control villages had by far the largest percent increase in irrigated area, followed by AGY/IGWDP villages. Villages from other categories only had very small increases. However, the differences are not significant across project categories nor any other village characteristic. This unexpected finding is examined using econometric analysis below.

Changes in wages and employment: Changes in male and female daily wages over the study period showed virtually no difference across project categories (table B9). This is not surprising, since wages are likely to equalize across villages as workers can move among neighboring villages as employment opportunities change. However, a household level survey of a subset of the study villages indicated that employment availability had the highest growth in AGY/IGWDP villages.

Changes in seasonal migration: Changes in migration can indicate changes in employment opportunities, agicultural productivity and overall quality of life. With the exception of the AGY/IGWDP villages, seasonal migration rose in every project category (table B10). The AGY/IGWDP villages had a net reduction in migration overall, but this average figure masks the fact that more AGY/IGWDP villages experienced net out-migration than net in-migration. Also, these villages began the study period with a much higher percentage of seasonal migrants than any other project. Improvements in infrastructure and access to services may help to explain the net in-migration.

Erosion and conservation on cultivated and uncultivated lands: Irrigated plots are almost uniformly well-maintained, while rainfed plots have more erosion problems. Land use dwarfs other factors in its statistical association with erosion and conservation; differences in erosion and conservation across project categories are minimal in comparison. The definition of the erosion indicators and scores are presented in table B11 and the actual scores are in table B12. Erosion is examined further using econometric analysis, below.

Condition of drainage lines (nallas): All watershed projects in Maharashtra also focus on treating the drainage line, and here they perform better than on uncultivated lands. AGY/IGWDP villages perform much better than others, while control projects perform the worst. Condition of the nallas improved with the duration of project activities and the percentage of the village covered. Differences associated with these factors — project category, duration and percent area covered — were all statistically significant. Population density also is positively associated with good nalla management, suggesting that the incentive to manage the land may outweigh the greater pressure by users. Table B13 gives the definitions of the indicators and scores, and table B14 gives the actual scores.

Changes in availability of products from common revenue lands: Grass fodder, tree fodder and fuel were the only products from common lands found in enough villages to warrant analysis of change in availability between the pre- and post-project periods. On average, availability of these products declined in villages under all project categories (table B15), with mixed findings about which project categories fared better than others. Control villages performed the worst, suggesting that at least the projects may have prevented conditions from declining even further.

Discussion: It is difficult to state that the lack of significant relationship between the performance variables and the project categories reflects poor project performance. There are two reasons for this. First, the lack of significance more likely suggests that the relationship between project-type and performance is mediated by several different factors, so that grouping the villages broadly by project type most likely provided only part of the explanation for the outcome variables of interest. Accordingly, the econometric analysis presented below examines the joint effects on performance of numerous potential determining factors.

Another reason for the lack of significant relationships may be related to the chosen unit of analysis. The village was selected as the unit of analysis since most projects aim to develop villages and microwatersheds within villages. However, a project may affect areas within a village differently. In addition, no projects actually treat every hectare in a village. Hence, a project village will contain significant areas that have not received any project treatment. As such, as a unit of analysis the village may have been too large and too heterogeneous to reveal significant changes with only a bivariate analysis. The plot-level analysis, which differentiates between plots that were treated under a project and plots that were not, may be more effective in overcoming these problems. This analysis is discussed next.

3.b. Summary of Findings of Plot-Level Descriptive Analysis

The descriptive analysis at the plot level shows more interesting results than that at the village level. As mentioned above, the plot has the advantage of being a more homogeneous unit than the village. Another factor is that the plot-level analysis was based on a sample of over 350 (of which 279 were rainfed in 1987 and 246 were rainfed in 1997), while the village-level analysis was based on a sample of 70.

The first point is that interaction between respondents and project staff is surprisingly low, particularly in Maharashtra (table C9). This reflects the focus of the Maharashtra projects on treating drainage lines and nonarable lands rather than cultivated plots. Interaction between respondents and project staff is much higher on average in the NGO and NGO/government collaborative projects than in the government projects. The only exception is the World Bank pilot project in Andhra Pradesh, which had the highest level of interaction.

For all of the performance indicators that were defined in terms of the difference between the pre-and post-project period — change in irrigation intensity (table C10), change in the use of improved varieties (tables C11 and C12), and change in yields (table C13)— the plots in villages under the AGY and IGWDP performed better than all other project categories including control,

with NGO projects performing the next best. For soil and water conservation investments on rainfed plots during the period under study, these projects had the second highest levels after plots under NGOs, but they made by far the highest investments that were financed by their own savings (tables C16a, C16b, C16c). (Land improvement investments are discussed in more detail below.) Rainfed plots under the AGY and IGWDP also had the second highest net returns to cultivation per hectare after plots under NGO projects (table C18). At face value this consistently strong performance in the AGY/IGWDP project category suggests that these projects are having quite an impact. As shown in Appendices B and C, however, villages covered by these projects also had the greatest improvement in infrastructure conditions during the period under study, and there are good reasons to believe that this could also have contributed to the better performance. This is especially so since the projects' primary focus was on water harvesting and pasture protection, not rainfed agriculture per se. Multivariate analysis is required to sort out these differences before strong conclusions can be drawn regarding the success of these projects in generating improvements in rainfed agriculture; this is taken up later.

Those projects that did focus on rainfed agriculture, particularly the World Bank, ICAR and NWDPRA, did not appear to perform very well in encouraging adoption of improved varieties and raising yields, although they did slightly better than the control villages. One important comment to make regarding the World Bank and ICAR projects is that they were the only ones covered under the study in which the work had been completed and the staff had withdrawn. This means that the effects of their work had a much longer time to erode, and thus it is not fair to compare them to the effects of projects that are still ongoing. The same is not true for the NWDPRA, however.

One area where all of the Andhra Pradesh projects appear to have had an impact is in promoting cultivation across the slope (table C15). On the other hand, no farmers in the sample practiced strict contour cultivation, which the NWDPRA, World Bank and ICAR projects all promote. Nevertheless, cultivation across the slope is nearly as effective for cultivation as contour cultivation, and it represents a superior, easily adoptable alternative to cultivation along the slope. Farmers who interacted with project staff were more likely to cultivate across the slope than those who did not, and all farmers in project villages were much more likely to cultivate across the slope than farmers in control villages. This suggests that cultivating across the slope also spreads from farmer to farmer; this is not surprising since it does not cost anything. Of course, the fact that it is costless also suggests that it could probably be promoted even without expensive watershed development projects.

3.c. Land Improvement Investments on Private Plots

Introduction of soil and water conservation (SWC) structures on private land is an important activity in most projects, which typically pay for most or all of the work. Beneficiary farmers pay little or nothing in most projects. Because soil conservation is such an important component of all projects, it is examined in some detail in this section. The primary focus is on the effects of project subsidies on the level of SWC investment and the maintenance of assets financed by

project funds. Suggestions are made for improvements to subsidy policies that might promote higher investment and improved maintenance.

Subsidy policy varies by project category, but most projects pay for 90-100% of the cost of investment in soil and water conservation measures, while farmers pay little if anything. A few projects require much higher cost-sharing by farmers. The high rate of subsidy reflects two factors. First, most projects double as employment projects, and building structures and planting vegetation are highly labor intensive (Kerr et al 1996). Second, policymakers and project officials are keenly aware that canal irrigation is fully subsidized in India, and they argue that equity considerations require that rainfed farmers should receive the same treatment.

While the latter argument is really a matter of opinion, the issue is more complex due to the fact that projects have often introduced measures that farmers did not want and had no intention of maintaining once the project ended. This is because these measures conflicted with other components of local farming systems, thus imposing opportunity costs (Kerr and Sanghi 1992). Given these circumstances, it is important to require some kind of payment or other sacrifice by "beneficiaries" simply to make sure that they really want the work and are likely to maintain the assets created. Otherwise the project will simply be a waste of money. (This problem does not arise in irrigation projects, because there was never a farmer in India who did not want irrigation!)

Among the projects covered in this study, the government projects offered little or no flexibility in the choice of SWC technology, while the NGO and NGO-GO collaborative projects allowed farmers to select their own approach. Also, a small number of NGOs required significant levels of farmer cost-sharing in order to encourage better maintenance; one of these was Chaitanya in Andhra Pradesh, under whose projects farmers paid for 50% of the cost. Project subsidy policies are discussed in detail in Appendices A, F and G.

In this section the analysis is based on three categories of projects: government projects under either the MOA or the MORD, NGO projects and NGO-government collaborative projects, and control villages. Tables in Appendix C show the findings using more disaggregated project categories.

Soil and water conservation investment expenditure

Data on total SWC investment expenditure between 1987 and 1997 were collected for each plot covered under the study. It is important to note that expenditure is not synonymous with protection against erosion, for two reasons. First, plots vary in their susceptibility to erosion due to agroclimatic factors (like slope, soil type and rainfall) and to differences in their condition at the start of the study period. Therefore one plot may require more investment than another for protection against erosion. Second, there are many ways to protect against soil erosion, and their effectiveness is not necessarily related to their cost. Vegetative barriers are less expensive than earthen barriers, for example, and agronomic practices like cultivation across the slope cost nothing at all. Despite this caveat, investment levels do provide useful information about what

both projects and farmers are doing to control erosion, and how project interventions affect farmers' own investments. This in turn can help policymakers and watershed officials target their interventions resources to support the kinds of investments that farmers are less likely to make with their own funds.

The focus here is on soil and water conservation investments on rainfed plots, since the evidence suggests that irrigated plots receive plenty of investment with neither financial nor technical assistance. The types of soil conservation investments listed by respondents include land leveling, earthen, stone or vegetative barriers, grass strips, drains, and tree planting. The mean value of investment between 1987 and 1997 on all rainfed plots was about Rs 4,475 per ha in 1997 rupees. The corresponding value for irrigated plots was Rs 69,900, of which Rs 10,630 was for nonirrigation investments like leveling and bunding. Figure 1 shows the variation in both total investment and source of finance across project categories for rainfed plots; three main points arise from the figure. First, plots under NGO/GO projects and in control villages have the highest levels of investment, followed at a much lower level by those in government projects. Second, while NGO/GO projects and government projects invested about the same level of subsidy, the NGO subsidies leveraged a much higher amount of funds contributed by the farmer. Third, farmers used very little credit to finance their investments, but this amount was much higher in control villages that had little if any access to subsidies for SWC. (A few farmers in control villages received subsidies from sources other than watershed projects.)

This broad picture of total investment suggests that watershed projects are not succeeding in stimulating soil and water conservation investments that farmers would not have made otherwise. However, the situation changes when one looks at how investment costs and sources of finance vary by the slope of the plot. As shown in figure 2, while total investment cost varies somewhat by slope, the source of finance shows dramatic differences. Farmers invest their own savings mainly on plots with less than 2% slope. They use credit exclusively on these plots (not shown in the figure). Watershed agencies, meanwhile, devote their funds mainly to plots with more than 2% slope. The reason behind this finding is most likely that soil and water conservation investments have important productivity impacts in semi-arid rainfed agriculture, and efforts to conserve and concentrate soil and water may have greater productivity impacts on plots with more fertile, flatter soils. As a result, that is where farmers invest their own funds. This clearly suggests that funds from watershed projects complement farmers' own investments by investing on sloped plots that farmers would otherwise neglect.

The question remains why farmers in control villages or those covered by the NGO or NGO-GO projects all invest more than farmers in the villages covered by government projects. There are at least four reasons to consider. First, it may be that the government projects just selected villages where farmers were less able or interested in investing on rainfed plots, but the selection bias analysis (presented below) suggests that this is not the case. A second possibility is that vegetative technologies under the NWDPRA and World Bank cost less than those introduced under the NGO and NGO/GO projects, but this would not explain the small proportion of total investment costs paid by farmers with their own funds. Third, it may be that farmers in government project villages invested less of their own funds while waiting for the project to pay

for the investments instead, which would be reasonable given that government projects pay 100% subsidies in practice. A fourth possible reason is that some NGOs' higher cost-sharing requirements leverage larger private sums. Some farmers covered by the Chaitanya project indicated that they could not afford to contribute 50% of the cost of investment, but other farmers did invest large sums of their own money. Perhaps Chaitanya's subsidy policy could have a stronger impact by helping farmers gain access to credit to pay the matching cost. Figure 1 shows that very few respondents in NGO villages used credit for land improvement investments on rainfed plots.

Use of credit for land improvement investments

The average amount of credit for soil conservation investments was only around Rs 360 out of an average total investment of nearly Rs 4500. An even more striking finding comes from examining the sources of the small amount of credit that is used. About 50% is borrowed from moneylenders, nearly another 50% is borrowed from relatives and friends, and a trace amount — Rs 14 per respondent — comes from thrift groups. Meanwhile, not one farmer out of 246 in the survey borrowed even a single rupee from the bank for land improvement investments on rainfed plots during the ten year period under investigation. Irrigated plots, by contrast, receive an average of over Rs 23,300 credit with almost Rs 9,000 coming from banks. Of this amount, about Rs 4,400 is for nonirrigation investments like bunds and leveling, with an average of Rs 900 coming from banks. This is consistent with the findings of Kerr and Sanghi (1992) that formal credit is not even available for such investments on rainfed plots. Sometimes bank credit may be tied to special watershed projects so that farmers can borrow to invest in certain approved technologies such as contour bunds. But typically such credit is useless since farmers are not interested in the approved approaches. Farmers have their own practices, but banks do not recognize them and thus do not make loans available (Kerr and Sanghi 1992).

It is difficult to infer from the data presented here whether making bank credit more available to farmers would help stimulate land improvement on rainfed plots. The problem is that most farmers may not want to borrow funds for rainfed land even if they are able to. This may be particularly so for sloped, erosion-prone land. On the other hand, if credit were made available in combination with subsidies, farmers might respond favorably. In fact, the experience of MYRADA and Outreach, two NGOs in the southern Indian state of Karnataka, shows on a limited scale that this may be true (Kolavalli 1998, Fernandez 1998, Mascarenhas 1998). The key features of an approach that combines credit and subsidies would be, first, that credit must not be tied to specific technologies that farmers may not be interested in, and second, that subsidies must be low enough that farmers have to invest significantly from their own pockets or their time. As demonstrated in the next section, this is necessary in order to make sure they are serious about maintaining assets created by their investments.

Maintenance of SWC assets

If watershed agencies succeed in stimulating investment in soil conservation on sloping land prone to erosion, the next step is to encourage farmers to maintain the assets created by those

investments. Table 3 shows the percentage of SWC measures that are well maintained on rainfed plots under different watershed projects, by the level of subsidy. (Investments on irrigated plots are almost always well maintained regardless of the level of subsidy, so they are not discussed here.) Investments with no subsidy are almost uniformly well maintained, with only 2 out of 82 that are not. When subsidies of Rs 2500 or less are introduced, the overall maintenance level slips to 84%, and for subsidies over Rs 2500 it falls to 64%. The overall percentage of subsidized investments that are well-maintained is 74.

The pattern holds when the data are examined separately by project category (table 3). One noticeable feature is that the NGO and NGO-government collaborative projects have higher maintenance rates than government projects. 100% maintenance is achieved for smaller subsidies, but only 79% on higher subsidies. The corresponding figures for government projects are 84% for small subsidies and 58% for larger subsidies. The better performance in NGO and NGO-government collaborative projects compared to government projects suggests a payoff to their willingness to listen to what farmers actually want. On the other hand, it might also reflect the fact that some of the NGO investments are on flat plots and are thus easier to maintain. However, further analysis (not shown) indicates that the high maintenance under NGO projects is not limited to plots with little or no slope.

As mentioned above, with subsidies exceeding Rs 2500 the maintenance rates under the NGO and NGO-GO projects is only 79%. NGOs invest in response to farmers' demands, and where subsidies are very high (100% for some NGOs), labor intensive investments may provide employment for the farmer. In this case farmers may accept large investments that they do not intend to maintain.

An important question for policymakers is whether the high subsidy outlays are justified by the performance of the subsidized land improvements. With overall maintenance levels of 74% (only 69% under government projects), subsidized investments covered in this study are not likely to be cost effective. This is especially so since the regression analysis displayed in table 5 (discussed below) indicates that pre-1987 soil and water conservation investments only resulted in a 2.8% increase in net returns to cultivation, on average.[3] A stronger commitment to cost sharing will help ensure that farmers only accept land improvement measures that they truly want.

Recommendations for policies to promote land-improvement investments

Based on the findings of this section, four simple steps can help stimulate land improvement investments that will have a lasting impact. They are summarized here and discussed in more detail in section 6 below.

[3]The coefficient of pre-1987 investments was 0.028, meaning that 1 rupee of investment results in Rs. 0.028 additional net income per ha.

1. Projects must invest in practices that farmers want in order to ensure long term maintenance.

2. In order to make sure farmers really want the land improvement technology introduced on their land, they must pay for a significant portion of the cost. Only then will there be any guarantee that they will be interested in maintaining technologies that are introduced.

3. In order to help farmers pay for the cost of soil and water conservation measures, they need better access to credit. Credit must be made available for land improvements on rainfed plots, without restrictions on the type of technology to be used. Past experience showed that tying credit availability to certain approved technologies is useless because farmers rejected those technologies.

4. A sliding subsidy scale, with different rates on different types of rainfed land, might help stimulate conservation investments on rainfed lands without simply substituting for expenditures that farmers would have made anyway with their own funds. MYRADA and Outreach have shown that high levels of investment can be maintained when subsidies are sharply reduced (Mascarenhas 1998, Fernandez 1998).

4. Econometric Analysis of Projects in Maharashtra and Andhra Pradesh

Econometric analysis is conducted for a sample of performance indicators in order to sharpen the understanding of the relationship between the performance indicators and associated village- and plot-level characteristics. The basic conceptual framework is represented by the following model:

$$W = f(V)$$

$$Y = f(W, V, H, P)$$

where

W = village's watershed project category
V = village-level characteristics
Y = outcome (from performance indicators)
H = household-level characteristics (omitted from the village-level analysis)
P = plot-level characteristics (omitted from the village-level analysis)

The key analytical feature of this model is the endogeneity of W, the project category. This results from the systematic biases in the way that each project selects villages in which to work. In short, if each project category has different criteria for selecting villages, then it is possible that differences in performance can result more from differences in initial, pre-project conditions than from the work undertaken by the watershed project. Differences in selection criteria for each project may be based on both observed and unobserved village characteristics. Unobserved differences cause standard econometric approaches to yield biased coefficients.

4.a. Adjusting the Analysis for Selection Bias

Econometric methods to control for selection bias are well-established for analysis of only two categories (such as a single treatment and a control), but the current study covers five project categories and this makes the problem much more complex. In fact, econometric methods for this problem have yet to be developed, so this report addresses the selection bias problem in a two-category framework. It also compares the findings when selection bias is and is not corrected for.

The uncorrected model is presented in two specifications. In Model 1, all five project categories are included, while in Model 2 they are consolidated to only three categories: purely government projects (MOA and MORD), projects with input from NGOs (NGO and NGO-government collaboration), and control villages with no project. (The project categories are represented by dummy variables; "control" is omitted.) For the village-level analysis of soil conservation status, a tobit model is used to account for the fact that the erosion and conservation scores are bounded at 1 and 3 (this is explained further below). For the analysis of change in irrigated area and net returns to cultivation, the model is a simple OLS.

A second set of models uses the treatment effects approach (Greene 1990) in order to correct for selection bias.[4] This model can only contain two project categories, so it is run separately under two alternate specifications. In Model 3, the project dummy variable is equal to one if any kind of project (MOA, MORD, NGO or NGO-government collaboration) operates in the village and zero for control villages. In Model 4, the project dummy is equal to one for villages with an NGO or NGO-government collaborative project, and zero for villages that have either an MOA or MORD projects or no project.

4.b. Variables Used in the Analysis

The econometric analysis here is presented for four dependent variables:

- a village's selection for inclusion in a given project
- soil conservation at the village level
- change in village-level percent irrigated area from 1987 to 1997
- net returns to cultivation at the plot level

The village-level soil conservation and irrigation variables are described in detail in Appendix B and the plot-level returns to cultivation variable in Appendix C.

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[4]The treatment effects method is similar to the 2-step Heckman correction but for uncensored data in which the dependent variable is observed for all cases. The first step is a probit model that predicts the probability that a village will fall into one project category or the other. It also calculates an adjustment factor that is included as an explanatory variable in the second stage equation, which is an OLS regression to predict the outcome variable. The treatment effects model uses OLS instead of tobit for the analysis of soil conservation status. Although the tobit is a better specification than the OLS, there was virtually no difference between the two in the model that does not correct for selection bias.

Explanatory variables

Each model uses a separate but overlapping set of explanatory variables. In all of the models, the variables explaining the performance indicators include agroclimatic characteristics, project inputs, economic factors, and social organization.

Project category: The factors determining a village's selection by a given project were described in detail above and in Appendix A, so the dependent variables are listed here without much discussion. They represent conditions prevailing in 1987, before the projects began. Altitude range (the difference between the highest and lowest points, in meters) is important since many projects seek to work in areas with high potential for water harvesting. Infrastructure variables include the distance to taluka headquarters, the population density in 1990 (which is positively correlated with most indicators of infrastructure development), percent area irrigated, adequacy of drinking water availability, distance to market, distance to the nearest bus stop, and distance to the nearest public health center. Other infrastructure variables are omitted due to high correlation with those included. One such variable is the existence of an old COWDEP project in the village; it is omitted from the analysis because it perfectly predicts the existence of a current project, making the multinomial logit infeasible. Variables representing social conditions and social institutions are whether the village practiced shramdan, the number of communal groups, and the male literacy rate. Male literacy was used instead of overall literacy or female literacy because the latter were highly correlated with some of the infrastructure variables.

Soil erosion: Each village is assigned a score representing the extent of erosion based on a transect of the village's agricultural land. The score is a weighted average of scores assigned for smaller segments of land crossed during the transect. A detailed explanation of the transect is presented in Appendix B.

1987 variables are used in the model of determinants of soil erosion conditions, since erosion is a long-term process. 1997 values would not be the correct explanatory variables for conservation measures that took place prior to 1997. Agroclimatic variables include the village's altitude range, which is reflected in the transect route and determines susceptibility to erosion; mean annual rainfall (measured only at the taluka level) and the share of the transect line under irrigation, rainfed agriculture and pasture. Irrigated plots have the most conservation and the least erosion on average; pasture plots are on the opposite extreme, so the share of each type of land is an important controlling factor in the analyis.

Social institutions and characteristics include a dummy variable indicating whether *shramdan* is practiced in the village, a dummy variable indicating the presence or absence of a strong leader (determined subjectively by the investigators, who spent several days in each village), and the number of different communal (caste and religious) groups in the village. Literature on social organization in India suggests that *shramdan* is an indicator of social organization and collective action that may contribute to better land management, particularly in the commons, whereas greater communal diversity may increase the coordination costs of working together. The expected impact of a strong leader is ambiguous, depending on the interests of the leader (Wade 1988).

Economic factors include infrastructure, such as the presence or absence of a paved road, distance in km to the nearest bus stop, distance in km to the taluka headquarters (the nearest town, where markets and other services are located), population density (inhabitants per sq km), and the percentage of people in the village who earn most of their income from a source other than cultivation, livestock or agricultural labor. Population density, infrastructure and access to markets can increase the pressure on natural resources, but they can also raise the returns to better land management. Off-farm income also has an ambiguous effect; it can help finance land improvement or it can lead people to focus their interests elsewhere, making them less willing to participate in social action to develop the village's natural resources. Finally, as discussed above, project inputs are represented by dummy variables for each project category. Variables are available for the percentage of each village covered by the project and the number of years of project activity, but these were highly correlated with the project dummy variables and did not vary much across project category, so they are omitted.

Change in irrigated area: The model of change in percent irrigated area uses mainly explanatory variables representing changes in conditions between 1987 and 1997, along with some variables representing initial conditions or factors that never change. Fixed or nearly fixed factors include average annual rainfall, a dummy variable indicating whether the village lies in the upper part of the macrowatershed, which is hypothesized to have a negative effect on irrigation potential. The Maharashtra government has mapped the entire state into macrowatersheds, so it is easy to know in which part each village falls. Population density is given for 1990, the only year in which it is available; it provides an initial condition that is correlated with relatively good infrastructure at the start of the project period. Infrastructure factors that change over time include changes in the distance to a bank, a bus stop, and a regulated market, a dummy variable indicating whether a better road was built in the village, a dummy variable indicating the introduction of electricity for irrigation pumps, and the change in the percentage of houses electrified during the project period. Socioeconomic factors include the practice of *shramdan* in 1987 and the percentage of households primarily engaged in agriculture; this is hypothesized to be negatively related to availability of off-farm income to finance irrigation but positively related to the incentive to invest in land improvement. Project category variables are straightforward; an additional variable is included to cover the total number of years under a watershed project, since longer project duration is expected to bring larger benefits.

Returns to cultivation: Finally, variables for the plot-level analysis of returns to hectare include village-, plot-, household-characteristics. 1997 values are used for variables that change over time since cultivation took place in 1997. The plot characteristics include area, land capability classification (which incorporates both slope and soil fertility), the rank of the plot within the farmer's overall holding, and the number of seasons the plot is cultivated each year. Household characteristics include the farmer's total land holding size, percentage of income that comes from off-farm sources, the number of household workers, and the cost of past soil and water conservation investments. Village-level characteristics dropped in the plot-level analysis include the altitude range and the percentage of people in the village who work off-farm.

Although this model is estimated using data for both states, a state-level dummy variable is not used because it is so highly correlated with many other explanatory variables. Government policies affecting agriculture do not differ greatly between the two states, but there may be other state-level differences that are not accounted for in this model.

Irrigation is probably the single most important determinant of net returns to cultivation; the mean annual net return on irrigated plots was Rs 29,770 but only Rs 1867 on rainfed plots. Since irrigation is likely to dwarf the effects of all other factors, irrigated plots are omitted from this analysis, leaving a sample of 246 plots from 29 villages.

4.c. Results of the Econometric Analysis

Determinants of project category in Maharashtra

The multinomial logit analysis supports some of the descriptive findings about project selection but not others. With control villages as the base category, the analysis shows the following (table 4). All projects have a greater range in altitude between the highest and lowest point in the village compared to control villages, and this difference is significant for all except the NGO-government collaborative projects. This is to be expected since hilly areas are most suited for water harvesting. All project villages also are more likely to have more communal diversity, and the difference is significant for the NWDPRA and DPAP villages. NWDPRA villages are likely to be more densely populated and NGO villages less densely populated than control villages, but this difference is not significant. NGO villages are significantly further from markets than control villages, and their literacy rate is lower. They also are more likely to practice *shramdan*, but the difference is not significant. Government-NGO projects are signficantly more likely to practice shramdan, and they are significantly more likely to be located further from the nearest public health office.

Conducting the analysis again using NWDPRA as the base instead of control provides further insights about differences between projects in different categories (as opposed to differences between project villages and control villages). In this case (not presented in a table), the NWDPRA villages are significantly likely to be more densely populated than the DPAP villages, and significantly less likely to practice shramdan than the NGO or NGO-government collaborative villages. They are likely to have more communal diversity than NGO-government collaborative villages, and they are likely to be closer to a public health office and villages in any other project.

Soil conservation at the village level

Table 5 presents the results of the analysis for soil conservation scores in the transect. Model 1 shows that NGO and NGO-government collaborative projects have highly significant, large positive coefficients, indicating that they contribute to good performance in soil conservation. This contrasts sharply with the small, insignificant coefficient for government projects under the MOA and MORD. In Model 2 the projects are aggregated to three categories and the finding is

the same. Other variables with significant coefficients in both models 1 and 2 include paved roads, which contribute to improved soil and water conservation status, and greater communal diversity, which has the opposite effect. By far the largest and most statistically significant coefficients are those for share of the transect line under different land uses; a larger share of irrigated land improves soil and water conservation status while a larger share of pasture land reduces soil conservation. This finding is expected for reasons described above. NGO and NGO-government collaborative projects also have a high coefficient. In comparison to the small, insignificant coefficient for government projects, this suggests that the NGOs' greater attention to social organization has a high payoff in stimulating conservation investment.

In the models presented in table 5, the variable indicating the presence of *shramdan* in 1987 was excluded from the models 1, 2 and 4 because of the high correlation between the practice of *shramdan* and the presence of an NGO project. Coupled with the significant, positive coefficient for *shramdan* in Model 3, there is reason to suspect that positive coefficients for NGO and collaborative NGO-government projects may be driven more by the practice of *shramdan* than the activities of the project. However, when models 1 and 2 were respecified to include the *shramdan* variable (not shown), the NGO and NGO-government collaboration dummy variables remained significantly positive while the *shramdan* variable was insignificant. Further work is needed to determine the optimal specification of the model in order to account for the effects of both project categories and shramdan.

The negative effect of greater communal diversity is consistent with expectations; it suggests that watershed projects can more easily achieve success in more homogenous villages but does not provide any clues about how to proceed in more diverse villages. (Suggestions in this regard are discussed in section 6.) The coefficient of roads, though small, suggests that the benefits of access to the outside world may outweigh the associated costs of increased pressure. None of the other infrastructure variables -- distance to the taluka headquarters, distance to a bus stop -- are significant.[5] This finding suggests that any effects of infrastructure on soil and water conservation are dwarfed by project inputs and land use status, which is not surprising since the projects make very large direct investments.

The treatment effects model to control for selection bias contains almost identical findings. In model 3, the project dummy variable represents all projects and is not significant, but in model 4 the project dummy variable represents only NGO projects and it is large and highly significant. All other significant variables are the same as in models 1 and 2. The similarity in findings among all the models suggests that the effects of selection bias are small, so it is not discussed for the remaining dependent variables.

[5]The data include many infrastructure variables such as distance to a regulated market, distance to an industrial unit, percentage of houses in the village that are electrified, etc. These were tested in other specifications of the model but were never significant.

Change in percent area irrigated

Table 6 shows that the change in irrigated area in the Maharashtra villages between 1987 and 1997 is determined by the percent area irrigated at the start of the period (1987), the population density, and mean annual rainfall. All watershed project variables are insignificant; in fact the project category coefficients are all negative, reenforcing the findings from the descriptive analysis that villages with projects had less increase in irrigation than control villages. This is notable given that raising the water table is the primary objective of all watershed projects in Maharashtra.

The large, negative effect of percent area irrigated in 1987 is expected because it indicates that much of the irrigation potential was already exploited before the watershed projects were initiated. In fact, table B8 shows that villages under the NWDPRA and AGY-IGWDP projects had substantially higher irrigated area than control villages in 1987 and this may have left less scope for further irrigation expansion in these villages.

The coefficient of 0.05 for population density means that percent irrigated area rises 0.05% with every inhabitant per sq km, or 5% for 100 inhabitants. This positive effect is expected since high population density should raise the incentive to invest in land intensification. Also, villages with high population density had relatively good infrastructure in 1987.

The positive coefficient of rainfall most likely reflects greater recharge capacity of aquifers in high rainfall areas.

The small, insignificant coefficients of most of the variables representing changes in infrastructure may reflect the fact that most kinds of infrastructure did not change in most villages, so the effect is difficult to capture in the regression. The coefficient of an improvement in the type of road is relatively large, indicating that improving the road brought a 5.6% increase in percent irrigated area, but it is significant only at 20%. The large negative coefficient of introduction of electricity for agricultural pumps is surprising, but it is counteracted by the positive coefficient for the change in the percentage of houses that are electrified. Most likely agricultural power spread faster in rapidly electrifying villages than in those where agricultural electricity was introduced for the first time.

Finally, the negative signs of the project variables, along with the insignificance of the variable representing the total number of years under any kind of project, require mentioning a few caveats. First, the analysis has not been carried out with the adjustment for selection bias, but results for the soil erosion model (table 5) suggest that this is not likely to be of major importance. Second, changes in irrigated area are determined by numerous factors, some of which cannot be captured here due to data limitations. For example, no information was available about the nature of each village's aquifer. More detailed information might yield some signs of a positive project contribution to irrigated area. However, even with better data it is unlikely that the projects would demonstrate a major contribution to irrigated area. The regressions were repeated with the project categories aggregated into 2 and 3 categories, but there

was no difference in the finding. These models included a variable indicating the practice of shramdan, but its coefficient was small and insignificant.

A similar regression was run at the plot level since village-level measures of change in irrigation might be too blunt to capture in a regression framework. In that model, the dependent variable is the change in the number of seasons irrigated per year. However, the results (not shown) were very similar; only the plot's irrigation status in 1987, with a negative coefficient, was a consistently significant determinant of the change in the number of seasons irrigated. None of the project category variables were significant, but the signs for projects operated under the Ministry of Agriculture (NWDPRA, World Bank and ICAR) were positive while others were all negative. This finding is unexpected as the Ministry of Agriculture projects focus the least on raising irrigated area.

Net returns to cultivation

Table 7 shows the findings regarding returns to cultivation.[6] In this case the model is not corrected for selection bias since it was shown not to matter in the earlier analysis.

The table shows that NGO and NGO-government collaborative projects have a significantly positive contribution to net returns on rainfed plots. Projects under the MORD also have a significant positive return, and those under the MOA -- the NWDPRA, the World Bank Pilot Project, and the ICAR Model Watershed Project -- have a positive but insignificant coefficient. The coefficient for NGOs is significant at 1% while those for the NGO-government collaborative projects and MORD are significant only at 10%.

The finding that MOA projects have the least impact on net returns per hectare on rainfed plots is disappointing because these are the projects that devote the most attention to rainfed agriculture. The positive contribution of NGOs is interesting because NGOs place less emphasis on technical assistance than government projects. In fact, some NGOs have no staff with technical skills. On the other hand, many NGOs lobby government agencies to provide better service to the villages in which they work, and this may bring additional technical expertise. In addition, they help farmers work together to buy inputs or outputs at better prices, contributing to increased profit margins. The finding of higher profits is supported by additional findings (not presented here) that farmers in NGO villages use more fertilizer and improved varieties than farmers in other villages.

High quality land has a positive coefficient, as expected, as does the value of soil and water conservation investments made prior to 1987. However, the coefficient of the latter is very small, suggesting a low return to such investment. The coefficient of 0.028 suggests that each

[6]The model was also run with gross returns instead of net returns as the dependent variable, and the results were roughly the same. Net returns is the more relevant number but it may suffer from inaccuracies because imputed values of family resources may be overestimated.

rupee of investment resulted in a 2.8% increase in current annual net returns to cultivation. The value of more recent conservation investments has a much smaller, statistically insignificant return; this may be because the full benefit of soil and water conservation investment is realized with a lag. It may also reflect the fact that some of the more recent investments were made by the watershed projects but not always maintained by the farmer. The number of seasons cultivated has a positive effect on net returns, as expected. Rainfall also has a positive coefficient. This makes sense in the dry areas covered by the study, but it may also capture other regional variations. Further analysis of the data is needed to check this.

One unexpected finding concerns the significant, negative coefficient of the variable indicating that the village lies on a paved road. Roads should improve access to markets, thus reducing the costs of buying inputs and selling crops. Additional examination of the data is needed to know what drives this finding.

Summary of econometric results

The econometric analysis shows mixed findings, but the overall points are as follows:

- NGO and NGO/government projects have a positive, significant impact on a measure of natural resource management (soil conservation) and agricultural productivity (net returns to cultivation of rainfed lands), while government projects do not. Neither has a positive impact on irrigation.

- Infrastructure variables show some limited effect on the same outcome variables. A paved road contributed to better soil conservation status but lower net returns. Population density had a positive effect on irrigation; it is not clear the extent to which this indicates the effect of land scarcity or that of infrastructure, since population density is positively correlated to various types of infrastructure. Distance to the taluka headquarters, where many services are located, had a negative but insignificant impact on soil conservation and net returns, meaning that villages located further from the taluka headquarters had less soil conservation and lower net returns.

5. Findings from Qualitative Analysis

As mentioned above, qualitative data focused largely on project impacts on specific interest groups in each village. The discussion here focuses primarily on landless people, many of whom earn a living herding sheep or cows, and women. The findings are summarized here and presented in more detail in Appendices D and E.

5.a. Perceptions of Positive and Negative Effects of the Watershed Projects

As mentioned above, qualitative data focused largely on project impacts on specific interest groups in each village. The discussion here focuses primarily on landless people, many of whom earn a living herding sheep or cows, and women. The findings are summarized here and presented in more detail in Appendix D.

Landless people

Landless people indicated overwhelmingly that they had benefitted from labor employment provided directly by the project. In fact, employment was the most commonly cited project benefit among all respondents. However, landless people rarely reported any other benefits, and they expressed concern that employment opportunities would dry up when project activities ceased. In some villages respondents said they thought that employment had risen permanently due to an increase in irrigated area stimulated by the project, but this was not common.[7]

Livestock herders in many villages complained that they had suffered from loss of access to their traditional grazing lands, which were sealed off under the project to promote regeneration. All of these projects had provided employment opportunities to the herders, but they said it was not enough to compensate their loss. This problem commonly arose in Maharashtra, where landless, low caste people are a small minority in most villages and the decision to close the common lands was based on a majority-rule vote. In some villages herders said that they had been promised that access restrictions would be temporary while vegetation was allowed to regenerate. However, they complained that regeneration had already taken place but the common lands remained off-limits to them. Ironically, such inequity is more likely to be a problem where projects succeed in productivity and environmental objectives. In other places, herders were able to ignore grazing restrictions, protecting their immediate livelihoods but undermining project objectives.

A few NGOs, particularly in Andhra Pradesh, have worked to overcome this kind of problem by trying to build interests of different groups into the project design at the outset. For example, in some projects landless people are granted fishing rights in the water bodies protected by soil conservation and revegetation. Projects may encourage farmers without irrigation to dig group-owned wells so that they have an interest in promoting groundwater recharge. Outside of the study area in the famous Sukhomajri and Pani Panchayat projects, landless people even own tank or lift irrigation water rights which they utilize by leasing in farmland or, in the case of Sukhomajri, sell to other farmers. And in several Andhra Pradesh villages not covered by any kind of project, shepherds lease cultivated land and manage it as pasture. Such an arrangement could be made in a watershed project as it would give the shepherds an incentive to manage those lands more productively. A wide assortment of such arrangements can be devised to spread the benefits of watershed development and, as a consequence, increase its chances of success.

Women

Women are an important but often-ignored part of the farming community in India. Guidelines for all projects contain language about promoting women's welfare, but in practice virtually no projects created a role for women or addressed their interests. For example, almost all projects

[7]Findings in table 6 showed no significant difference in increased irrigated area between control villages and those under any of the projects.

reserve one position in the village watershed committee for a woman, but in every case she turned out to be a token who played no role. This is not surprising as an individual woman on a male-dominated committee in rural India will always find it difficult to make her voice heard. Moreover, women are a heterogeneous group whose diverse interests cannot normally be represented by just one or two women.

Women rarely were aware of project objectives or activities simply because they never had a chance to learn about them. They were excluded from the technical training provided to men, and this limited their opportunity to participate in activities or accept responsibility. For example, they could never hold supervisory positions in earthmoving work, so their only contribution is unskilled labor. Even in wage employment they are discriminated against as project agencies pay them less than male workers.

Project officials rarely understood that watershed projects can increase women's workloads. This happens for two reasons. First, if a project succeeds in raising agricultural production, women will have to devote more labor to various cultivation operations. Second, restrictions on collecting fodder and fuelwood from common lands forces women to collect these resources elsewhere, increasing the time they must allocate to these tasks.

Project activities for women have been limited to establishing women's groups and introducing income generation activities. Although the women's groups have made positive contributions towards enabling women to express their needs, these groups have not served to integrate women into the mainstream project activities. The income generation activities have had limited impact on women's economic empowerment.

Just as some projects have taken innovative steps to incorporate the interests of landless people and herders and give them a role in project management, all projects can do the same for women. A few simple steps that can be easily adopted are to ensure that women attend all project meetings (in part by scheduling meetings at times when women are available to attend), give them 50% representation in project committees, listen to them to find out their interests and concerns, identify the contributions they can make, and train them in various watershed activities, among other things. The findings regarding project impacts on women and recommendations for improvement are presented in more detail in Appendix E.

5.b. Respondents Priorities for Developing the Village

Respondents were asked about their priorities for developing their village and their ideas about how to go about turning their ideas into reality. While few respondents had suggestions about how to implement their ideas, all of them were able to list their priorities. Many respondents made multiple suggestions; they are listed in table 8.

As is the case with much of the data collected for this study, responses from the two states overlap but have some significant differences. In Mahrashtra, the three most commonly listed priorities are improved medical facilities, better roads, and better drinking water supply, followed

by increased irrigation and improved educational facilities. In Andhra Pradesh, improved medical facilities are mentioned most commonly by far, followed by better roads, latrines and better bus service. Table 8 shows other priorities also listed, including several that were listed too infrequently to warrant inclusion in the main body of the table.

While there were no significant differences across project categories, there were differences across landholding categories; larger landowners tended to be more interested in irrigation, watershed development and credit, while landless people were more interested in improved housing, electricity and latrines.

6. Priorities for Future Directions in Watershed Development

This report began with the hypotheses that participatory approaches yield superior project impact and that favorable economic conditions and good infrastructure also support better natural resource management and higher productivity. This section presents recommendations for future investments and watershed approaches based on the analytical findings from both the Maharashtra/Andhra Pradesh study (sections 3, 4 and 5) and the Karnataka/Rajasthan/Orissa study (Appendix F). It describes the best practices found in the most successful projects and discusses the opportunities and constraints facing government projects attempting to adopt these approaches. The experience of the Ministry of Rural Areas and Employment (MRAE) in implementing new guidelines for participatory watershed development provides some lessons, and they are discussed here. Some specific steps that all projects can take immediately are presented, along with suggestions for bureaucratic reforms that will be needed to enable government projects to become more participatory in the future.

6.a. Infrastructure Development Supports Watershed Development

Tabular analysis summarized in Section 3, and presented in detail in Appendices B and C, shows that villages with the greatest improvements in performance in agricultural production between the pre- and post-project period were those with improvements in infrastructure. This relationship is also somewhat evident in the econometric analysis presented in section 4 above, as village-level soil erosion scores are significantly better in villages linked by a paved road, and irrigation increased more in villages with high population density. Stronger association might exist, but the econometric analysis suffers from the fact that changes in various types of infrastructure were found only a small number of villages, so the sample may be too small to capture the effect. Respecification of the models might yield a stronger link. Also, analysis at the district level by Fan and Hazell (1998) clearly suggests that improved infrastructure raises agricultural productivity. This would suggest that the growing interest in India in an approach dubbed “watershed plus”, in which watershed and infrastructure investments are designed to complement each other, has merit.

Another reason to believe that infrastructure is important is that respondents consistently list various forms of infrastructural improvements as their top priority for developing their village, as shown in table 8 above.

Infrastructure development is important regardless of the extent of people's participation, but there is also a role for participation in infrastructural improvement. In short, people should have a say in what kinds of infrastructure investments are made; this is part of the idea behind the Panchayat Raj legislation for decentralized government. A further distinction is that people should also be able to choose between watershed and infrastructure investments. In a truly participatory environment in which villagers are equal partners, they should be able to determine whether scarce investment funds should be devoted to watershed development, infrastructure development, or both. It is easy to imagine that some villages must be in greater need of improved infrastructure than watershed development, so there should be flexibility to make this judgement. This is especially so given the small impact of the large amount of funds devoted to watershed development in the past.

6.b. Best Practices for Successful Watershed Development

The quantitative analysis of Andhra Pradesh and Maharashtra has shown that projects managed by NGOs and in collaboration between NGOs and government organizations have performed better than strictly government projects, which in many cases do not show significant improvement over conditions in control villages. The RRA study of Karnataka, Rajasthan and Orissa also shows support for programs with an NGO component, including those with bilateral funding. While the NGOs have an advantage in that devote more attention and resources to any given village in which they work, their good performance also results from characteristics of their approach that government projects would be able to adopt as well.

Before discussing the best practices for successful watershed development in rainfed areas of India, it is worth reiterating some of the characteristics of these areas that distinguish them from irrigated lands and the most favorable rainfed areas. In irrigated areas, transferring green revolution technology was relatively simple because improved seeds and other inputs were well suited to millions of farms covering huge areas. The new technology was so profitable, with relatively little risk, that farmers were willing to abandon traditional farming systems in favor of new approaches. In less favorable rainfed areas, on the other hand, the success of technical interventions often depends on location-specific biophysical and socioeconomic conditions and requires collective action by local people. Farmers pursue complex strategies for producing food and earning their livelihoods. Many apparently attractive production technologies have not been adopted because they are incompatible with existing livelihood systems, thus imposing unacceptable opportunity costs (Walker and Ryan, 1990). Early watershed projects all introduced technologies for conservation and production without any input from farmers, all on the basis of trials in experiment stations far from the village and devoid of socioeconomic constraints. The lack of sustained maintenance or adoption under these circumstances is not surprising given the difficult conditions prevailing in many rainfed areas.

This background helps explain why people's participation is the key feature of best practices for watershed development. All projects claim to take a participatory approach, but clearly the term "participation" means different things to different people. In the most innovative and successful NGO projects, participation means that local people are full partners in the watershed

development program, with both the authority to determine how the project proceeds and the responsibility to help plan, implement and pay for it. In most government programs, on the other hand, "participation" means convincing local people to go along with the predetermined project design. Our findings suggest that full participation is critical to project success, and this should not be surprising given the special characteristics of rainfed areas.

1. Attitude comes first: project staff consider local people as full partners

The most important — and perhaps most challenging — aspect of a truly participatory approach is that project staff must consider local people as equal partners in the watershed development program. Embracing this attitude is critical to project success because it enables adoption of all the specific participatory measures listed below, and to tapping the imagination and creativity of local people to develop project innovations. Senior staff of the best NGOs all share this attitude that they are no better than the people whom they serve, as do some government project officials, especially those in the higher ranks.

Spreading the attitude of equality throughout the watershed profession is not a trivial problem in a system where the traditional management approach is hierarchical and educated professionals have always been led to believe that they are superior to poorly educated program beneficiaries (Fernandez 1994:23, GOI&Danida 1996:50). A change in attitude is critical, however, because of the importance of understanding local biophysical and socioeconomic conditions in watershed areas. Under these circumstances, local knowledge is at least as important as a graduate degree and impressive professional credentials.

While the superior attitude of project staff is especially common in government projects, it can also be found in NGO projects. Some NGO officials think of themselves as saviors of the helpless rural people, a perspective that is not conducive to an equal partnership. Harnessing local skills and ideas requires believing that local people are capable of solving their own problems (with assistance in getting organized and tapping existing public services). Even in NGOs where senior officials are highly committed to full participation, teaching younger staff members to follow suit may be a challenge. Often the young NGO recruits would have preferred to obtain a government job and, being young and ambitious, they are enamored by the idea of being important and respected. Treating villagers as equals may not come naturally to them (Ajay Mehta, Seva Mandir, personal communication).[8]

Building the bureaucracy's capacity to embrace participatory approaches will require fundamental changes (Thompson,1995:1522). First, people in the bureaucracy need exposure to new ideas and a new attitude about their relationship with villagers, for example through training programs. However, opportunities and incentives to participate in training are inadequate (Turton and Farrington, 1988:8). Second, training will have little or no lasting effect without

[8]Superiority carries benefits, of course; as a result, many professionals are not only uninterested in promoting people's participation, but they are even threatened by it (Fernandez 1994:68; ODA 1997:5).

changes in incentives that cause people in the bureaucracy to feel the need to learn to change the way they work (Thompson, 1995:523). Senior members of the bureaucracy can lead by example, but they will also require support from changes in incentive systems that encourage their staff to change their attitudes. Some suggestions in this regard are discussed below.

2. Social organization addresses the needs of each interest group to give them an integral stake in the project s success

The best NGO projects recognize that rural communities are heterogeneous, composed of social groups with diverse, sometimes competing interests. These groups may include people of different castes, land holding status, occupation, gender, etc. Some groups are always more politically powerful than others, who may have little or no say in decisions that affect their well-being. Accordingly, some NGOs in Karnataka and Andhra Pradesh organize communities for watershed development by working separately with each interest group they can identify. They help each group become organized and then mediate negotiation between groups, ultimately brokering a watershed development approach in which every interest group stands to gain from overall project success. This approach was discussed in more detail in Appendix A and Appendix F, where it is referred to as the building block approach.

Other participatory projects, particularly those in Maharashtra, devote a great deal of effort to social organization but they are less careful to address the interests of each social group. In particular, project plans are approved not on the basis of consensus among interest groups but by a simple vote requiring a 51% to 70% majority (depending on the project). This approach is easy to implement in Maharashtra with its relatively homogeneous social structure, but often it means that the landless minority has no say in the project design. As mentioned above in section 5 and discussed in detail in Appendix D, typically shepherds have no say in project plans that remove their access to traditional grazing grounds. In some villages the shepherds ignore the grazing bans, undermining the project, while in other villages the grazing ban is enforced and the shepherds suffer. In this case equity and productivity objectives are in conflict.

Under the building block approach, on the other hand, measures could be introduced to give shepherds a stake in protecting grazing lands, for example by granting them rights to other project benefits that depend directly on the grazing ban. As mentioned above in section 5, the famous Sukhomajri project followed this principle, granting irrigation water rights to shepherds who agreed not to graze the catchment area of a small irrigation tank. These and similar approaches are discussed in Appendix D.

Also, it would be easy to devote greater attention to addressing women's interests. Women make up half the farming community, but watershed committees typically include only one woman who is inevitably a token. Reserving half of the membership for women, or working separately with women's groups to enable them to articulate their interests on their own, would be a positive step. For this to work, meetings will have to be organized around women's schedules to reduce interference with housework and child-rearing duties. Technical training for watershed

work should also be targeted to women so that they can have greater capacity for decision-making. Working with women as part of social organization efforts would reveal the best opportunities for women to contribute to and benefit from watershed development.

Social organization is so important that it calls for employing project staff who specialize in this area.[9] All NGOs employ staff trained in social organization skills, whereas none of the government projects do. In some government projects agriculture graduates are responsible for organizing villagers even though they do not have the proper training. Typically they are able to do little more than inform villagers that they must form a watershed committee. Other government projects subcontract social organization to NGOs, which is a good idea since they do not have the necessary personnel in-house. But this should only be an interim approach while government organizations develop these skills. Otherwise they will continue to consider people's participation as a discrete activity, such as establishing a committee or informing villagers about the project plan, rather than a process that should underlie every activity.

Evidence from projects visited in Karnataka, Rajasthan and Orissa shows that social organization as conducted by NGOs is relatively inexpensive. Less than 3% of the total project funds are spent on awareness building in the Danida (Koraput) project. The per hectare costs of employing NGOs ranges from Rs 500 in SIDA (Pratapgarh) and Danida (Koraput) to about Rs 1050 in SDC (Bidar). These costs are highly affordable considering the potential contribution of thorough social organization to long term project goals.

The major constraint to social organization is not cost but the supply of trained personnel. Currently there are not nearly enough people in the country who are trained in the necessary skills. Further training is a high priority.

3. Project funds flow only after villagers prove they can work collectively

Organizing communities and building social institutions for the long term is a complex task. It requires that each household in a community undertake the effort to work collectively with all the others, including those from other communities or social classes with whom they have never cooperated before. It also requires that every household make sacrifices in a process of give-and-take so that in the end, everyone is willing to go along with the watershed project. Under the building block approach to social organization, which is necessary to establish social institutions to promote long term sustainability, productivity and equity requirements, organizing people is slow and requires patience.

The best projects undertake this difficult process without providing any funds for development activities that require social organization as a prerequisite. They may provide funds for unrelated

[9]The need to employ staff with social skills is not unique to India or to developing countries. The Landcare movement in Australia found that recruiting staff members with social skills contributed to improved performance there as well (Campbell 1994).

community needs, such as drinking water facilities or a temple, and they help establish credit groups that help people save money and obtain credit while also learning organizational skills. However, no funds are made available for watershed development until the people have shown that they can work collectively and adhere to agreements to control grazing, maintain investments, and share benefits equitably. They wait for six to eighteen months before investing in watershed development, depending on the project.

Offering funds before such social arrangements are solidified is dangerous because it may lead to superficial social organization that will not be sustained after project funds and staff are withdrawn. In short, field observations suggest that people will quickly establish a watershed committee and demonstrate some token collective action efforts if that is all it takes to qualify for a large injection of development funds. Projects such as the World Bank-assisted IWDP, the NWDPRA, and some second-rate NGOs operate this way. Some project implementation agencies under the MRAE's new guidelines also have pursued this approach (Turton and Farrington, 1998: 6), although this is not the intention of the guidelines. A study by ICRISAT (1996) showed that watershed committees established rapidly under the IWDP in Rajasthan were unable to maintain grazing restrictions once project funds were withdrawn.

Finally, withholding funds until after social organization is feasible under a large project. The World Bank's Rural Water Supply Project in Uttar Pradesh takes this approach with favorable results (Benoit Blarel, World Bank, pers com.)

4. The project is designed and technologies are selected in full participation with local people

The best projects do not adhere to rigid, pre-established work plans, which undermine participation because they limit local people's ability to influence the project design. Instead, in participatory projects the staff work hand-in-hand with villagers to develop the project plan according to the local conditions and the needs of the people. For example, local terrain, land use patterns, soil types and availability of raw materials may determine which technical interventions are most suitable and how they should be carried out. Similarly, local social institutions and livelihood strategies may determine the best management strategies for resources such as trees, pastures and water. Flexibility is critical to choose the best approach for a given location.

Closely related to participation in planning the project design is participation in choosing the technology to be introduced on a farmer's field. As mentioned above, early watershed projects all prescribed the technology to be used in each project, and farmers often rejected the recommended approaches because of conflicts with existing farming systems. Some current projects like the NWDPRA and World Bank projects still place severe limits on farmers' role in choosing their own technologies, and maintenance of investments made under these projects remains low (table 3). Most projects with an NGO component, on the other hand, have taken a much more flexible approach and have better results to show for it.

Technical experts in many watershed programs are uncomfortable with the idea of allowing farmers to choose which technology to use because they may select something that is suboptimal from a technical perspective. However, farmers' interests are generally consistent with watershed objectives, mainly because conservation and productivity objectives are complementary in the SAT. As mentioned above, this is because measures that conserve moisture also conserve soil. Also, as shown in section 3, if farmers do not want a given technology they will not maintain it, in which case it will have no effect at all. For this reason, the most effective technology may be only second-best from a technical perspective (Kerr and Sanghi 1992).

In any case, a sensible approach for selection of technology is that technical experts from the project staff can teach farmers about a wide variety of improved technologies. Farmers should be encouraged to test and adapt the new ideas, but ultimately they must make the decision of what to adopt on their own plot. Also, projects should begin by investing in project components in which people are most interested, and then expand the scope of the work later, after sustained interaction between project staff and local people brings greater trust and awareness of new ideas (Vaidyanathan, 1989: 19).

5. Target orientation is relaxed

Government projects traditionally have been planned and evaluated on the basis of achieving physical targets. This approach makes planning and evaluation easy and objective, but it is not conducive to successful watershed development. Watershed development is as much a social problem as a technical one, and social organization takes time. Target orientation makes time scarce, so it discourages project staff from taking the time to resolve conflicts, gain people's input on technology choice, or insist on cost-sharing (Adolph 1996: 4, Thompson 1995: 1529). This leads projects to invest funds without adequate assurance of post-project maintenance.

Targets cannot be abandoned completely because they help establish accountability. Without targets, work in any given village might drag on endlessly. Many NGOs "adopt" a village and never leave, severely limiting the area that they can cover. On the other hand, the best NGOs have found a good balance between target orientation and stagnation. They specify in advance the number of years the project will operate in each village, with a social organization phase, an investment phase, and then and a pullback phase when responsibility for the project is gradually transferred to the people. Obviously this last stage will be much easier and more successful if the people already bore significant responsibility for the project right from the beginning. The payoffs of participatory planning and cost-sharing will be fully realized when it is time for project staff to withdraw.

6. The project and the local people share the costs of investment

Cost-sharing between local people and the project is a critical component of successful projects. Not only does cost-sharing stretch scarce project funds but, more importantly, it leads to higher quality work and better maintenance. As discussed in detail in Appendix F and in the analysis of

SWC investments in section 3, if farmers are required to help pay for project investments they will insist on accepting only those approaches that they truly want and intend to maintain. Cost-sharing also ensures that villagers will evaluate project inputs on the basis of their long-term productive impacts rather than short term benefits such as employment generation. If farmers do not contribute a substantial portion of the costs, they may lobby for labor-intensive investments that provide work in the dry season even if they do not contribute to long-term development. For this reason, participatory planning without cost-sharing can have a negative effect on achievement of project objectives.

Virtually all projects in India claim to require that farmers contribute to investment costs, but as discussed in Appendix A and Appendix F, cost-sharing in most projects is actually nothing more than a book adjustment, or sleight-of-hand in accounting. In particular, these projects employ farmers to plant trees or build bunds on their fields, paying them an official minimum wage that exceeds the market wage. They require that the farmers contribute 10% of the value of labor, but even after this amount is subtracted, the wage paid by the project is at least as high as the market wage.

In order to ensure that farmers are committed to maintaining work done under a project, their share of the cost must be high enough to remove the possibility of perverse incentives. Also, as discussed in section 3, higher project subsidies may be justified for some kinds of investments than others; for example, farmers are quick to invest their own funds for soil conservation on flat, highly fertile plots, but less so on sloping plots with poor soils. Since the latter are particularly prone to long term degradation, they should be targeted for project investment funds. Irrigated plots and the best dryland plots, on the other hand, should receive no project subsidies since farmers will invest their own funds there anyway.

In most cases administrative feasibility will require setting fixed subsidy rates for certain activities. Ideally, however, specific subsidy rates should be determined on a location-specific basis in consultation with local people. Project funding should be flexible enough so that funds saved on one activity can be allocated to another; this way project beneficiaries will have an incentive to accept higher cost-sharing requirements. MYRADA and Outreach, two NGOs operating in Karnataka, Andhra Pradesh and other southern states, have experimented with approaches like this. For example, in some cases community members jointly decide the level of subsidy for different kinds of investments, and project funds conserved through cost-sharing are then retained for other development priorities. More recently, both of these organizations have experimented with financing conservation investments entirely on the basis of credit with no subsidy at all. Initial experience appears to be favorable, but it is important to note that this approach became feasible only after a strong thrift group had helped farmers raise their savings and obtain informal credit (Mascarenhas 1998, Fernandez 1998).

Credit should be made more easily available everywhere to help farmers finance land improvement on rainfed plots. As discussed in section 3, banks have no funds available for this purpose, except under some special schemes that target specific introduced technologies that farmers may not want. This situation needs to be changed.

Many observers and project officials insist that substantial cost-sharing is unattainable, because they have seen first-hand how difficult it is to encourage beneficiaries to devote funds to project activities. But this is no surprise when one considers the villager's perspective of the typical development project, which is target-oriented and follows a pre-established design without local input. Target orientation discourages project staff from pursuing cost-sharing by farmers because it slows down progress, and pre-established project design too often leads to interventions that local people do not want because they are not suited to local conditions. As a result, project "beneficiaries" resist cost-sharing because they know that work will be done anyway and because they doubt that it will bring benefits worth paying for. If traditional physical target orientation is abandoned and local people are allowed to decide how to spend project funds, they will be much more interested in sharing costs. The experience of MYRADA, Outreach and also Chaitanya, an NGO in Andhra Pradesh, demonstrates that this is so.

Finally, cost-sharing in government watershed projects is complicated by the fact that many of them are funded through government employment programs in which it is illegal to pay less than the minimum wage. At first glance this appears to limit the possibility of serious cost-sharing, but with more careful thinking it is possible to develop creative mechanisms for cost-sharing that are consistent with employment programs and also have other attractive characteristics. For example, one approach is that a certain amount of money could be allocated in a given village for employment to build watershed structures. If a farmer wanted to obtain some of these resources, he could present an application, or proposal, for what he wanted to do. Once the proposal was agreed to, the farmer would do half of the work with his own resources (or hire laborers to do the work for him), and the employment program would pay for laborers to complete the job. The farmer would supervise to make sure the work was done correctly, and the laborers would be paid only when the farmer agreed that he was satisfied. The employment funds could be managed by a committee within the village in order to keep track of the funds available and disburse them as different farmers take advantage of the scheme. Such a committee would have to have strong representation by laborers who participate in the program (N.K. Sanghi and G. Sriramappa, personal communication).

It is important to note that this approach is just one of numerous possibilities. With a little creativity and imagination, a wide variety of innovative approaches can be developed for every aspect of participatory watershed development. The critical point is that projects should be flexible enough to take advantage of such ideas and test them under actual village conditions so that promising approaches can be identified.

7. The project and the local people jointly manage the budget

An equal partnership between villagers and project staff requires that they have joint control over how the budget is allocated. This is essential for two reasons. First, it reduces the likelihood of graft since project staff become accountable to villagers. Second, it is a critical prerequisite for villagers to have a greater say over project design and decision-making.

In the best NGO projects and the Indo-German project, the budget is fully transparent and villagers jointly decide how the funds are spent. Some other projects have taken the positive step of making the budget transparent to villagers, but they stop short of giving them joint control. This approach retains the benefit of reducing the opportunity for graft. It also encourages villagers to provide input about how funds are allocated, but ultimately their authority to affect the watershed plan is limited. Still, it is far better than the traditional project approach in which even the sarpanch does not know the extent of funds allotted to different activities. This is the practice in the NWDPRA and the Government of Maharashtra's Jal Sandharan project.

Even if projects are required to share budget information with the villagers, they might not do so without pressure. One way to address this is through a publicity campaign to inform all villagers of their rights. This can be done through the mass media as well as through public meetings. NGOs or other independent groups could be hired to create awareness so that local people, armed with information, can assert their rights. (Such a publicity campaign could cover all aspects of project management, including the obligation to satisfy the interests of politically weak groups.)

8. Field staff are encouraged to take initiative and participate with farmers

Implementing all of the recommendations listed so far will require that field staff have greater authority to make decisions. Field staff are in the best position to identify problems and solutions and to learn how project interventions fare after design and implementation, so senior officials must rely on them to report problems or suggest alternatives. In NGO projects this problem is less serious since the chain of command is small and senior officials spend a lot of time in the field. In government projects, however, this can be more difficult. Senior staff are mainly confined to their offices, and several layers of bureaucracy separate the state-level directors from low-level field staff, acting as a significant barrier to communication. In addition, in the traditional culture of the bureaucracy seniority and superiority are synonymous, so a major shift in attitude will be needed to decentralize authority. High-level officials must lead by example.

Some project staff will be keen to adopt participatory approaches but others may find it difficult. NGOs and bilateral projects try to encourage adoption of participatory methods through close monitoring, but this will not be feasible in large scale government projects because of its high cost. It will be easy to monitor outcomes, such as establishment of watershed committees, but monitoring processes is much more difficult.

Accordingly it is important to develop self-enforcing mechanisms to encourage participation. Two ways to do this are 1) to provide incentives to staff members and 2) to give project participants some leverage to enforce it. An example of an incentive to encourage staff members to work closely with villagers is to require that the watershed plan be presented to the taluka- or district-level office by representatives of different groups in the village rather than the project staff member, yet still hold the staff member accountable for its quality. Requiring that villagers contribute a substantial portion of project costs would also encourage participation since villagers would never pay unless they could have substantial input into project design. Adjusting the current approach to target orientation to allow more time for social organization would also help.

A variety of incentives could be developed to encourage workers to participate with project participants; a little imagination will yield numerous ideas.

Approaches to give villagers the means to influence how the field staff operate include giving them joint responsibility for designing the project and managing the budget, undertaking a publicity campaign to make them understand their rights, and providing them with a means to air any grievances about how the project operates.

In general, the bureaucracy needs to undertake a learning process to change attitudes and procedures (Thompson 1995: 1523). "Double-loop" learning is needed in which staff not only review their progress but also ask whether the existing way is the right way to do things (Liebenstein and Maital 1994: 257). Working in participation with local people will take bureaucracies into uncharted territories in which learning will play a key role. They will need the capacity to assimilate new information and make decisions on new ways of working at all levels. Authority must be decentralized so that field staff members can make decisions appropriate to the circumstances and then learn from their outcomes. Processes will need to be put in place to ensure that individual learning translates into learning by the organization as a whole.

The bureaucracies involved in watershed development tend to be highly rigid. They attempt to control all the actions of field staff as a way to increase effectiveness, but this leads to a narrow, inflexible approach that is actually less effective. Staff at lower levels, even at the state level, are not expected to think, but rather just to do as they are told. Project guidelines are prepared at the central government level, usually by outside experts. Even program reviews are conducted without involving the people actually who actually implement the projects, let alone the beneficiaries. It is remarkable the extent to which guidelines drawn up in Delhi or Jaipur can limit implementers and farmers from making sensible decisions. For organizations to be able to learn and to achieve useful outputs, they must rely less on planning, organizing and controlling as the means of increasing effectiveness and focus instead on developing vision and appropriate values (Senge and Sterman, 1992:354).

One highly innovative approach in a government project was found in the Department of Watersheds in Rajasthan under its first Director, who established a line of communication for every staff member to contact his office directly at any time, with a reply guaranteed within one day. Field staff were strongly encouraged to report problems or suggest new approaches. Unfortunately, even this isolated example of flexibility suffered due to constraints imposed from above. In one case, under the World Bank-assisted IWDP, a field staff member reported to the Director that vetiver grass hedges did not grow well in certain areas where rocky soils limited root penetration. He sought permission to use stone bunds in this area, since farmers had to clear stones from their fields anyway in order to cultivate. But this idea could not be implemented because the responsible office in New Delhi rejected it, insisting on adhering to the approach prescribed by World Bank officials in Washington! (Anirudh Krishna, Director of Watersheds, Govt of Rajasthan, personal communication, 1993.) The project continued to prescribe the use of vetiver grass and other vegetative barriers even in places where they were ineffective.

9. The village, not the watershed, is the primary unit of social organization, planning and implementation

Since people in rural areas are organized on the basis of villages, participating with them as a community requires using the village as the primary project unit rather than the microwatershed, which would be the logical unit of implementation in a purely technical program. All of the best projects studied here are organized around villages rather than microwatersheds; this facilitates implementation of all the participatory approaches discussed here. However, generally the successful projects are able to reconcile the village-based approach with the watershed orientation of the technical plan; they do so in two ways. First, they select villages in which the microwatershed and village boundaries nearly coincide, or in which the microwatershed falls within the village. If a microwatershed is larger than the village, they break it up into sub-units that are treated separately within each village. Second, they do not adhere rigidly to one set of boundaries or another; if the upper reaches of a microwatershed fall outside of the village boundary, or if part of the village falls outside of the microwatershed boundary, they treat it anyway. (It is easy to see that this principle could be followed in World Bank's approach of working in large macrowatersheds that cover multiple villages and microwatersheds.) Just as pragmatic considerations have caused virtually all projects to abandon contour bunds on farmers' fields in favor of "modified contour bunds" (boundary bunds across the slope), the watershed-based approach must yield to a modified watershed approach whose primary orientation is to the village.[10]

10. Projects operate in villages with favorable social conditions

Before deciding where to implement watershed development, some of the best programs screen villages to ensure that they possess social conditions that are conducive to successful watershed development. This is particularly important given the extent to which participatory approaches rely on project participants to help manage the project and make it successful. Also, one might argue that how the NGOs and NGO-government collaborative projects screen villages for their work is one of the most important determinants of these projects' success. The best examples of screening villages for favorable social conditions are the Indo-German Project and the Adarsh Gaon Yojana in Maharashtra, which work only in villages that practice *shramdan*, or voluntary community labor. *Shramdan* is a good indicator of capability to undertake collective action, which can contribute to watershed project success. In these same projects and also in some NGO projects in Andhra Pradesh and Karnataka, no project investments are made until the villagers have demonstrated that they can successfully control grazing on common lands. Details of the screening approaches taken by different programs are provided in Appendix A.

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[10]Kerr and Sanghi (1992) explain why virtually all farmers in the Indian SAT reject strict contour bunds that run through their fields. Although many project guidelines still proclaim that contour bunds must be installed on cultivated lands, field staff know that they can only gain farmers' cooperation if they accede to their preference for bunds aligned to plot boundaries. Watershed officials in even the most technocratic programs have come to accept this reality.

It is important to note, of course, that there is no single critical factor that should be used to screen villages for project participation. Critical social organization skills, and indicators of their presence, may vary by location. For example, projects in Maharashtra have selected *shramdan* as an important prerequisite, but projects in other states with different customs and traditions may find that other indicators are more important.

Selecting villages with favorable social conditions makes sense in a country where each state contains tens of thousands of villages and the watershed development budget is limited. Given that successful watershed development is a challenge under the best of circumstances, selecting villages with the most favorable conditions is good financial management. Many other investment options remain for villages not selected for watershed development; respondents in the present survey listed roads, schools, buses, telephones, drinking water, public health and many other services as being ripe for improvement (table 8). Also, in nonwatershed villages interventions can try to stimulate conditions favorable for watershed development so that it can be introduced later. For example, they can try to help develop social institutions that facilitate collective action, resolve conflicts, and give every community a voice in decision-making.

World Bank-assisted projects that work in large macrowatersheds encompassing numerous villages can pursue the approach outlined here. Work can begin in the villages with the most favorable social conditions, while in other villages steps can be taken to introduce better social organization. Of course, people in those villages can take exposure visits to the areas where work is underway. Also, if people in some villages are simply not prepared to work together in ways that are needed to support a good watershed project, those villages can be excluded from the work.[11]

11. Government departments operate in coordination with each other

Coordination among state-level government departments is critical to effective operation of large watershed projects, whose activities fall under the domains of numerous departments. Typically these include the departments of soil and water conservation, agriculture, minor irrigation, forestry, rural development, animal husbandry, and sometimes others. Turf wars and incomplete, poorly implemented works are the result when these various departments do not operate in a coordinated manner. Some states, including Maharashtra, Karnataka, Rajasthan and Orissa in this study, have established departments watershed development staffed by members of all the concerned line departments. But experience suggests that this is not enough. As discussed in Appendix A, in the Maharashtra Department of Water Conservation (Jal Sandharan), interdepartmental coordination was effective at higher levels but not at the field level, thus hampering operations on the ground. This is an area in which progress is being made but further

[11]In principle, the current World Bank-assisted IWDP follows such an approach, so it should not be difficult to pursue it again in future projects. However, the IWDP's standards are too lenient and must be reformed in future projects. Delaying the release of project funds, requiring substantial cost-sharing, and generally placing more responsibilities on project participants would discourage them from joining the project unless they are seriously committed to long term natural resource management.

encouragement from senior officials is required. The Indo-German Project and the Adarsh Gaon Yojana have handled this issue well; Farrington and Lobo (1997) discuss the intricate approaches taken by the Indo-German Project to iron out interdepartmental administrative complications.

Another problem of administrative coordination in Maharashtra is that Jal Sandharan does not have its own funds. It draws funds from the DPAP and the NWDRPA at the central government level and the Employment Guarantee Scheme (EGS) at the state level. As discussed in Appendix A, sometimes project works dependent on EGS funding have been interrupted due to fluctuations in the demand for EGS funds in a given village. This makes effective planning difficult and leads to piecemeal implementation. Funding on a project-by-project basis is okay as long as project officials know in advance what level of funding they will receive.

12. Monitoring and evaluation must be taken more seriously

This study suffered from a lack of good data on agricultural productivity and natural resource conditions, but this lack of information has other implications that are much more serious. In particular, it means that government planners lack sufficient data to draw firm conclusions about the returns to different kinds of watershed development investments. Given the vast size of the budget for watershed projects, better information about their performance would go a long way toward more cost-effective government planning. Currently too many funds are allocated on the basis of too little information and, as the findings from this study show, the potential for waste is great.

The data shortage takes two forms: 1) a lack of baseline data against which to compare current conditions, and 2) a lack of monitoring data for easy assessment of current conditions.

Baseline data: Most projects collect at least a small amount of baseline data while selecting project sites and preparing work plans. In NGO projects, background data cover both agroclimatic and socioeconomic issues, while in projects managed by state-level government departments, the data are skewed toward agroclimatic factors. This reflects the technical orientation of most government watershed agencies. Government projects typically conduct detailed soil surveys before commencing work and prepare detailed land use maps. Many NGOs may collect similar data through less formal but equally detailed participatory rural appraisal (PRA) exercises. In both cases, however, typically there is no systematic mechanism for storing the data and making it available for comparison at a later date. Inquiries with government offices revealed that such records are often discarded once the project work came to a close. The reason is that for both government and nongovernment projects, baseline data are usually collected for the purpose of planning, not evaluation.

Monitoring: All government watershed projects keep detailed records of funds spent, structures built, and other physical targets, but such information reveals nothing about impact. It is purely a bureaucratic requirement to limit misuse of funds. Most NGOs also keep records of work done, and again, a small number of the better ones evaluate their own work. It is not known by the authors if any of them collect systematic data on a regular basis or if data are collected only at the

time of evaluation. The World Bank's Integrated Watershed Development Project (IWDP) provides a clear example of collection of detailed monitoring and evaluation data; this work is contracted to researchers at state agricultural universities who produce regular, detailed reports on the performance of technical interventions. The NWDPRA also has guidelines for monitoring and impact evaluation.

Three important problems remain, however. First, it is difficult to obtain the data that have been collected for monitoring. We tried to obtain such data for this GOI-sponsored study but could not. Second, the data are not organized in a common format across different types of projects, so they are not necessarily useful for comparison between project types. Third, the monitoring procedures under the IWDP and the NWDPRA fail to address socioeconomic issues or the implementation process. In the future, monitoring should address process in order to obtain a better understanding of the challenges and impacts of participatory approaches.

Common guidelines are needed: There is a strong need to develop common guidelines for collecting baseline and monitoring data. The difficult question concerns what kind of information should be gathered and at what level. It is best to keep the data set small so collecting and maintaining it do not become a burden. It would be easy for the Ministry of Agriculture and Ministry of Rural Areas and Employment to issue common guidelines for all projects within their jurisdiction, but generating common guidelines acceptable to multiple ministries and even NGOs would be more difficult. Accordingly, a high level meeting to develop a common framework for data collection should be a high priority. Such a gathering should include not only ministry officials but also representatives of NGOs and researchers in order to make sure that all parties' priorities are addressed and that a workable, usable system is developed. A tiny proportion of the vast watershed budget in each ministry could then be set aside for collecting and maintaining such data in a representative sample of all kinds of watershed projects throughout the country. A common interministerial cell could be responsible for monitoring watershed projects. Arrangements could be made to gather data from all kinds of projects, including those of NGOs.

Simple baseline data for each project could be collected at the village and household level and then updated every year. They would have to include a balance of socioeconomic and biophyical data. Collecting biophysical data can be time-consuming and prone to error, so there is a need for indicators that are as simple as possible to collect. For example, the National Remote Sensing Agency or its state-level counterparts could be contracted to provide satellite photos during critical periods of the year. At the start of each dry season, for example, satellite images taken at regular intervals would provide information on the rate of recession of vegetative cover and water bodies after rain has stopped falling (Merle Anders, USDA, personal communication). This would be a powerful indicator of moisture conservation and afforestation efforts. This technique could also provide information about the status of severe, highly visible soil erosion problems. Data from the satellite images could be transferred to computerized databases so that monitoring could be done quite effectively. This system would be much less prone to error than the kind of ground-level data gathering approach conducted in this study.

This approach has been undertaken sporadically for evaluating various watershed programs. For example, remote sensing images of a DPAP project site in Anantapur district of Andhra Pradesh clearly showed signs of successful water harvesting (S.P. Tucker, Dept of Rural Development, Andhra Pradesh, personal communication). However, remote sensing for evaluation is not undertaken on a regular basis. It needs to be institutionalized to contribute to a better understanding of the real impact of watershed development investments.

Aerial photos (from planes rather than satellites) are used in many countries to monitor natural resource conditions and plan or evaluate watershed development projects. Aerial photos could also be effective in India, but security laws currently restrict their use. Perhaps under a government initiative they would be made available.

The monitoring system currently used by the World Bank-assisted IWDP provide some useful ideas about collecting biophysical data, but they are weak on the socio-economic aspects. Better input from social scientists will be required as part of a balanced monitoring evaluation effort. Also, greater effort will be needed to incorporate the views of people in villages, since they are the ones most directly affected by the watershed projects and have numerous insights about their operation.

6.c. Conclusion: A Call for Caution

The findings of the analysis show that participatory watershed projects managed by NGOs have made a significant contribution to agricultural productivity and natural resource conservation in the study areas. More technocratic, top-down government projects, on the other hand, have fared less well. In fact, for many performance indicators the government projects did not perform any better than control villages with no project.

Collaborative projects between NGOs and government agencies have performed particularly well, and this appears to bode well for efforts to expand participatory approaches to a large scale. However, it is important to acknowledge that the NGO-government collaborative projects analyzed in this study have benefitted from favorable treatment that cannot be extended on large scale. For example, as mentioned above, all of their villages had been the site of previous watershed projects (as had almost all other projects in Maharashtra), and in most of their sites an experienced NGO had already been active in the village for several years. Moreover, as these were high profile projects subject to relatively frequent visits from high ranking government officials, project staff worked particularly hard and development funds for all kinds of activities were allocated on a priority basis. Such special treatment will not be possible as these projects continue to expand, so it is premature to draw conclusions about the potential for scaling up based on the findings presented here. However, these comments are not meant to detract from the good performance of these projects; resources should be allocated to experiment further with government-NGO collaborative projects and any other efforts to introduce more participatory approaches to government-funded projects.

The major lesson to be learned from this study is that most government watershed development investments have yielded disappointing results given the vast resources allocated to date. Lessons learned from early projects have been put to good use in more participatory approaches on a relatively small scale, but expanding them to a large scale remains uncharted territory. The new MRAE guidelines represent an attempt to scale up participatory approaches, but progress has been slow and there have been many pitfalls. The new guidelines represent a very favorable development, but it is unrealistic to think that they can be successfully implemented on a nationwide scale very quickly.

A strong argument can be made that watershed investments should slow down, focusing on experimenting with innovative participatory approaches, until there is sufficient capacity among government staff to work in a more decentralized, participatory way. However, given that large watershed budgets have already been put in place, the focus should be to use project funds to encourage such government reform. This could be done by disbursing funds only when state and district governments show that they are making progress in adopting more participatory approaches. The MRAE is already taking this approach. If it can help encourage bureaucratic reform it will represent an important spillover benefit that will offset slow progress in the actual watershed development objectives.

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Table 1: Performance indicators used to compare project performance

Performance criteria	Ideal indicators[1]	Proxy indicators used in this study
soil erosion	- measurement of erosion and associated yield loss	- visual assessment of rill and gully erosion (current only)
measures taken to arrest erosion	- inventory, adoption and effectiveness of SWC practices	- visual assessment of SWC investments and apparent effectiveness (current only) - adoption of conservation-oriented agronomic practices - expenditure on SWC investments
groundwater recharge	- measurement of groundwater levels, controlling for aquifer characterisitcs, climate variation and pumping volume	- approximate change in number of wells - approximate number of wells recharged or defunct - change in irrigated area - change in number of seasons irrigated for a sample of plots - change in village-level drinking water adequacy
soil moisture retention	- times series, intrayear and interyear variations in soil moisture, controlling for climate variation	- change in cropping patterns - change in cropping intensity on rainfed plots - relative change in yields (higher, same or lower)
agricultural profits	- net returns at the plot level	- net returns at the plot level, current year only
productivity of nonarable lands	- change in production from revenue and forest lands (actual quantities)	- relative change in production from revenue and forest lands (more, same or less than pre-project) - extent of erosion and SWC on nonarable lands
household welfare	- change in household income and wealth - nutritional status	- perceived effects of the project on the household - perceived change in living standard (better, same, worse) - change in housing quality - change in percentage of families migrating - perceived changes in real wage and availability of casual employment opportunities (higher, same, lower)

[1]All ideal indicators would be collected both before and after the project

Table 2. Location of the study villages

	Maharashtra	Andhra Pradesh	Total
village-level only	57	0	57
village, plot, household and qualitative	13	16	29
Total	70	16	86

Table 3. Percentage of SWC investments that are well maintained, by project category and subsidy level, rainfed plots[1]

	no subsidy		less than Rs 2500 subsidy[2]		more than Rs 2500 subsidy	
Project Category	total number	% maintained	total number	% maintained	total number	% maintained
Government	31	97	35	77	26	58
NGO and NGO-GO	25	96	14	100	14	79
Control	26	100	0	n.a.	4	50
Total (all categories)	82	98	49	84	44	64

[1]This covers investments made from 1987 to 1997
[2]Real value in 1997 rupees

Table 4. Village characteristics determining selection by different projects

Multinomial Logit Regressions (standard errors in parentheses)

Variable	Project category			
	NWDPRA	DPAP/Jal Sandharan	NGO	NGO/government collaboration
paved road in 1987	0.031 (1.372)	0.510 (1.143)	0.371 (1.391)	0.365 (1.389)
distance to taluka headquarters	0.014 (0.063)	-0.045 (0.048)	-0.037 (0.046)	0.002 (0.040)
population density in 1990 (persons/sq km)	0.005 (0.012)	-0.019* (0.010)	-0.009 (0.012)	-0.001 (0.007)
distance to regulated market in 1987 (km)	0.084 (0.094)	0.007 (0.083)	0.176* (0.093)	-0.016 (0.106)
whether shramdan was practiced in 1987	-1.232 (1.33)	-1.196 (1.108)	1.780 (1.313)	3.925** (1.856)
percent area irrigated in 1987	1.708 (4.353)	-1.546 (3.911)	1.10 (4.59)	4.97 (5.62)
number of communal groups in the village	0.617** (0.253)	0.550** (0.225)	0.373 (0.235)	0.137 (0.229)
altitude range (meters)	0.039** (0.016)	0.029* (0.016)	0.038** (0.017)	0.010 (0.023)
male literacy rate in 1987	-6.695 (7.87)	-9.265 (6.4)	-10.71* (6.18)	-8.02 (6.05)
whether the village had sufficient drinking water in 1987	1.265 (1.397)	-1.052 (1.106)	0.397 (1.155)	0.144 (1.227)
distance to nearest bus stop in 1987, km	0.225 (0.407)	-0.294 (0.3)	0.151 (0.283)	0.015 (0.266)
distance to nearest public health center, 1987	0.010 (0.143)	0.115 (0.101)	0.108 (0.104)	0.194** (0.098)

[1]Reference category is control (no project).
[2]Variables reflect values in the pre-project period.
*, ** and *** indicate statistical significance at the 10%, 5% and 1% level.

Table 5. Models of determinants of soil conservation transect score[13]

Variable	Model 1 tobit model not corrected for selection bias, 5 project categories	Model 2 tobit model not corrected for selection bias, 3 project categories	Model 3 treatment effects model, all projects vs. control	Model 4 treatment effects model, NGO projects compared govt projects and control
NGO project operates in the village	26.0*** (9.2)			
NGO/govt collaborative project	26.5*** (8.4)			
Ministry of Agriculture project	8.0 (9.8)			
Ministry of Rural Development project	1.9 (8.2)			
NGO or NGO/govt collaborative project		26.02*** (7.45)		37.52*** (0.05)
government project (MOA or MORD)		3.94 (7.56)		
any project (govt or NGO or NGO/govt)			23.23 (20.72)	
altitude range (meters)	0.05 (0.07)	0.05 (0.07)	0.04 (0.07)	0.06 (0.07)
distance to bus stop in 1987 (km)	1.8 (1.6)	1.88 (1.56)	2.41 (1.67)	14.66 (16.57)
paved road in 1987	14.1** (6.5)	13.94** (6.45)	15.84** (.6.81)	13.42** (6.79)
number of communal groups	-2.1** (0.09)	-2.03** (0.90)	-2.48*** (1.05)	-1.84** (0.90)
population density (persons/sq km)	0.01 (0.05)	0.02 (0.05)	0.04 (0.06)	0.03 (0.05)
% of households working primarily off-farm	-0.30 (0.27)	-0.31 (0.26)	-0.41 (0.27)	-0.33 (0.26)
mean annual rainfall at taluka town (mm/yr)	-0.02 (0.04)	-0.02 (0.04)	-0.03 (0.04)	-0.03 (0.04)
share of transect line that is irrigated	36.8** (14.0)	35.25*** (13.41)	37.89*** (14.03)	33.92** (13.38)
share of transect line that is uncultivated	-73.0*** (17.6)	-73.59*** (-17.65)	-62.98*** (17.99)	-77.53*** (17.76)
strong leader in the village	-5.6 (7.3)	-05.08 (-73.03)	-1.22 (7.43)	-9.56 (8.05)
distance to taluka headquarters	-0.04 (0.26)	-0.04 (0.26)	-0.03 (0.27)	-0.13 (0.27)
shramdan (voluntary community labor)[14]			14.19** (6.19)	

[13]Coefficients and standard errors are multiplied by 100 for easier reading.

[14]Shramdan is excluded when NGO project category is included as an explanatory variable because they are highly correlated. 85% of villages covered by these projects practice shramdan.

Table 6. Determinants of percent change in area of cultivable land in the village that is irrigated[1]

Variable	coefficient (and standard error)
NGO project operates in the village	-16.9 (12.7)
NGO/govt collaborative project	-6.4 (14.3)
Ministry of Agriculture project	-8.9 (12.9)
Ministry of Rural Development project	-11.4 (12.5)
total number of years the project operated in the village	0.6 (0.9)
% of cultivated area irrigated in 1987	-37.7*** (13.1)
village lies in upper part of macrowatershed	0.7 (3.8)
population density in 1990 (inhabitants per sq km)	0.05* (0.03)
percentage of workers in the village who are primarily farmers or agricultural laborers	0.1 (0.16)
change in distance to nearest bank from 1987 to 1997	0.2 (0.4)
change in distance to nearest regulated market from 1987 to 1997	-0.01 (0.6)
road improved between 1987 and 1997	5.6 (4.4)
change in distance to nearest bus stop from 1987 to 1997	-0.1 (1.2)
electricity for irrigation pumps was introduced in the village after 1987	-7.8 (6.2)
change in percentage of houses electrified in the village from 1987 to 1997	0.06 (0.1)
mean annual rainfall measured at taluka level (mm)	0.09*** (.02)

[1] ***, **, and * indicate significant at the 1%, 5% and 10% level, respectively.

Table 7. Determinants of annual net returns to cultivation from the plot-level survey

Variable	Model 1 OLS model not corrected for selection bias, 5 project categories	Model 2 OLS model not corrected for selection bias, 3 project categories
NGO project operates in the village	3030*** (1107)	
NGO/govt collaborative project	2393* (1402)	
Ministry of Agriculture project	1041 (1032)	
Ministry of Rural Development project	2124* (1169)	
NGO or NGO/govt collaborative project		2716*** (1047)
government project (MOA or MORD)		1400 (962)
distance to bus stop in 1997 (km)	103 (231)	101 (230)
paved road in 1997	-1575* (832)	-1846** (797)
distance to taluka headquarters	-36 (39)	-32 (38)
mean annual rainfall at taluka HQ (mm/yr)	8*** (3)	8*** (3)
farmer's total landholding (ha)	11 (24)	11 (24)
% of farmer's income that comes from off-farm	-7 (13)	-7.6 (13)
number of workers in farm household	-7 (92)	-10 (92)
farmer is high caste	11 (749)	38 (729)
number of years schooling of best-educated household member	45 (64)	51 (64)
number of seasons per year the plot is cultivated	3139*** (751)	3024*** (742)
plot ranks highly within the farmer's holding	742 (640)	688 (637)
plot is of land capability classification 2	3080*** (1139)	3018*** (1136)
area of the plot (ha)	-131 (213)	-120 (211)
value of land improvement investments made before 1987 (Rs/ha)	0.028* (0.015)	0.028* (0.015)
value of land improvement investments made after 1987 (Rs/ha)	-0.0001 (0.03)	-0.0001 (0.03)

Table 8: Priorities for developing the village: percentage of responses within each state

Priority	Both states	Maharashtra	Andhra Pradesh
irrigation	5.2	8.2	3.2
roads	14.8	16.3	13.8
improved medical facilities	21.1	16.6	24.3
improved educational facilities	5.3	7.9	3.6
improved housing	4.5	1.7	6.5
Drinking water	9.5	15.2	5.5
better electricity	6.4	4.5	7.7
improved bus service	7.1	3.4	9.7
latrines	10.0	4.5	13.8
Other	16.1	21.7	11.9
Total number of responses	862	355	507

Other priorities (listed in descending order of frequency):
water (purpose not specified), credit and banks, watershed works, veterinary service, employment, dairy or milk collection center, telephone service, including STD, community hall and equipment for it, government shop, ban on alcohol, vocational training, land for landless, fruit trees, horticulture, tree plantation, improved seeds and fertilizer, ban on dowry, community tractor, grain storage facility, weekly market, petrol pump, post office

Other interesting things in this data: Big landholders more interested in irrigation, watershed works and credit; landless are more interested in housing, electricity and latrines.

No patterns across project types.

Figure 1
SWC investment by project category and source of finance

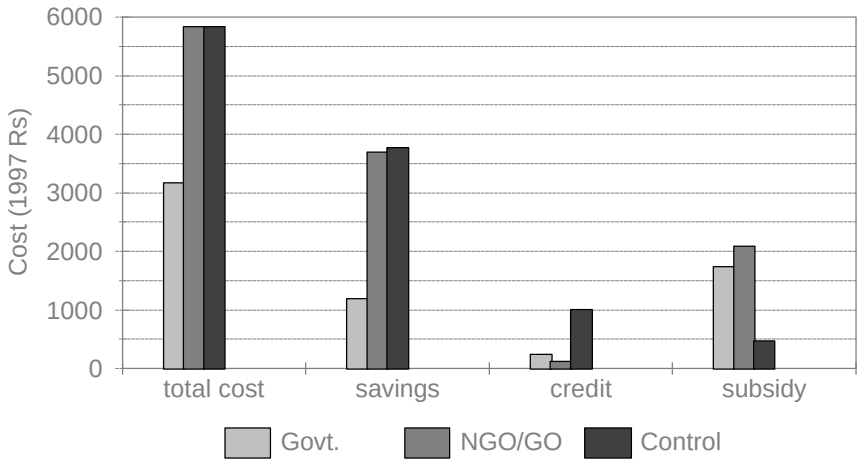

Figure 2
SWC investment by plot slope and source of finance