Watershed development in SAT India- a review of topics for further research
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Although under the title 'watershed management' a variety of activities is being pursued, the goal of most watershed projects is to increase agricultural productivity by improved soil and water conservation at the level of the micro-watershed. However, watershed projects might also involve reduced siltation of downstream water tanks, decreased water pollution and/or the implementation of integrated water management (Worldbank, 2000). Springgate et al. (2001) define watershed development as "the development of a watershed through changes in structural and non-structural activities taken up in a watershed, and the resultant changes in ecological variables (such as land use, vegetative cover, in situ soil moisture and groundwater level) and their economic impact". On the macro level, the watershed is nothing less then a river basin, on the micro level the watershed is the hydrological unit from which all waters drain to a common stream.

In time, the design of watershed development projects has changed from mere attention for the implementation of technical soil and water conservation measures to the broader socio-economic and hydro-ecological context in which the watershed is used. Natural resource management became an important part of watershed development as the sustainable management of upstream natural resources (forests, grazing lands) improves the water availability and quality of the land downstream. Poverty reduction increasingly became important as evidence indicates equity to be an important prerequisite for the sustainability of water and natural resources management (Adolph, 1999).
Since 1990, the Government of India has invested on a large scale in watershed development through the " National watershed development project for rainfed areas". Andhra Pradesh is at the forefront of implementation, receiving in the 90s up to 50% of the total budget available. Besides the watershed development projects implemented by the government of Andhra Pradesh, international donors and local NGO's are investing in the development of micro-watersheds as well. Some of the major projects by international donors taking place at present involve projects of the Worldbank, DFID (AP Rural livelihoods programme) and several bilateral projects (APWELL), besides numerous projects by local and international NGO's.

For a number of reasons watershed development is increasingly seen as the central focus for rural development:

- Agricultural production in irrigated areas is stagnating and further development of rainfed areas is necessary to take up the momentum of productivity growth.
- The increased scarcity of water is affecting rural livelihoods in multiple ways. In fact, increased water scarcity is seen as the major constraint for livelihood security and rural development in India' s semi-arid zones (ICRISAT 2001).
- The degradation of natural resources (soil erosion, groundwater depletion, deforestation etc) affects rural livelihoods and has made the current development pathway unsustainable
- The increasing 'privatisation' of the common resource base has left landless and marginalized households with a lack of access to the resources necessary to sustain their livelihoods.

Although the main focus in watershed development has been on the improvement and development of agricultural land and water uses (improved soil moisture, increase productivity of rainfed agriculture, increased water security), attention is now spreading to non-agricultural water uses (livestock, drinking water), non-land based livelihood strategies (forest products, off farm employment) and groundwater issues as well.

The few ex-post evaluations that have actually analyzed the outcomes of watershed development show quite disappointing results: the results are so-far not so positive and most of the improvements that were realized were short-lived. Although several reasons can be identified on the assessment side of why this might be the case (complexity of the evaluation, long time scale for ecological effects, non-tangible project effects), attention is focusing on the question how the effectiveness of watershed projects might be improved. The evaluations all point in the same direction; Participatory, demand oriented projects that were responsive to community needs have been most successful. The problem is that these are also the projects that were most site specific and difficult to replicate; not accidentally the most successful projects were NGO led. Besides, the sustainability of these projects is yet to be assessed, as even the projects that were implemented first cannot yet prove community resource management to work.

The following will review some of the literature with regard to watershed development in India's semi arid tropics. Some attention will be paid to the socio-economic characteristics of India's semi-arid tropics and the institutional setting in which watershed development takes place as well. The review will end with a first screening of some research that is being done with regard to the issues of replicability and sustainability of watershed development. The aim of the review is not to cover the whole literature on participatory watershed management in India's semi-arid tropics, but to have a first screening of relevant topics for further research.

Watershed development in Andhra Pradesh/SAT India

Although watershed development has received a lot of attention in the last two decades, the concept is not new. Since 1939 the government of India has stimulated the development and protection of watersheds, and since the 1970s the state and national government have been actively involved in soil and water conservation of micro-watersheds (Springgate et al 2001). At the level of the community, the history of land and water conservation is much and much older, many communities sharing a tradition of collective, village level water harvesting and distribution, soil conservation, grazing and forest management. In most villages these traditional techniques have been deserted however, and little traditional collective land and water management arrangements still persist. Opinions differ about the reasons why, although research indicates increased population pressure, economic development, and the centralization of natural resource management to have probably played an important role. (Springgate 2001, Adolph 1997). Fact is that, the loss of management systems for common property resources has been a critical factor in the increased over-exploitation, poor upkeep and physical degradation of the natural resource base (Pretty & Ward 2001). Elsewhere, private ownership or operation of surface and groundwater use for irrigation have replaced the collective systems, with has often marginalized the position of the landless and rural poor.

Watershed development projects are implemented through different channels. Adolph (1999) distinguishes the following:

1. National programs under Department of Agriculture and Cooperation (MoAC): the National Watershed Management Project for Rainfed Areas (NWMPRA)
2. National programs under Department of Rural Areas and Employment (MoRAE): the drought prone area program (DPAP), the desert development program (DDP), the integrated wasteland development project (IWDP), the Jawahar Rozgar Yojana (JRY) and the Employment assurance scheme (EAS). Since 1995, the projects implemented through this channel have to be participatory.
3. National projects funded by multi lateral donors.
4. State programs
5. Operational research projects (ORP) or model watersheds under the Indian council for Agricultural research (ICAR): In 1983 the government of India started 47 model watershed projects in dryland areas with technical supervision from the Central Research Institute for Dryland agriculture (CRIDA)

Basically, three types of watershed projects exist: government projects, projects run by NGO's and research watersheds. With regard to the first, the main difference between the projects run by the Department of Agriculture and the ones of the Department of Rural Development is that the former focuses on improving the productivity of rainfed agriculture while the latter also pays attention to non-agricultural water uses and livelihood security. Most of the literature on watershed development in SAT India focuses on the projects by the Department of Rural development, as these form the main thrust of watershed investment at the moment. Besides, in 1995 this departement adopted a set of guidelines for Watershed development that put community participation at the forefront, making it an interesting test case for the replicability of participatory watershed approaches. With regard to the research watersheds, ICRISAT has done extensive research on the technical aspects of soil and water conservation and improved cropping patterns on the level of the micro-watershed. At the moment, they are in the process of broadening the scale and scope of analysis to the farm and village level. With regard to other research watersheds, the main focus seems to have been on the technical aspects of watershed management; socio-economic and institutional aspects are usually mentioned but are hardly analysed in a systematic way.

The central role in most of the current projects initiated by the government is played by the project implementing agent, the PIA, who basically controls and manages the funds. The PIA might be a government agency, research institute or an NGO and is controlled by the Department of Rural Development and the Zilla Parishad (district level authority). From a formal institutional point of view, the Panchayati Rai institutions (the rural local bodies) (PRI) should play a role in the implementation of watershed development as well, as the recently adapted 73rd constitutional amendment act strengthened the position and role of PRI to plan and manage rural development (including watershed management, agriculture, soil conservation, social forestry, farm forestry, fuel and fodder and the maintenance of community assets). Although the state of Andhra Pradesh passed conformity legislation to acknowledge acceptance of the laid down principles, it has made slow progress with devolving powers and functions to PRI's.

For the short term implementation of watershed development projects, the Andhra Pradesh government has bypassed the Panchayats, by creating watershed associations. Baumann (chapter 6, Farrington et al 1999) questions whether this is a problem, comparing the institutional role designed to Panchayati Rai institutions with the institutional and developmental needs of participatory watershed management. He concludes that although both PRI as the watershed guidelines aim to decentralize control over development to local communities, the former is a constitutional part of Indian democracy while the latter is an executive order of a ministry: There is no contradiction in establishing watershed associations within a PRI, as both serve different purposes. Only when watershed associations become involved in the broader rural development of the community do the responsibilities of PRI and watershed associations start to mix.

An example of the latter are the so-called 'watershed plus' projects. This term was coined during the design of the western Orissa Rural livelihoods project in India and involves activities usually not associated with watershed management. Activities might include improved water management, minor irrigation, drinking water and sanitation improvement, forestry and interventions to address the specific needs of the poorest (including credit, collection and processing of non-timber forest products) aquaculture, vegetable/fruit garden activities and local crafts. Although the development of 'watershed plus' projects seems to be rather new, many of the NGO related watershed development projects might be regarded as such as NGO's usually become involved in community development before they actually start work on the watershed.

As the range of NGO's involved in watershed development is quite large, it is difficult to give a general picture of the approach used. Most NGO's however regard watershed development as a means to improve the livelihood security of the rural poor. As such, they generally pay a lot of attention to community needs and to the capacity of communities to manage their resources in a sustainable and equitable way. As many of the rural poor are landless, much attention is paid to improve the availability of non-agricultural land and water uses, to ensure that the rural poor benefit from watershed development as well. An extra reason to make sure the poor benefit is that if the poor are unable to maintain or enhance their livelihood through access to existing or new benefits streams, the tendency is for common-property resource arrangements to break down, resulting in a downward spiral of poverty and natural resource degradation. (Farrington)

Managing watersheds for rural development

To get a picture of the extent to which improved watershed management might actually contribute to the further development of India's SAT, it is important to understand the mechanisms through which poverty, natural resource degradation and low agricultural productivity are related. As mentioned before, there are effectively 4 routes through which the rehabilitation and development of water scarce watersheds is expected to contribute to rural development:

1. Increased agricultural productivity
2. Increased water security
3. Improved quality of natural resources and sustainability of agricultural production
4. A more equitable and sustainable management of the common resource base

Before elaborating the ways in which watershed management is expected to contribute, it is important to have a picture of the broader socio-economic and biophysical characteristics of SAT India. The green revolution that greatly improved agricultural productivity in other regions of India largely bypassed SAT India. The poor natural resource base of these areas did not seem to provide a very secure basis for agricultural development and the expected productivity gains were relatively low. However, as agricultural production in the irrigated, ‘ Green revolution’ areas is stagnating, policy makers are increasingly looking at rainfed agriculture to take up the momentum of productivity growth (Rosegrant et al, 2001). Besides, for the 300 million people that depend on these regions, agriculture is the main source of income. To improve rural conditions, public investments and policy interventions are needed, not only for agricultural development, but for the alleviation of poverty and sustainability of the natural resource base as well. The question is how watershed development might contribute to these goals.

First, watershed development can contribute by making rainfed agriculture more productive. In degraded watersheds, fertile soils and scarce water get lost, degrading the resource base on which agriculture depends. By capturing the rainwater (in soil, tanks, ponds or groundwater aquifers) both soil degradation and water scarcity can be reduced, increasing the availability of (irrigation) water and reducing the risk of drought. Besides, rainfed agriculture is relatively knowledge extensive, with many potential improvements to be made. The development of drought resistant varieties and on-plot soil and water conservation can improve agricultural productivity in a major way, agricultural R&D being one of the main drivers of further agricultural development (ICRISAT 2001, Wani et al 2000). As far as the economics of dryland agriculture are concerned, strategies that reduce the uncertainty of rainfed agriculture are important as the agroclimatic conditions of low and uncertain rainfall, soil heterogeneity and a short cropping season have a strong effect on the household and village economics of the region (Walker and Ryan, 1990). This will involve attention for mechanisms to improve water security, farming practices that allow farmers to react to uncertain rainfall in a flexible way, soil and water conservation measures to increase soil moisture and agricultural R&D to improve the drought resistance of crops.

However, although increased productivity of rainfed agriculture might be important from a food security point of view, it remains unclear to what extent rural households actually depend on rainfed agriculture for their livelihood. In fact, the land and water conservation mechanisms required to improve the productivity of rainfed agriculture are so labour intensive, that small scale producers are often reluctant to invest. With increased out migration, they earn more working elsewhere then they would by farming their low productivity lands. Besides, land holdings are on average so small, that the space needed for conservation measures is relatively large. Finally, a large part of the rural poor has no access to land and an increased agricultural productivity will not directly serve their needs. However, they might benefit indirectly, as increased productivity would involve increased employment opportunities as well.

Second, watershed management contributes to poverty reduction by improving the availability of water. Have the advantages of increased water availability already been discussed with regard to agricultural water use, an increased security of water has some important other benefits as well. The rural poor, as well as the rural non-poor for that matter, depend on surface and/or groundwater in different ways.

Water use	**Contribution to livelihood**
Domestic water use (drinking water, washing, cooking)	Basic survival, health, quality of life
Agricultural water use	Income, food security (nutrition), employment
Water for livestock	Income, food security (nutrition), security (insurance)
Fishing	Income, nutrition
Other harvesting of water-ecosystem	Nutrition, health, income
Industrial water use (not so relevant)	Employment (income)
Hydropower (not so relevant)	Employment (income)

The different water uses might be grouped under three categories:

1. **Reproductive water uses**
   Drinking water, water for household food production, cooking and washing etc.
2. **Productive water uses**
   Agricultural water use, water for livestock, other direct productive water uses
3. **Indirect effects of other water uses**
   Industrial water use and hydropower (employment), ecological water uses

The availability of water not only influences livelihood security by its direct and indirect water uses, but through the security of its supply as well. Floods and droughts for example have a large impact on livelihood security, as the poor have little means to insure themselves against such external shocks. The inability to deal with external shocks is in fact part of the definition who the poor are: using the definition of livelihoods by Chambers, livelihood insecurity might be defined as the inability to cope with and recover from stresses and shocks, the inability to maintain the capabilities and assets available while at the same time undermining the natural resource base. Poverty in these terms is nothing less then a vicious circle of degraded resources, degraded assets and degraded capabilities, that all increase the susceptibility of poor households to shocks. In principle, sound watershed management should be capable of breaking this circle, by managing the scarce water and land resources in a sustainable and equitable way.

Third, watershed management is supposed to improve the quality and sustainability of the natural resource base, by reforestation, protection of common lands from over grazing, ground water recharge and a reduction of soil erosion. This serves rural development in a couple of ways both through the increased agricultural productivity and improved water security already mentioned, but also through the direct benefits households derive from the environmental services the natural resource base provides. Most important will be an increased availability of fuel and fodder. Other benefits might involve the use of medicinal plants, wild foods, construction material and non-timber forest products, assuming that the harvesting is managed in a sustainable way. Improving the sustainability of resource use will benefit long-term agricultural development as well: Halting groundwater depletion will be essential for future agricultural production.

Finally, watershed development contributes to rural development by stimulating a more equitable and sustainable use of the common resource base. To illustrate the increasing 'privatisation' of the common resource base in SAT India the changes in agricultural water use might serve as an example. In the last 30 years, the source of agricultural water use changed from communal tank irrigation to private well irrigation. This shift started already in the 70s, but the use of tubewell/ groundwater irrigation really increased in the last 10 years. The growth of tubewell irrigation was possible because of the increased availability of cheap electricity and borewell drilling techniques. The advantage of using groundwater over surface water irrigation is that no valuable land is lost to store water. Besides, the evaporation loss of aquifer water storage is much lower then that of tank water storage and as long as groundwater does not get depleted, water security is relatively high. The increased use of groundwater irrigation improved agriculture productivity. However, the shift also represents a shift from communal to private water sources, leaving households that could not afford to drill a well without access. The security of some came at the expense of others, as the lowering groundwater level negatively affected other water uses as well. Although in time, the technology of borewell drilling is expected to become cheaper, the rate at which groundwater is currently used does not seem to be sustainable, in other words; those with access are using up the common resources of all. Whether the change from communal to private water sources has actually resulted in increased income differentiation at the village level remains unclear, but to use groundwater irrigation as strategy for rural development, both the sustainability and equity of ground water use would need to be improved.

Farrington (1999) mentions two concerns why an equitable watershed management is important. First, the poor own only limited private resources, and thus depend more heavily on access to common resources. The commons constitute a high proportion of individual watersheds and will continue to do so for the foreseeable future. Second, there are important linkages between equity and sustainability, both institutional and environmental. For instance, if the poor are unable to maintain or enhance their livelihood through access to existing or new benefits streams, then the tendency will increase for common-property resource management arrangements to break down into an open access ' free for all'. Similarly, if common pool resources are taken over by the more wealthy and so effectively privatized, then public funds effectively subsidise the creation of a private resource by the more wealthy. Increases in population pressure have in some cases led to the breakdown of traditional common property arrangements, leading to a vicious spiral of free-for-all open access and inability of the poor to engage in long term environmental restoration. The key step to a win-win dynamics is the creation of equitable and transparent institutions to manage the commons.

Managing watersheds for rural development thus seems to be a potentially important strategy to reduce poverty, improve the management of natural resources and increase agricultural productivity. But what has watershed development been able to achieve in practice? This will be addressed in the next paragraph.

Box 1 Village and household economics in India's semi-arid tropics: 1974-1985 (Walker & Ryan, 1990)

The main difference that distinguishes dryland farming from agriculture in non-SAT regions is rainfall uncertainty at planting. This has an impact on other factors as well, like the increased importance of synchronic timing of operations, the impact of covariate production risk and the increased impact of soil heterogeneity. Although all dryland agriculture depends on the southwest monsoon of June-October, the standard deviation of rainfall security and intensity in SAT is quite high. This, together with the large variety in soil types, makes that agrcoclimatic conditions (soil moisture, cropping season etc.) are variable for the different SAT regions as well. Land is mostly privately owned, and around 30% of the population is landless (mainly dalits). Land is unequally distributed: in 1975 60% had holdings smaller then 2 ha and only 5% of holdings exceeds 10 ha. In all villages, irrigation increased during the study period: in 1975 about 12% of total gross cropped area was irrigated, but by 1984 the area had increased to 20% (mainly groundwater irrigation) Since then, groundwater irrigation has increased even more. In the same time the area of common lands, used for grazing, fuel and fodder, steadily decreased: in 1950s 20% was common, in 1989 this was less then 10%.

Although the study villages were selected on the basis of the least possible external influences (roads, government interventions etc.) they were representative for SAT India. Seasonal out-migration was even in these isolated villages quite important, with over 40% of all population leaving for work elsewhere. The average village had around 14-22 different castes, dalits constituting 10-25%, muslims or buddists less then 10%. To give an impression of differences in productivity of dryland vs irrigated farming: the same farmer who harvests 200-400 kg per ha of dryland crops, harvests 2 to 4 ton per ha of paddy on irrigated fields. Lower lands (with potentially more water and/or irrigation) are saved for high value crops. Agricultural practices and crop choice varied widely in the study villages, ranging from traditional, low input to modern, intensive cropping systems. With regard to income, crop revenues and labor earnings were dominant income sources. Livestock was less important, contributing on average 15% to household income, and 8% to wealth. Poorer households, like landless shepherds, derived a much larger part of their income from livestock, and also for women livestock seemed to play an important role. Still, 2/3 of the rural poor had livestock to supply them with manure, milk, meat and/or draught power and as cash buffer and insurance. For the use of livestock for draught power, bullocks, buffalo's en cows were used. Still, many smallholders could not afford to keep this type of livestock as because of fodder scarcity the costs of maintenance were high.

Average income did not differ much for different farm sizes: landless were on average not worse off then medium size landowners. Apparently, in these dryland villages, the resource base of small and medium size holdings was not sufficiently well endowed to enable their owners to attain higher per capita incomes then landless laborers. 2/3 of the households moved in and out of poverty during the study period. Households that did not fall below the poverty line had often both a secure income source (government job) and more diversified income sources. However, the structurally poor are disproportionally low caste with small or no land holdings. During the study period some upward mobility could be recorded, but much more downward mobility, spurred by bad luck (investing in dry holes looking for groundwater, diseases), alchoholism, gabbling and/or dowry problems (many daughters) Household income variability was on average 30%, (most stable 10% most unstable 80%), variability being larger in drought prone areas and for landless households. Labor earnings were important to dampen household income variability: households with no able bodied, healty family member available suffered most from income variability. Although remittances and gifts played a role in mitigating household volatility, the main income smoothing took place through the local financial market (consumption credit).

With regard to household risk management, two types of risks were examined: a) severe and prolonged drought b) rainfall insecurity affecting income but not threatening existence. In face of severe covariate risk like droughts, farm management methods are usually ineffective in preserving crop income (and external interventions are needed). In more normal years, crop diversification and intercropping partially ironed out fluctuations in crop income, at least in the rainfall assured regions. Rural public works (food for work) were the main institutional response in times of scarcity. Intermediate to moderate levels of farmer risk aversion often did not have a direct bearing on decisions in technology choice because tradeoffs between risk and expected profitability were nonexistent or negligible. The labour was hardly segregated by caste, but strongly by gender; Men supply most of the labour for crop production, women for the hired labour market. Wages of women were 57% from those of men Women generally worked 10-30% longer hours, as they are responsible for domestic work, food and fuel gathering/processing and handicrafts. There were some regional differences in crop labor use intensities, although in general smaller plots were more labour intensive then larger plots. Asset ownership seemed to be strongly and inversely related to labor market participation. Because of a decrease in the number of landless labourers (due to land distribution, out-migration) and the increased profitability of non-agricultural activities (toddy and livestock production, small enterprises) local labor markets were tightening at the time.

The results of watershed development in India's semi-arid tropics.
Although in the last decade in India 500 million dollars has annually been invested in government related watershed development, the impact of this investment has to date been quite disappointing. Few studies have been able to actually assess the effects as the complexity of watershed management and the intangibility of the benefits have complicated the evaluation. Besides, few projects have been completed long enough to actually measure their long-term performance (time lag ecological effects, time lag to measure the sustainability of institution building efforts).

The most extensive evaluation of watershed development in India's semi-arid tropics, has been the study by Kerr et al (2000), who evaluated the performance of 86 watershed projects, implemented by both government agencies and NGO's, in different villages in Maharahstra (70) and Andhra Pradesh (16). Their analysis compared pre and post conditions in the study villages, studying performance indicators such as changes in access to irrigation and drinking water, employment opportunities, soil erosion and protection of uncultivated lands and the revenues from common lands (fuel and fodder). At the plot level performance indicators included changes in cropping intensities, yields, soil erosion and annual net returns. The analysis was supplemented by qualitative information about the effect of the project on different interest groups, like farmers with and without access to irrigation, landless people, shepherds and women.

Kerr et al. distinguish two types of watershed projects in SAT India: increased water harvesting and improved rainfed agriculture (Kerr et al, 2000) In hilly regions (mainly Maharahstra), water harvesting projects are most popular, as these projects allow for an increase of irrigated area with large productivity gains as result. In flat areas (mainly Andhra Pradesh), opportunities for water harvesting are much less and attention focuses on improving the productivity of rainfed agriculture with on site water and soil conservation and improved cropping patterns. In fact, the projects of the Department of Agriculture (NWDPRA) mainly focus on improving the productivity of rainfed agriculture, while the projects of the Department of Rural development (DPAP) focus on water harvesting. NGO's usually do both, especially those in Andhra Pradesh (the ones in Maharasthra mainly focus on water harvesting).

Findings supported the hypothesis that more participatory projects (implemented by NGO's) performed better then their more technocratic, top-down counterparts (implemented by government agencies) (Kerr et al 2000). In fact, the projects that provided both a participatory approach and sound technical know how (NGO-government collaborations) performed best of all. Participatory projects were more successful in managing common lands, reducing soil erosion, expanding the area under irrigation (mainly in Maharashtra) and improving the productivity of rainfed agriculture. Landless and farmers without access to irrigation indicated to have benefited less from the projects then those with access to land and water: they were less satisfied with the outcome of the project. (Kerr et al, 2000).

Since the research of Kerr et al., little empirical research seems to have been done to measure the impact of watershed development on rural livelihoods.

Reddy et al (2001) tried to evaluate the impact of watershed development in 4 villages in Andhra Pradesh. Their study ‘ Watershed development and livelihood security’ was much less extensive and elaborated then the study performed by Kerr et al. It proved difficult to distinguish what effects might be contributed to what: irrigation did improve, but to what extent this was a result of the project remained unclear. The same held for yield increases, which were highly variable among villages, and among project and non-project villages as well. As the analysis performed was qualitative, outcomes were not very robust. However, groundwater availability did seem to have improved in the study villages as well as soil moisture in the vicinity of check dames. Did the benefits of soil moisture mainly accrue to the households owning the land near the check dam, the benefits of increased groundwater availability were shared by all.

Farrington et al (1999) give an overview of several watershed project evaluations as well. Results indicate that successful projects have in fact reduced rainwater run-off and recharged ground and surface water aquifers, improved drinking water supply, increased the irrigated area, changed cropping patterns, crop intensity and agricultural productivity, increased availability of fuel and fodder, improved soil fertility and changed the composition of livestock. An evaluation of the watershed portfolio of the Worldbank (2000) showed similar results: successful projects contributed to both agricultural productivity, natural resource protection and reduced soil erosion. The impact of successful projects on poverty alleviation and the long-term sustainability of project results were less clear: Although some projects did seem to have paid attention to the needs of the landless and poor, their impact on poverty reduction was not assessed.

Has the potential of watershed development to serve as a catalyst for rural development been proved in some projects, the majority of interventions has failed to deliver results. Besides, of even the most successful projects the effects on poverty reduction remained unclear. In some cases, the poor actually became worse off, because the measures for soil and water conservation restricted their access to common resources (forests, common lands). Failing to account for the needs of the poor not only makes watershed development less effective in reaching one of it’s main goals, it also affects the sustainability of the total results. If the poor are unable to maintain or enhance their livelihood through access to existing or new benefits streams, the tendency will increase for common-property resource management arrangements to break down.

To get more grip on the factors that actually determine project success, the following will focus on the factors that made the participatory NGO approach so successful. As this question has been at the centre of much of the literature on common property management, social capital and community participation, some attention will be paid to this literature as well. The aim again is not to give a complete overview, but to merely perform a first screening of relevant issues for further research.

Improving the effectiveness of watershed development

What is it that made the approach of NGO's so successful and how can this approach be scaled up? In his study, Kerr distinguishes two features that make NGO programs differ from government projects: scale of operations and staffing time. While government projects have huge budgets and work in hundreds of villages, NGO's mostly work in a handful of villages. They devote more staff time per village and they often work on a variety of activities in addition to watershed management. Although NGO projects are on average 20-40% more expensive, they are still more cost-effective then the cheaper, but not so effective, top-down approaches. Second, while government employees concerned with watershed management are almost exclusively trained in agricultural sciences and engineering, NGO staff members include more non-technical staff trained in community organization. NGO's typically devote a lot of time to project preparation: in fact, many NGO's first get involved in other village development activities before venturing off in watershed development.

Similar factors were found to explain the success of several Worldbank projects. Demand orientation and responsiveness to community needs were key to the success of the better performing watershed projects with community participation in the planning and design of the project from the very start. Efficient, committed and accountable project management proved important as well, especially with regard to the projects ability to deal with the recurring institutional constraints. Then, successful projects made sure that the technologies chosen responded to the farmers own felt needs and that locally available resource were used for project implementation. Finally, the sequencing of activities seemed important, focusing activities first on the generation of short-term results. This way, farmers became interested and more susceptible to the need to invest in measures to generate long-term benefits as well. (Boersema, 2000)

Both studies point to the importance of project preparation, demand orientation and institution building as key factors to determine project success. In all these, community participation is central, as the community will need to sustain the results after the project has gone. Participation in itself will not guarantee the outcomes to be sustainable. In fact, Boersema (2000) argues that in many projects high subsidies and other inducements have distorted the true nature of demand. While impressive rates of participation might be achieved on the short term, the uncertainty of benefits on the long term and lack of mechanisms to ensure long term cooperation might lead unsustainable results once the project ends. In many instances, this has derived from a mistaken assumption that what might be socially optimal in terms of overall environmental improvements will also be optimal from an individual point of view. After all, many of the benefits watershed development generates are long term and collective, the watershed being a typical example of a common good.

In fact it might be argued that the main reason why watersheds became degraded in the first place is because of a lack of mechanisms to manage the common resource base in an effective way. Although traditionally, collective mechanisms did exist, these institutions were in time replaced by either private property rights (drilling of private borewells, redistribution of common lands) or not replaced at all.

Historical studies in South India reveal that the number of communal water harvesting structures (tanks) increased with population density up to a level of 220 persons/km2. Above this level the number of communal irrigation tanks started to decline, supposedly because of the deterioration of administrative structures for tank maintenance and repair and the increasing pressure on the catchment area (Van Oppen and Subba Rao, 1980, in Adolph, 1999). Other mechanisms might have existed for the management of common resources like ground and surface water, forests and grazing lands as well, but due to the increased population pressure and other developments affecting local resource use these institutions eroded as well.

Institutions are needed to regulate the rights and duties of individuals and to enforce commonly agreed rules and regulation. Without institutions to coordinate resource use, demand might easily exceed supply resulting in a so-called ‘ tragedy of the commons’ where resources get depleted and everybody is worse of. Wades work (1988) in South India shows that large differences exist with regard to the existence of institutional mechanisms to coordinate the use of common resources. In villages where common resources are scare and the externalities of over-use are high (environmental costs of resource degradation, loss of revenue from common lands, reduced availability of water etc), villagers have developed rules and regulations to cope with externalities, as well as institutional arrangements to enforce them (quoted in Adolph, 1997) However, the extent to which communities are able to manage their resources depends on the characteristics of the community as well. For example, homogeneous communities will more often be capable to establish effective coordination mechanisms then heterogeneous societies. A study in Ethiopia (McCarthy et al 2001) showed cooperation to be positively related to factors that increase the profitability of common resource use, but negatively related to the total number of households, the use of the common resource by non-community members and the heterogeneity of wealth. Also, common property resources became increasingly privatized when levels of cooperation were low. This last trend might apply to India as well, were the decline of collective tank irrigation was preceded by an increase in private well irrigation. The dynamics of common property management might in fact follow an inverse U-curve, increasing with population pressure up to a certain point, after which the pressure on the resource base becomes thus that private mechanisms start to take over. This would not be a problem if public access could be guaranteed; the increased ‘privatisation’ of common resources could actually improve resource efficiency and sustainability, as ownership induces maintenance and investment as well. The problem is that public access is not guaranteed and the poor are left with less access to the resources most important for their livelihood.

In the last 10 years a lot of attention has been paid to common resource management. Social scientist, policy makers and NGO’s have been trying to understand the mechanisms that make collective coordination mechanisms work, and much experience has been gathered with regard to community participation and local institution-building to make groups of people responsible for the long term management of their resource base.

In a review of experiences, Pretty & Ward (2001) estimate that in the last decade around 408.000- 478.000 local groups have been established, in an effort to build local institutions for the management of watersheds, forests, irrigation, farmers research, micro credit and integrated pest management. They conclude that there is surprisingly little empirical evidence about the differing performance of these groups, and that little is known about the factors that determine whether these groups will be sustainable in the long run.

The lack of empirical research has made it difficult to test the hypotheses derived from the many models developed to analyse how collective management institutions work. Much of the non-conceptual work on social capital, collective action and community participation is rather descriptive, listing the factors that have contributed to the success of a specific project or case. Although this information is useful to help replicate participatory and collective action approaches on a larger scale, it does not answer the question why. This question will need to be answered to actually design projects with sustainable results. Ostrom (1990, 1993) has addressed this issue with regard to irrigation. Her conclusion with regard to the question why so many investments in irrigation have proved not to be sustainable is because of adverse incentives in the design, finance, construction, operation, maintenance and use of the infrastructure developed.

Farrington et al (1999) reach a similar conclusion when analyzing the factors that determine watershed development success. Although not stated explicitly, the indicators he distinguishes to help explain successful approaches are in fact all positive incentives for increased cooperation. Incentives are little else then a combination of motivation, knowledge, trust and all these other factors that determine whether people or organizations are willing to become active and engage in interaction or not. Adverse incentives arise when people or organizations act on behalf of reasons that are different then the transaction concerned (strategic behaviour) or when the information on which decisions are based has been distorted. Without wanting to elaborate the issue of incentives and institutional arrangements at this point any further, it is important to note that for a thorough understanding of the question why certain institutional arrangements work it is necessary to understand the mechanisms underneath.

Finally, a workshop by Knox et al (2001) brought together the key research findings with regard to collective resource management in watersheds. With regard to the factors that determine watershed management to be sustainable they concluded the following:

- Robust collective management is likely to depend on the level of existing community organization and social capital, that is, the strength of the norms and social relations that enable people to work together to achieve their goals
- Existing community organizations rarely incorporate all of the stakeholders with interests in watershed management. However, the extensive nature of resources and the interdependency of users at the watershed level make it very important for all stakeholders to participate in the development and implementation of watershed management techniques and practices.
- Attempts to organize collective action along strict hydrological boundaries generally fail

- The size and social structure of communities sharing the watershed are likely to be important: small communities are usually more unified.
- Market forces can either weaken or strengthen the incentives for collective action
- Insecure property rights to cropland can reduce incentives to invest in soil and water conservation.
- Watershed systems are highly complex, with multiple users, over multiple scales, making conflict resolution mechanisms important.

Conclusion/ Topics for further research

The objective of this paper was to perform a first screening of relevant issues for further research. Although only part of the literature on watershed development has been reviewed, some general conclusions might be drawn.

First, in the process of transformation from soil and water conservation to integrated rural development, the relation of the concept of 'watershed development' with the watershed has become more abstract, and the term ' watershed development' more diffused. To address the main problems of India's semi arid tropics, it seems important to re-strengthen the relation with the watershed and make water leading. Water scarcity being the main constraint of India's SAT, focusing watershed development on improving the security and accessibility of water resources on the long run seems an important strategy for sustainable development. Putting water management at the front of watershed development will not only contribute to rural development by increasing the security of agricultural water use, it will improve livelihood security in other ways as well (drinking water, water for livestock and all other water uses that directly or indirectly affect rural livelihoods).

Bringing water back into watershed development has implications for the scope and scale of analysis. With regard to the scope of analysis, the analysis would not be confined to water use alone: Land and water are intrinsically linked, and what happens in the catchment will affect water resources, be it in the quality or the quantity of the water available. Looking at land and water uses the analysis would need to include all livelihood activities that use the watershed in one way or the other, ranging from household production (collection of fuel, drinking water, food production), agriculture and the use of the forest and the common resource base (livestock, fishing, forestry).

With regard to the scale of analysis, by definition 'watershed management', implies a scale that is larger then the village. After all, the watershed is nothing less then a river basin, all waters draining to a common stream. This stream, the water flow, should be accounted for when analysing issues concerning watershed development, as water saved in one place might lead to a reduction elsewhere: This might solve issues at one location, but at the cost of a worsening of conditions elsewhere. From an institutional perspective, choosing the watershed as the functional unit greatly complicates the analysis as on the level of the watershed usually no coordination mechanisms exist. This has led several authors (Kerr et al, 2002, Farrington et al. 2000, Knox et al 2001) to conclude watershed projects should chose the village as the scale of analysis, assuming collective action and common resource management on the level of the watershed won't work.

Examples from Sri Lanka (Jinapala et al. 1999) and Europe (EU Waterframework Directive, 2000) have proven this assumption wrong, and although complicated, the establishment of watershed and river basin authorities can be an effective way of accounting for up/down stream issues in watershed management.

Second, improved livelihood security being the most important objective for the development of India's semi-arid zones, it is of crucial importance that watershed development addresses the needs of the poorest. For a long time, poverty alleviation was regarded as synonymous with agricultural economic growth, as increased agricultural productivity was supposed to result in increased incomes for the rural poor. Without contesting the importance of productivity growth, by now it has become clear that poverty is affected by more then income alone. To ensure their livelihood, rural households pursue a whole range of activities, depending on the assets and capabilities available to them. Rainfed farming is one of them, but livestock production, off-farm employment and natural resource harvesting might be important livelihood activities as well. A framework that allows for a more integrated analysis of the means and mechanisms with which households try to ensure their livelihoods is the sustainable livelihood framework promoted by DFID (1999). Looked at from the livelihood perspective, poverty alleviation should focus on reducing the risk of livelihood insecurity, a livelihood being sustainable when it can cope with and recover from stresses and shocks, maintain and enhance its capabilities and assets while not undermining the natural resource base. Understanding the way watershed development can contribute to livelihood security is important to improve the impact of watershed development on the poor. This will require insight into the way households cope with water scarcity and other environmental risks in the activities they pursue to secure their livelihood.

Third, to improve the effectiveness of watershed development, empirical research is needed in to the mechanisms through which poverty, natural resource degradation and low (agricultural) productivity are related. The few evaluations that have been performed to improve the effectiveness of watershed management have mainly focused on the way projects have been implemented. The participatory NGO approach being more successful then the top down approach used by the state, participatory watershed management has become the main strategy to improve project implementation. However, less attention has been paid to the influence local conditions have had in explaining the projects success. The heterogeneity of SAT India, both in terms of agro-ecological and socio-economic characteristics, affects project implementation in different ways. Regions with good market access and a well-developed non-agricultural sector might depend less on the watershed for their livelihood security then areas that are more remote, while the environmental impact of land and water use will be determined not only by household water use but by the bio-physical characteristics of the ecosystem as well. To be able to design effective interventions it will be necessary to understand the influence of local conditions on project performance and to identify the trade-offs between equity, efficiency and sustainability that locally exist. This will need to involve not only an analysis of the broader welfare effects of land and water uses in the watershed (environmental impact and economic value of the different land and water uses) but of the accessibility of land and water resources as well (access of the poor to land and water)

Fourth, to ensure watershed projects to be sustainable in the long run, more insight is needed into the mechanisms that make community watershed management work. Although attention has focused on improving the success of implementation, the key step to a win-win dynamics is the creation of equitable and transparent institutions to manage the watershed on the longer term. Might household level analysis answer the question how households cope with resource scarcity and environmental risks, households alone are not in the position to influence the circumstances that determine the security of their resource base. Can households to some extent manage the quality of their lands (a private resource), the security of the common land and water resources depends on the extent to which the community (or even communities at the scale of the watershed) is capable of managing these in a sustainable and equitable way. Although much research has been done with regard to common resource management, empirical research into the conditions that determine community watershed management to be successful has been lacking. Recent micro-scale empirical research has shown a large heterogeneity in environmental management by the rural poor to exist (Scherr 2000). Local endowments, conditions affecting the adoption of resource conserving technologies and local institutions supportive of the poor proved to be key in determining the outcomes. Getting insight into the conditions that determine local communities to be successful in the management of their common resource base (homogeneity of the population, scarcity of natural resources, external costs of over use, distribution of assets, size of the population) will help increase the sustainability of watershed development, not only for project implementation but for the long term management of the watershed as well.

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