Participatory Integrated Watershed Management

Evolution of Concepts and Methods[1]

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Abstract

This paper focuses on the conceptual evolution of watershed management within the context of an action research program operating in the highlands of eastern Africa, as informed by both theory and practice. After situating the AHI watershed program within the global context, the paper explores the conceptual underpinnings of watershed management within AHI. The paper summarizes progress made thus far in conceptualizing "watershed issues" (NRM problems at landscape or watershed scale and related incentives) and "stakeholders", and how such clarifications have helped to operationalize "integration" and "participation" in watershed management. By discussing these concepts one by one in the context of an implementation process, the influence of practice (approaches and lessons) on the program's conceptual development are brought to light. The paper concludes with a discussion of implications for agricultural R&D in the eastern African region.

Keywords: Participatory watershed management, Agricultural systems, Integrated natural resource management, Eastern Africa

Introduction

Fresh water is expected to become the most limiting resource in many parts of the world in the near future (Gleick, 2000; Postel, 1997; Postel et al., 1996). This has led to a surge in funding for watershed management programs (Shah, 1998; UNCED, 1992). Given this new funding climate, there has been a surge in actors involved in watershed management programs. Yet as often occurs as interests soar in response to funding levels rather than endogenous developments, an imbalance emerges between development aims and outcomes (Hinchcliffe et al., 1995; Rhoades, 2000; Shah, 1998). Therefore, there is an urgent need to take a critical look at the motives for watershed management, the beneficiaries, and methods used to reach specified objectives.

This paper highlights some of the different forms of watershed management emerging in the global arena, focusing on a participatory integrated watershed management program being implemented under the African Highlands Initiative (AHI), an ecoregional program operating in the highlands of eastern Africa. The bulk of the paper highlights recent progress made in operationalizing some of the key concepts underpinning PIWM on-site through approach development and testing. The paper fills an important gap in the watershed management literature by illustrating how the states objectives and beneficiaries influence approach development, and by contributing to the body of literature on methods and approaches for participatory watershed management.

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WATERSHED MANAGEMENT

The Political Ecology of Watershed Management

The recent surge in funding and interest in watershed management must be looked at closely in terms of its political foundations. Political ecology helps to shed light on how the agendas of different actors in the global system shape how ideas (science) are formulated and leveraged toward particular ends (Agrawal and Gibson, 1999; Leftwich, 1994). It is no different within the watershed domain (see Shah, 1998), where multiple actors see in the approach a means to accomplish disparate objectives. This has resulted in multiple visions of the "watershed approach". Among agronomists, it is seen as a means of scaling out technologies, primarily those for soil and water conservation or environmental protection more generally (see analysis by Hinchcliffe et al., 1995). For the water resource sector and policy-makers, it is seen as a means for enhancing environmental services and public goods emanating from upper catchments for the society at large (FAO, 2000; IIED, 2004). Among conservationists, it is viewed as a framework for enabling trans-boundary natural resource management (van der Linde et al., 2001), in which livelihood concerns are often addressed only to the extent that they help to further conservation goals. Yet among social scientists and others, watershed management is seen as a framework for enhancing collective action and equity in natural resource access and governance, or livelihood problems that cannot be solved at the level of the farm or household (Meinzen-Dick et al., 2002).

A critical question that we must ask ourselves to unravel the political ecological foundations of watershed management aims and methods (in terms of who benefits and whose agendas are furthered by the approach) is, "watershed management for whom?" A clarification of the intended beneficiaries, whether local users, society at large or diverse external stakeholders (i.e. agricultural, conservation or health organizations), is needed to define everything from watershed objectives to watershed boundaries, stakeholders and methods. If implemented for the benefit of local users, for example, boundaries can be defined by the issue at hand – whether inscribed within a set of contiguous farms, the micro-catchment at other spatial scales. If the aim is water provision for society at large, then boundaries become the basin. If for scaling out technologies or reforming policies, administrative units may be equally useful units. Any attempt to operationalize watershed management must therefore be grounded in a preliminary statement of aims, beneficiaries and the nature of problems to be addressed.

Participatory, Integrated Watershed Management (PIWM)

In participatory integrated watershed management, the approach can be qualified through two aims. First, the process must be participatory in terms of the particular issues to be worked on, and how related activities are carried out (Hinchcliffe et al., 1995; Rhoades, 2000; Turton and Farrington, 1998). A critical question to ask when formulating a participatory watershed management agenda is, "Why would a farmer want to think beyond the farm level?". Only by gaining clear answers to this question can a participatory watershed approach be developed. Participatory problem definition also implies that the relevant boundaries for interventions are not necessarily the "watershed," but perhaps units defined by non-biophysical parameters (administrative or cultural units) or at other scales (for example, a set of neighbouring farms or a particular landscape niche). It must therefore be treated as a hypothetical unit of analysis until participatory diagnosis confirms that problems conform to hydrological boundaries.

Second, the process must be integrated. While different people may define integration differently, a common approach is to emphasize the integration of disciplines (technical, social and institutional dimensions) (Bellamy et al., 1998; FAO, 1977; Reddy, 2000) or objectives (conservation, food security, income generation) (Shah, 1998). While it is increasingly clear that the success of watershed management programs rests on the integration of conservation with livelihood goals, technical with institutional interventions (Reddy, 2000; Shah, 1998), few programs have effectively achieved such integration in practice (Rhoades, 2000; Shah, 1998). It is therefore essential that any approach at integration integrate an understanding of the principles operating within natural and social systems (Meinzen-Dick et al., 2002; Reddy, 2000).

THE AFRICAN HIGHLANDS INITIATIVE

The African Highlands Initiative (AHI) is an ecoregional program of the Future Harvest Centers (CGIAR)[2] and the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA). The program operates in benchmark sites of the eastern African Highlands that share similar characteristics: high population density, declining agricultural productivity, and limited economic opportunities. Since 1995, AHI has worked in partnership with NARS of Ethiopia, Kenya, Madagascar, Tanzania and Uganda to develop new working approaches that enable improved farm- and landscape-level natural resource management (NRM) among rural communities. Research and funding during Phases 1 and 2 of AHI emphasized farm-level natural resource management, primarily through technological innovation. In recognition of the strong interactions among users and components (trees, cropland, water, livestock) at landscape level, Phase 3 aims to address broader dimensions of NRM beyond the farm level. This has catalyzed funding for what has become a full-fledged emphasis on participatory, integrated watershed management and the development of methods to operationalize this approach. While still in early stages of implementation, important lessons are emerging for agricultural research and development (R&D) in the eastern African region. It is important to take a look at the foundations of watershed management within AHI, given the variability of objectives and approaches falling under the "watershed management" umbrella. AHI's aim is to operationalize a participatory, integrated watershed management approach to address problems of immediate relevance to highland communities. This means that it is a largely endogenous approach in terms of the motives for change (i.e. NRM problems identified by watershed residents themselves) and the ultimate beneficiaries (upper catchment residents). Principles guiding watershed approach development include equity, sustainability and local empowerment. While higher-level actions in the near future will be restricted to district-level institutional and policy interventions in support of watershed-level actions, it is possible that such 'working catchments' will be integrated into higher-level (watershed or basin) management initiatives.

Research Sites and Methods for Approach Development

RESEARCH SITES

Research was conducted in four AHI benchmark sites in the highlands of eastern Africa: Lushoto District in the East Usambara Mountains of Tanzania, Vihiga District in western Kenya, and Ginchi and Areka Woredas in central and south-central Ethiopia, respectively (Table 1). Each site is characterized by high population

Table 1. Characteristics of AHI Benchmark Sites (Adapted from AHI, 2001)

Site Attributes	BENCHMARK SITE Areka	 Ginchi	 Lushoto	 W. Kenya
Altitude	1800-2600 masl	>2200 masl	1100-1450 masl	1500-1700 masl
Pop. density	400-600 (p./km^2)	100-200 (p./km^2)	200-300 (p./km^2)	600-1200 (p./km^2)
Enterprises & Land Use	Enset, wheat, pea, maize, barley, sorghum, sweet potato, faba bean, horticulture, communal grazing	Barley, pulses, irish potato, wheat, oilseeds, seasonal rotation from individual cropland to communal grazing	Maize, banana, tea, coffee, horticulture in valley bottoms, high-value trees, zero-grazed livestock	Maize, beans, horticulture, some coffee, tea, sugar cane, semi-intensive dairy
Irrigation	None	None	Seasonal	In riparian areas
Livestock Trends	Low numbers and decreasing	High numbers yet decreasing	Small numbers; most zero-grazed	Small numbers but stable
Forest/wood-lot access	Medium (tree planting common)	Limited (planting & biomass limited)	Medium to high (mostly cultivated)	Limited (only cultivated)
Market Integration	Limited, some off-farm employment	Medium	Medium to good (tea, vegetables)	Medium to good

[2] CGIAR stands for the Consultative Group for International Agricultural Research.

density, natural resource degradation and declines in agricultural productivity – posing significant challenges to farmers to provide for the growing population while maintaining the productivity of basic resources (water, food, fuel, fodder).

EVOLUTION OF CONCEPTS AND METHODS IN AHI: ACTION RESEARCH

Action research and social learning approaches are central to the evolution of concepts and methods within AHI. Concepts and methods are developed through an iterative process of reflection and implementation at site and regional levels, where practice informs concepts and vice-versa. While a central office or regional research team assists in the coordination of strategic research and interventions and to synthesize findings at regional level, national scientists in each benchmark site develop methodology on-site and carry out the bulk of the work on the ground. As the process unfolds, site teams work with one or more regional research fellows to develop "best bet" approaches, test them in the field, and improve upon them before implementing more broadly. Thus, while most ideas are generated through a "constructivist" (Chambers et al., 1992; Rodwell and Woody, 1994) approach to knowledge generation and social learning on-site, regional staff enhance cross-fertilization of ideas between sites. The latter enables a more robust approach through cross-site comparison, and greater regional integration (Figure 1). While this cross-fertilization helps to strengthen the approach followed as well as the regional research dimension, site-level scrutiny of approaches under development ensures sufficient variation so as to enhance comparative learning between sites.

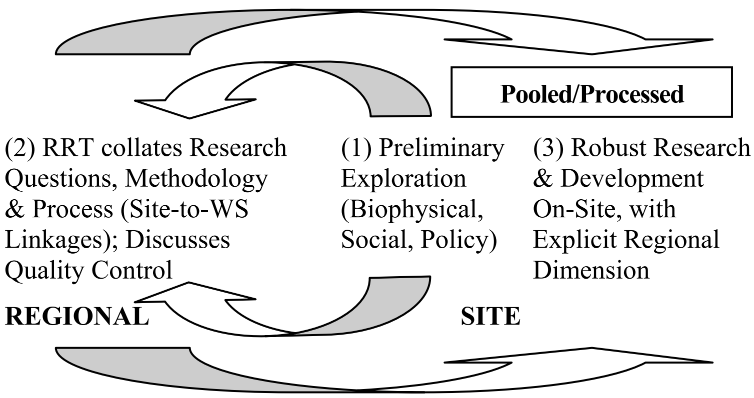

Figure 1. Site-Regional Linkages in AHI

Through this iterative approach to site application and regional synthesis, concepts are formulated and approaches formulated and tested with watershed communities. This has led to an improved conceptualization of a number of important concepts in watershed management (watershed issue, stakeholder, integration, participation). Without having a fixed idea about the nature of issues to be addressed within the watershed management umbrella, understanding of what constitutes a "watershed issue" remains illusive. Following the diagnostic phase, a typology of watershed issues facing highland communities in eastern Africa was formulated. These include common property resource (CPR) management problems, negative trans-boundary interactions (among neighboring farms and villages), problems of resource access and distribution, and areas for which limited collective action hinders agricultural productivity and livelihoods more generally (German, 2003). Given the nature of then AHI watershed approach and the issues facing local communities, "stakeholder" then becomes defined in more specific terms – often local actors with different interests or "stakes" as defined with respect to the particular issue at hand (trans-boundary, CPR or other). Non-local stakeholders are only involved if the issue involves them directly, including the management of public lands, governance issues or public services (water, etc.).

The nature of issues identified in AHI benchmark sites has also enabled a more explicit understanding of watershed "integration" and "participation." While several forms of integration can be identified, the most prominent include: a) managing interactions between and benefits to diverse watershed-level components (trees, water, livestock, crops, soil); and b) a multi-disciplinary (multi-sectoral) approach to integrate biophysical, social, market and policy interventions. Operationalizing "participation" around specific issues allows it to becomes less associated with a particular methodology (i.e. PRA), and more linked to underlying values of equity and empowerment. It therefore assumes multiple meanings, from *local ownership* of the process (from problem identification to planning and implementation) to *collective action* (in terms of widespread motivation and participation, and more negotiation of processes and outcomes) and more *equitable benefits* to diverse user groups.

"Participation" in Watershed Management

"Participation" means different things to different people. All too often, however, it is taken to mean mere turn-out at community fora, undermining true participation in decision-making and benefits. Throughout the diverse stages of watershed management, we have experimented with diverse forms of participation, from equity to representation to negotiation.

PARTICIPATION IN PROBLEM DEFINITION

The political ecology of watershed management suggests that those involved in defining the watershed management approach will have important influence on the definition of objectives and methods. It is therefore important to look at how the questions asked, and the methodologies utilized, influence the outcomes of problem definition in watershed management. In Lushoto benchmark site, Tanzania, the correlation between questions asked and elicited responses was closely tracked (Table 2). The results enable a better understanding of how the formulation of questions influences the definition of problems. They also demonstrate the importance of triangulating research questions for a robust diagnosis of watershed problems. After seeing the contribution of different types of research questions, all of the questions were integrated into a single interview checklist.

Table 2. Correlation between Questions and Elicited Responses in Lushoto Benchmark Site

Research Question	Elicited Responses
1. What activities could benefit from collective action?	Soil and water conservation, farmyard manure application, banana planting Maintaining community bull Community mill construction and operation Maintenance of roads and community buildings Managing water sources and irrigation infrastructure
2. How do activities of neighboring farms and villages influence your livelihood?	*Eucalyptus* spp. on neighboring plots and boundaries Neighboring fields harboring rodents, pests and weeds Stray fire from neighbors' fields Failure of neighbors to conserve their plots and run-off Lack of respect for farm boundaries
3. Are there any natural resource management conflicts?	Land shortage / boundary encroachment Free grazing Theft of crops and village trees Traditional vs. modern beliefs on NRM Limited drinking / irrigation water
4. Are there any problems associated with the management of communal property?	Water shortage (drinking, irrigation) Water pollution Fires and theft in village forest Impact of crops and *Eucalyptus* spp. on water availability

More open-ended interviews conducted during the more formal watershed diagnosis enabled the identification of additional issues affecting the livelihood of some groups. In Ginchi, for example, women mentioned the decline in fuel wood access as a key problem. In recognizing the existing research questions did not effectively elicit this problem, it was decided that an additional question was required, namely, "How have land use and landscape changes over time influenced livelihood?"

Another critical issue are the methods used to identify watershed problems. The community forum is the most popular approach to problem definition due to widespread experience with Participatory Rural Appraisal techniques. However, in recognition of the influence of more outspoken individuals on effective participation, approaches aimed at greater social disaggregation were tested within AHI. Individual interviews and focus group discussions were both utilized. While individual interviews are more advantageous for understanding how perceptions differ within different groups, focus group discussions were found to foster greater rapport and debate over elicited responses. To identify the key watershed problems from the standpoint of diverse social groups, focus group discussions by gender, age and wealth were utilized in several benchmark sites. In other sites where there is a clear patterning of households according to landscape position, landscape location (upslope vs. downslope) was an additional basis for focus group formation. Once the issues were identified, they were compiled into single lists and ranked. For the ranking procedure, individual interviews were utilized to capture inter-group variation in responses. Ranks were compiled into watershed averages, as well as group averages (by gender, wealth, age and landscape position). Results demonstrate the critical importance of socially-disaggregated problem diagnosis (Table 3). Issues reflecting female domains of activity such as domestic water supply receive a much higher rating by women than by men, while issues affecting male rights (i.e. rights to land and irrigation water) and responsibilities (road maintenance) are prioritized more highly by men. Similarly, wealth influences how issues requiring significant resource inputs (labor, capital) are ranked. Finally, landscape position influences the relative access to drinking and irrigation water, and the corresponding ranks for these issues.

Table 3. Socially-Disaggregated Ranks of Selected Watershed Issues

Watershed Issue	**Socially-Disaggregated Ranks**							
	Men	Women	Elder	Youth	High Wealth	Low Wealth	Up Slope	Down-Slope
Water Issues								
- Limited access to potable water	15	**2**[a]	-	-	-	-	**1**	15
- Insufficient irrigation water in the dry season	**8**	18	-	-	-	-	**8**	13
- Individual ownership of springs	16	**6**	-	-	-	-	-	-
Trans-Boundary Issues								
- Insufficient respect for farm boundaries	**13**	27	-	-	-	-	-	-
Other Land Management								
- Need for group tree nurseries	13	**2**	**<5**	**<5**	**<5**	**<5**	14	**8**
- Lack of improved seed	**5.5**	**<5**	**<5**	**<5**	12	**<5**	**<5**	**6.5**
Infrastructure								
- Need for cooperation in road maintenance	**3.5**	16	-	-	14.5	**3**	-	-

[a] Lower numbers (in bold font) refer to issues that received high ranks, and are of greater importance.

Participation in problem definition can also be operationalized through the identification of strategic leverage points or 'turn keys' from a social perspective. One way to do this is to identify issues of high importance to most social groups. This can be done by contrasting the ranks given by different social groups to watershed issues falling within each category (as in Table 2) or overall. An example from Lushoto illustrates how trans-boundary issues are ranked by different groups (Table 4). Here, out of all 11 trans-boundary issues identified in the watershed, only 3 or 4 are considered highly by most groups.

PARTICIPATION IN PLANNING

Farm-level interventions, while often introduced through groups, are generally negotiated up to the level of the household only and applied to private property. Watershed-level interventions have the potential of enabling technological interventions to work better from both technical and social standpoints, given the strong

Table 4. Top Three Trans-Boundary Issues by Social Group, Lushoto Benchmark Site

	Gender		**Age**		**Location**	
	F	M	Elder	Youth	Up	Down
Theft of others' property	2				3	
Trans-boundary pest & disease effects		**1**[a]	**2**	**2**		**1**
Lack of respect for farm boundaries						3
Stray fire crossing farm boundaries						
Run-off from upslope cultivation	**1**		**1**	**1**	**2**	
Non-respect for communal land boundaries	**3**	**3**				**2**
Shade from boundary trees						
Run-off from upslope Black Wattle trees						
Drying of land from boundary trees		**2**	**3**	**3**	**1**	
Rodents from fallowed land						
Free grazing across boundaries						

[a] Figures in bold font indicate trans-boundary issues of high priority to most groups.

interactions between neighboring landscape units (farms, individual and private property, etc.). The question then becomes how to ensure equity in such negotiated outcomes when moving from potentially interest-based to more equitable decision-making. Watershed action plans must be negotiated among diverse users with different priorities and levels of influence. When considering how to ensure real participation in planning, the following should be considered: a) the level at which planning is carried out, b) whether to plan for multiple issues simultaneously or around specific issues, and c) how to address social trade-offs in decision-making.

Regarding the level at which planning is carried out, practitioners have a tendency to take the watershed as the appropriate level of diagnosis and planning – compelled both to conform to watershed boundaries and to simplify the "community-project interface" for practical purposes. Yet there are important implications of watershed-level planning and implementation in which representatives of each village come together to take key decisions for the entire area. The first of these is that levels of participation are compromised. Geographical and demographic barriers hinder participation by influencing the effort that must be expended in attending planning sessions and influencing the number of voices that may be heard during group discussions. Equally critical are psychological barriers to participation within larger, less familiar groups, which hinder the participation of less empowered and outspoken groups. One possible solution, watershed planning with community representatives, poses new problems. First, representation in name does not imply representation in practice, as those involved in planning will more often than not plan according to their own priorities and benefits than for those they are supposed to represent. This poses a problem in terms of elite capture of program benefits. Furthermore, unless high-quality feedback mechanisms are put into place, the broader watershed community will have little understanding of decisions taken and therefore little incentive to participate. Several strategies for addressing these constraints are currently under development within AHI. The first involves decision-making at the watershed level only after watershed units (village or other) elect representatives and establish a plan for more widespread feedback and validation once preliminary decisions have been taken. Yet for this to be effective, performance criteria for elected representatives should be established prior to the identification of individuals due to the tendency for elected representatives to reflect existing power dynamics rather than robust leadership criteria. The second strategy involves greater devolution of decision-making and management within the watershed, moving to higher levels of negotiation only for those issues that demand it.

The second consideration when seeking effective participation in watershed management is whether to develop general watershed action plans, or plan around specific issues. While the former enables an integrated approach to planning, the latter is more suited to an emphasis on stakeholder equity. This involves the identification of stakeholders specific to each issue, followed by multi-stakeholder negotiations at village or watershed level. A stakeholder approach minimizes involvement to only those who have a direct 'stake' in the issue at hand, and lends itself more easily to effective representation – since for any given issue the individuals directly involved in negotiation will hold views that approximate those of their constituents. It is also preferable in terms of the depth of planning, given that a single issue is addressed at a time and the nuances of different perspectives made central to analysis and planning. Stakeholders can be defined in a number of ways – according to the issue at hand (Table 5), or specific sub-components of these issues that define more specific stakes (see tree niche example, Table 6).

A final consideration for enabling effective participation is how to anticipate and manage the benefits and costs of interventions to diverse groups. Only by acknowledging such social trade-offs during the planning phase can solutions – and the benefits derived from them – be negotiated by different user groups.

Table 5. Stakeholders of Specific Issues

Issue	Stakeholders
Input quality	Stockists, farmers (by wealth[a]), suppliers
Water	Those implicated (owners of springs, tree lots), those most affected (irrigating farmers, women)
Poor governance	Local leaders, diverse local constituents (relatives of local leaders vs. others), district

[a] Farmers with different resource endowments will rely on different types of inputs, requiring that these divergent 'stakes' be made explicit.

Table 6. Niche-Specific Stakeholders, Lushoto District, TZ

Niche	Stakeholders
Farm boundaries	Owners of boundary trees, neighboring farmers, missions, churches
Forest buffer zone	Farmers in buffer zone, Ministry of Natural Resources and Tourism
Watering points	Individual landowners, water users
Within farmland	Individual household members (by gender, age)

Without explicit acknowledgement of such differential impacts and the development of strategies to manage processes and benefits more equitably, collective action will occur at the expense of equity rather than as a means to further it (Ramírez and Berdegué, 2003). An example from Ethiopia helps to illustrate this better. During the watershed exploration exercise, researchers identified conflict among neighboring villages due to limited water resources. Villages with more water were being visited by farmers and livestock from neighboring villages. Paths through the farms and villages were being blocked as a manifestation of resistance to water sharing. As we work to develop watering points in the watershed and water quantity and quality are positively affected, neighboring villages are likely to want access to these water resources. A solution may, therefore, be the source of a future problem (in this case, water resource conflicts), a problem that can be anticipated from what is known about the current situation. We are currently developing strategies for facilitating communities to consider such potentialities up front, and to develop an approach for managing watering points once "developed". This might include negotiation with neighboring communities to develop structures and rules of governance for the resource given anticipated demands on the resource in the near and distant future, and strategies for periodic re-negotiation of these strategies under changing circumstances.

To better target such efforts at negotiated planning, it is important to consider the conditions under which collective action, negotiation and/or formal by-laws (as opposed to a more individualized approach) are needed to enable improved NRM and equity. Thus far within AHI, three conditions have been encountered thus far which would require negotiation in planning to ensure effective participation:

- Negotiation of any program benefits;
- Negotiation of solutions where interventions may have an overly negative impact on certain groups; and
- Negotiation of rights and responsibilities where the intervention is likely to cause conflict through increased demand over the resource.

PARTICIPATION IN IMPLEMENTATION

Fostering effective participation during implementation can be seen in terms of greater numbers of participants, or in terms of negotiation of rights and responsibilities among diverse groups. For the first of these, collective action is seen as a vehicle for greater access to program benefits due to higher numbers of participants. Yet as mentioned above, collective action can be achieved through both voluntary and authoritarian means and either further or reduce existing inequities (Ramírez and Berdegué, 2003). It is therefore critical that collective action be seen as a conceptual framework for enabling equitable stakeholder involvement in implementation processes. For this, a system for ensuring that rules of governance established during the planning stage are implemented in practice. It is also important to consider that rules established at the outset are 'best bet' approaches, and not yet tested in practice. As such, overly rigid adherence to established rules can be as detrimental to program success and effective participation as non-adherence to rules (Kloppenburg, 1983; Nemarundwe and Kozanayi, 2003). A flexible yet accountable system of governance can be best achieved through an iterative social learning process, in which established mechanisms for ensuring equity are tested in practice, and modified according to successes and challenges faced during implementation and through equitable negotiation processes. This, in turn, requires a participatory monitoring and evaluation system that encourages active reflection on the implementation process (action learning).

In recognition that not all ramifications of watershed interventions will be anticipated, an effective monitoring and evaluation strategy is needed to capture trends in benefits capture and other social impacts as they emerge. Without such monitoring systems in place that make the distribution of benefits and social impacts explicit, it is likely that current interventions will become problems for certain social groups and further existing inequities. Continuous monitoring also enables continuous (re-)planning, a prerequisite to adaptive management in that realities encountered during implementation do not always reflect 'best approaches' as prescribed early on in the planning process and therefore require continuous adaptation of approaches (Chevalier, 2004; Holling and Meffe, 1996). This enables the learning from participatory monitoring (performance of key indicators, unexpected challenges encountered) to be integrated into improved actions.

While an optimal strategy for monitoring the impacts of interventions on diverse system components and social or stakeholder groups has yet to be determined in the context of AHI, it is clear that both rigor (in the sense of capturing diverse views) and efficiency must be considered. The trade-offs of external and participatory monitoring should be weighed in terms of the ability of each to capture nuances and political dynamics within a community, and the need to minimize time investments of farmers and outside actors. While socially-disaggregated monitoring could be taxing for facilitators and other participants, it may prove to be the only means to ensure effective "participation" (i.e. capturing negative impacts on less outspoken or more vulnerable groups) in societies governed by hierarchical decision-making processes (Figure 2). Ultimately, such outside control over who has a voice and who benefits should give way to a more vibrant civil society in which more marginalized groups can voice their own concerns.

Figure 2. M&E with non-participating farmers is necessary to capture local dynamics which influence the distribution of benefits. These women from Ginchi noted that they are not participating in a project income generating activity 'because they were not invited,' suggesting that new strategies needed to be tried to improve local "governance" of development interventions.

Integration in Watershed Management

Similar to participation, “integration” means different things to different people. Within AHI alone, several forms of integration are required. First, integration means managing benefits to diverse watershed-level components, including tree, water, livestock, crop and soil components. This is required so that gains to one particular component (i.e. timber yield) do not have an overly negative impact on other components (i.e. water resources) – or on users depending on the viability of this other component for their livelihood. Integration also means integrating diverse solutions through a multi-disciplinary or multi-sectoral approach. This form of integration is required not only given the “systems” thinking in a biophysical sense, but to support technical solutions with social, policy and market interventions (Figure 3). A third form of integration can be seen in the need to manage interactions among diverse tenure systems, so that investment in individual and private “goods” can be balanced with investment in common and public goods. This last form of integration can be aided by collective action theory, which seeks a better understanding of the conditions required to enable greater investment in common property resources and public goods (Meinzen-Dick et al., 2002; Ostrom, 1990; Pandey and Yadama, 1990; Wittapayak and Dearden, 1999). Since this last form of integration can be treated in unison with the first, given that system “components” can be defined in biophysical or legal (tenure) terms.

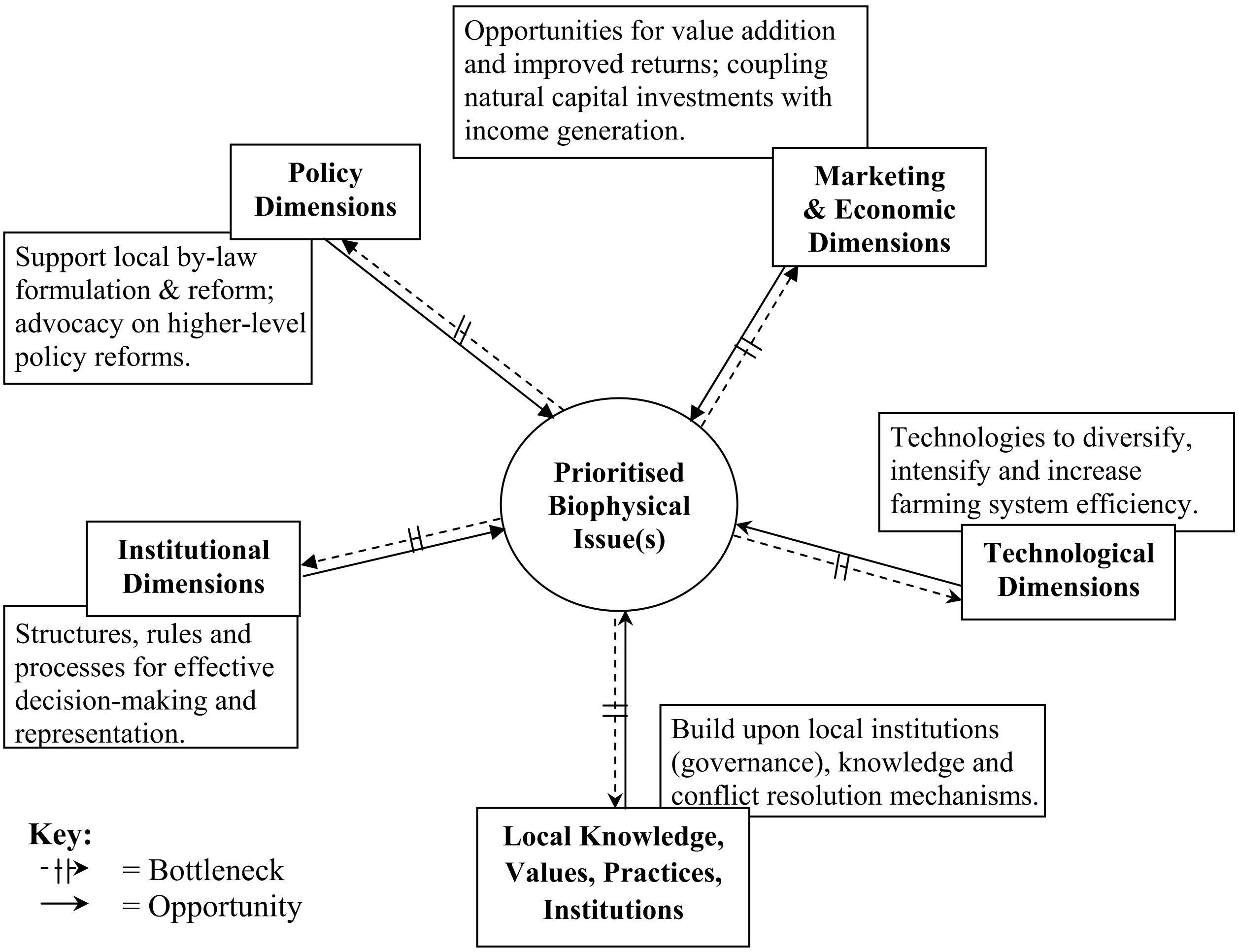

Figure 3. Multi-Disciplinary and Multi-Sectoral Integration in Watershed Management

INTEGRATION IN PROBLEM DEFINITION

During problem definition, integration can be achieved through a fully interdisciplinary exploration of watershed problems (including biophysical, social, policy and market dimensions) and through a systems analysis of component linkages. Research questions guiding problem and opportunity identification in AHI benchmark sites are illustrated in Table 7. These questions are not meant as a template for watershed exploration in other sites, given that biophysical dimensions are given more systematic treatment than other areas. It nevertheless illustrates a certain degree of interdisciplinarity in problem identification.

Table 7. AHI Regional Research Questions for Watershed Exploration (German et al., 2003b)

Primary Questions	Secondary Questions
(Biophysical) What are the key NRM problems, from the community's perspective, requiring a watershed approach or collective action?	1. How have changes in the landscape and land use over time influenced livelihood? 2. Do on-farm management practices of your neighbors' have any influence on your livelihood? How about the management of resources by neighboring communities? 3. Are there any NRM problems that could benefit from collective action? 4. Are there problems associated with common property resources? 5. Are there any conflicts associated land or NR management (within or between villages)? 6. How do different groups (by gender, age, wealth or landscape position) prioritize these issues?
(Social/Policy/Market) What are the key opportunities (social capital, policy mechanisms) and constraints (social & policy barriers) for enabling collective action in the watershed?	1. What local social units (internal) and institutions (external) exist in the watershed? What are their characteristics (history, objectives, strengths & weaknesses, tendency to cooperate with other groups, decision-making processes and importance to diverse social actors)? 2. Are there traditional practices or beliefs influencing NRM? Are there any NRM conflicts? Are there any traditional mechanisms for conflict resolution & decision-making? 3. Who are the influential individuals in the communities? How effective are they in community mobilization? 4. What brings people together for cooperation? Is there anything that keeps people from cooperating? 5. How do local, district or national policies influence land management & use of communal resources? Do any of these policies influence collective action? 6. What strengths & limitations exist for by-law enforcement? Are there any coping strategies for marketing agricultural produce?

The second step, systems analysis of component linkages, can be carried out once key watershed problems have been identified and prioritized. In each AHI benchmark site, a list of biophysical issues was generated from the above research questions through socially-disaggregated problem diagnosis, grouping of like issues, and socially-disaggregated ranking of issues as described above. In addition to identifying issues of high importance to most social groups, discrete issues were grouped according to the presence of strong functional interactions among them (German et al., 2003a). The idea behind this was to identify clusters of issues that could be addressed simultaneously, so as to foster positive synergies among them and multiple returns (i.e. water, food, fodder and fuel) (Ibid).

INTEGRATION IN PLANNING

Integration in planning can be addressed from the standpoint of both component integration and disciplinary or sectoral integration. For the first of these, higher-level system goals should be specified for each cluster in order to avoid disintegration during planning. An example from Ginchi Benchmark Site in Western Shewa Zone, Ethiopia, can help to illustrate the point. In Ginchi, two system clusters were identified by identifying strong functional linkages among discrete watershed problems:

Soil and Water Conservation and Utilization (SWCU) Cluster

- Poor water quality
- Water shortage for livestock and humans

- Loss of seed, soil and fertilizer from excess run-off
- Crop failure due to drought
- Loss of indigenous tree species
- Integrated Production and Nutrient Management (IPNM) Cluster

Integrated Production and Nutrient Management Cluster

- Feed shortage
- Wood shortage
- Soil fertility decline
- Loss of indigenous tree species
- Lack of income-generating opportunities

System-level objectives were then established not for discrete problems, but for the cluster as a whole:

Overall SWCU Cluster Objective
To enhance the positive synergies between water, soil and tree management in micro-catchments.

Overall IPNM Cluster Objective
To improve farmer incomes and system productivity (crops, livestock, trees) while ensuring sustainable nutrient management in the system.

Finally, when the watershed management program integrates research and development, higher-order research questions can be established toward which each component contribution is ultimately linked:

Primary Research Question, SWCU Cluster
How can NRM practices (SWC structures, tree planting, drainage systems, etc.) enhance agricultural production / productivity through decreased erosion while also enhancing spring recharge long-term?

Primary Research Question, IPNM Cluster
How can income be improved through increased agricultural production / productivity (crop, livestock, tree and nutrient management) and marketing while also enhancing system nutrient stocks?

Following the identification of a higher-level system goal, component contributions to this integrated objective should be clearly identified, particularly since the emphasis of conventional R&D is to enhance the performance of a single component rather than the system at large (Table 8). Component contributions to system objectives for the Soil and Water Conservation and Utilization Cluster at Ginchi are illustrated graphically in Figure 4 (Getachew et al., personal communication). It is clear from this diagram that in addition to contributing to their own component-specific objectives, activities falling within each cluster must aim to achieve system-wide benefits wherever possible.

Table 8. Re-Defining Research and Development Objectives for Greater Component Integration

Component	Conventional Objective	Integrated Objective
Soil	Soil fertility and stabilization.	To optimize soil quality and stability, water quality, and the production of food, feed and timber.
Agroforestry	To maximize the production of tree products.	To optimize the yield of tree products, crop yield, soil quality and water discharge.
Crop	To maximize the yield of edible and marketable plant products.	To maximize the yield of edible plant parts and crop residues (for soil fertility and feed) without depleting soil nutrient stocks.
Livestock	To maximize the production of edible and marketable livestock products (milk, meat, eggs, hides).	To optimize the production of livestock products (including dung) and soil fertility maintenance.

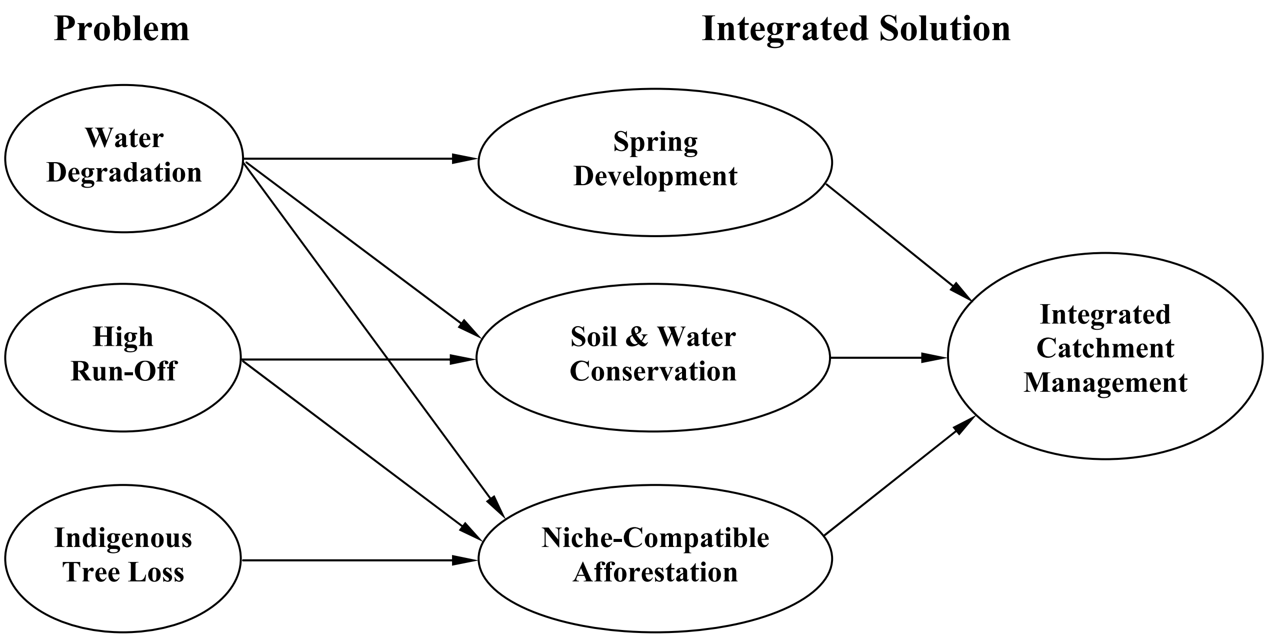

Figure 4. Articulating Component Interactions in Galessa Watershed, Ethiopia

While not immediately obvious, such strategies acknowledge the component interactions and trade-offs characterizing watersheds. The aim of such integration would be to avoid negative interactions (where maximizing one system objective hinders another) and to foster positive synergies among system components. An example of such component trade-offs is illustrated in a tree niche analysis conducted in two AHI benchmark sites. Key informants knowledgeable about the properties of indigenous and exotic tree species were asked to identify key species and species characteristics making them compatible with different landscape niches. Negative impacts of trees identified in each of the two sites are compiled in Table 9, where trade-offs between gains to forest and other components (soil, crops, water) are clear.

Table 9. Perceived Negative Impacts of Trees in Two AHI Benchmark Sites

Lushoto BMS, Tanzania	Ginchi BMS, Ethiopia
Arrests undergrowth	Is bad for crops
Creates large shady area	Dries springs
Has aggressive root system	Is bad for soil
Leaves bad for crops, soil	
Hinders infiltration & increases runoff	
Heavy feeder on groundwater	
Out-competes other tree species	
Dries valley bottoms	

Similar to efforts at achieving effective participation in watershed management, it is useful to consider the conditions under which system interactions and trade-offs should be addressed during the planning stages to enable optimal (system-wide) benefits. Thus far within AHI, two such conditions have been encountered:

- Where the intervention in any given component is likely to have a negative impact on other system components (water, livestock, crop yield, soil fertility), or
- Where integrated planning is likely to enhance positive synergies among components (multiple system benefits).

In terms of achieving sectoral or disciplinary integration during planning, two considerations have come to light within AHI. First, unless 'other' dimensions of the problem are made explicit during planning, biophysical interventions will take precedence. For each major intervention, it is therefore critical to crosscheck identified solutions by considering whether diverse dimensions (technical, social, policy, market) have been considered. An example from Ginchi and Lushoto benchmark sites (Table 9) illustrates how doing so ensures that complementary dimensions of watershed management are brought on board. Ensuring that strategies falling within each dimension are considered will help to address the second consideration, which is how to identify and enable positive synergies among diverse types of solutions. Three types of such synergies have been identified thus far within AHI. These are illustrated in Table 10, along with examples of each.

Table 10. Technological, Social and Policy Dimensions of Niche-Compatible Afforestation

Technological	Social and Policy Dimensions	Economic Dimensions
Niche adaptation trials	Rules on nursery management (benefits, responsibilities, sanctions)	Identification of alternative high-value trees to aid in negotiations
Tree nurseries	Negotiation of niche-compatible afforestation (regulations on species' location or density)	

INTEGRATION IN IMPLEMENTATION

While a number of strategies have been developed and are undergoing implementation in AHI benchmark sites, lessons on the relative success of different approaches – or of similar approaches sequenced differently – have yet to emerge. Nevertheless, it is possible to identify strategies being targeted to ensure biophysical and multidisciplinary integration during early stages of implementation.

To achieve integration of landscape-level components, there are several implementation options for any given problems. While the diagram in Figure 3 would appear to suggest an implementation pathway, there are two clear possibilities for operationalizing this form of integration. First, teams of scientists and practitioners can work on individual components (spring development, SWC practices and niche-compatible afforestation) independently, yet ensure the work addresses system goals, as defined in the overall cluster objective. The pitfall of taking this option is that existing interdisciplinary biases will tend to disintegrate the approach into component-specific approaches unless mechanisms are taken to ensure accountability to the system goal. This can include the integration of relevant disciplinary expertise on teams working on *each* component, so that hydrologists, soil scientists and foresters (in addition to social scientists and community facilitators) jointly work on niche-compatible afforestation for example. Other mechanisms include assigning a Cluster Leader to oversee implementation and adherence of each component to the higher-level system objective, and detailed interdisciplinary planning in which the actions to be taken in the name of integration are made clear to and debated by all team members.

The second option to ensure component integration is to implement each of the component activities through a single set of activities, for example by focusing activities on "Integrated Catchment Management" rather than individual components as in Figure 3. Within AHI, this approach has been planned in two ways that differ in terms of sequencing of activities. The first entails spring development to enhance enthusiasm about project activities, followed by integrated afforestation and soil and water conservation activities in different landscape units (Ginchi Site Team, 2004). One assumption inherent in this approach is that if spring development – as the most immediate solution to a highly-prioritized issue – is used as an entry point, outcomes of future R&D investments will be greater due to increased community trust and enthusiasm (Ibid). The second approach, planned for implementation in Lushoto Benchmark Site, does not assume this and rather ensures that the high-priority entry point is used as a stimulus for more integrated and long-term catchment planning among watershed residents (Mowo, personal communication) (Box 1). The difference between these two approaches lies in the sequencing of activities, and in the expected impact this will have on community willingness to invest not only in short-term solutions (spring development) but in long-term natural resource management investments (niche-compatible afforestation, SWC structures, etc.).

Box 1. Facilitation Plan for Integrated Catchment Management, Lushoto Benchmark Site

(a) Awareness creation through feedback of watershed findings, in particular the complex linkages between hillside erosion and valley bottom fertility, hillside management (physical structures & vegetation) and spring discharge, and existing problems (increased erosion due to iron sheet roofing) and possible solutions (water capture to enhance availability to domestic water).
(b) Establish an integrated catchment management competition by offering integrated services (technical assistance and materials for water reservoirs, technical assistance on soil and water conservation and niche-compatible afforestation; organizational and by-law support) in exchange for high-quality negotiated action plans and social mobilization at micro-catchment level.
(c) Micro-catchment interventions in select catchments (up to 3) to further develop and implement action plans. Findings and lessons from prior and current working groups (linked technologies, tree niche analysis, spring management) will be fed into the integrated catchment management approach to enhance impact.
(d) Impact studies to document the impacts of the above methodology in relation to other approaches being utilized (including technology dissemination approaches targeting individual farmers and isolated approaches to spring management).

In addition to considering the level at which integration is operationalized (at the level of objectives and research questions, as in the first example, or of activities as in the second), it is important to include a monitoring and evaluation system that seeks to ensure integration through periodic re-assessment. For the purposes of component integration, monitoring must assess the impacts of activities on diverse system components. Therefore, whether monitoring is carried out by component (niche-compatible afforestation, SWC structures or spring development) or by system (integrated catchment management), monitoring must address the impact of *activities* on *diverse components* (water, livestock, crop yield, soil fertility). To operationalize this, it is important to: a) consider all potential interactions between the activity conducted and different components, and b) to identify priority indicators from scientific and/or local perspectives that will be monitored for each. Examples of potential effects and indicators for afforestation activities have been developed with farmers from Lushoto and Ginchi benchmark sites, and are presented in combined form in Table 11.

Table 11. System Interactions and Indicators for Niche-Compatible Afforestation in Lushoto, Tanzania and Galessa, Ethiopia

Potential Interactions	**Indicators**
Crops – competition or compatibility (nutrient, light, hydrological and allelopathic interactions)	Does not arrest undergrowth; leaves have neutral or positive effect on crop growth; can be pruned to reduce shade; canopy holds onto rain and releases it slowly; does not extract too much water from soil.
Soil – nutrient interactions; erosivity	Does not hinder infiltration / enhance run-off; neutral or better effect on soil fertility; leaves decompose easily.
Springs – water quantity; taste	Does not change the taste of water; has a shallow root system and neutral or positive effect on spring discharge.
Livestock – provision of feed; effect on grazing land	Makes good feed for livestock; has neutral or positive effect on crop growth (crop residues used as feed); serves as shade for livestock; seedlings survive browsing after 2 years (for grazing areas).
Trees – competition or compatibility with other species	Does not inhibit the growth of other tree species.

In terms of multidisciplinary integration, it became clear during early stages of implementation that monitoring and evaluation of all program activities will benefit from interdisciplinary dialogue. In a recent case, it was found that quality control was being determined in purely technological terms due to the strong biophysical basis of site team expertise, in effect marginalizing social and policy dimensions despite joint planning on these issues. Two lessons can be derived from this experience. First, it is important that interdisciplinary planning be done *in detail*, down to the level of activities and the approach to be used to carry them out. Second, interdisciplinary planning should specify the sequencing of activities, so that principles specific to each discipline or sector are well integrated into the sequencing of technological and other interventions. In social terms, how to motivate and mobilize the community in terms of balancing short- with long-term benefits, and farmer investments with project inputs (as in the spring development example), becomes critical. In economic terms, market opportunities should be identified prior to the selection of the agro-enterprises or crop varieties to be field-tested to counter the supply-driven emphasis of smallholder farming systems (Ostertag Gálvez, 1999). Finally, and most important during the implementation phase, both intermediate planning (required to adjust action plans to field realities) and monitoring and evaluation (of all activities, independent of their disciplinary or component focus) should be done by multidisciplinary teams at project level and by multiple local stakeholders. This "constructivist" form of planning and evaluation, in which multiple views are consulted and negotiated, is one of the fundamental principles of social learning and adaptive management (Chevalier, 2004).

Finally, several insights may be drawn from the challenges faced in staying integrated during the implementation stage. First, integration is a continual challenge, given the role of disciplinary biases in favoring certain viewpoints and approaches, and the institutionalization of disintegration (in university training, the division of departments and programs, peer review, etc.). AHI is testing a number of approaches for ensuring ongoing integration: a) mutual capacity-building to reach a common understanding of the goal; b) team and cluster management to ensure that each component keeps the primary objective and research question in mind during the implementation phase; and c) regularly scheduled meetings at program and community levels to share experiences, evaluate and re-plan.

Discussion and Conclusions

Participatory, integrated watershed management presents many challenges to research and development actors. The first is the need to manage a complex, ambitious agenda in which diverse types of trade-offs and synergies must be identified and managed. The second lies in the gap between current institutional arrangements, which foster disciplinary planning and action and isolate research from development (Hammersley, 2004), and those required to operationalize integrated planning and action, research and development. A third challenge lies in the bias of research toward more formalized, empirical methods over action research approaches. A fourth challenge lies in staying integrated when moving from systems thinking to systems action.

This paper fills an important gap in the watershed management literature by illustrating how key principles (participation, integration) can be operationalized in practice. By taking a step-by-step look at diverse stages of watershed planning and implementation, the paper illustrates key challenges faced and principles to be applied when trying to enable widespread participation and landscape-level integration. Approaches developed thus far for integrated and participatory diagnosis, planning and implementation are outlined, citing specific examples that will enable other R&D actors to learn from AHI's experience.

While significant progress has been made in operationalizing a particular form of watershed management (integrated, small-scale, and driven by endogenous motives for change), much remains to be done for scaling up the approach and seeing it translate into concrete benefits for watershed residents. One of the key challenges lies in the formulation of appropriate institutional arrangements for more widespread application, given the isolation of different disciplines – and of research from development – within existing institutions. To move forward here, it is important to take a systematic look at the tasks and skill base required to operationalize PIWM, and the degree to which existing institutions can be mobilized to fill the gap. Funding for action research and social learning approaches to test new types of institutional arrangements and linkages (partnerships) can be a starting point from which broader experiences are drawn and strategies formulated. Another key challenge lies in forging stronger linkages between research and development, so that development (community or organizational facilitation) is linked to and given at least equal status as research, and action research given equal weighting as more conventional empirical research. For this, university training, institutional mandates and incentive systems, and opportunities for social learning at local and institutional levels must be given close consideration if the integrated mandate embodied in PIWM is to be enabled.

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References

Agrawal, A., Gibson, C.C., 1999. Enchantment and disenchantment: The role of community in natural resource conservation. World Development 27(4), 629-649.

Bellamy, J.A., McDonald, G.T. and Syme, G.J., 1998. Evaluating integrated resource management. Society & Natural Resources 12, 337-353.

Chambers, D.E., Wedel, K.R., Rodwell, M.K., 1992. Qualitative research methods and the constructivist paradigm in the evaluation of social programs and policies. In: Chambers, D.E., Wedel, K.R., Rodwell, M.K. (Eds.), Evaluating Social Programs. Allyn and Bacon, Boston, pp. 288-332.

Chevalier, J.M., 2004. The social analysis system. Url: www.sas-pm.com/.

FAO, 1977. Guidelines for Watershed Management. FAO, Rome.

FAO, 2000. Land-water linkages in rural watersheds: Introductory note. Land-Water Linkages in Rural Watersheds Electronic Workshop, 18-27 October, 2000. FAO, Rome.

German, L., 2003. Beyond the farm: A new look at livelihood constraints in the highlands of eastern Africa. AHI Brief A2, 2 pp.

German, L., Stroud, A., 2003a. Creating an integrated research agenda from prioritized watershed issues. AHI Technical Notes Series B5, 13 pp.

German, L., Stroud, A. Amede, T., Opondo, C., Mowo, J., 2003b. A Framework for Strengthening Site-Regional Research Linkages. AHI Technical Notes Series A1, 33 pp.

Ginchi Site Team, 2004. Site team watershed action plan 2004-2005. Holetta Agricultural Research Centre, Technical Reports, May 2004.

Hammersley, M., 2004. Action research: A contradiction in terms? Oxford Review of Education 30(2), 165-181.

Hinchcliffe, F., Guijt, I., Pretty, J.N., Shah, P., 1995. New horizons: The economic, social and environmental impacts of participatory watershed development. IIED Gatekeeper Series 50, 3-20.

Holling, C.S., Meffe, G.K., 1996. Command-and-control and the pathology of natural resource management. Conservation Biology 10(2), 328-337.

International Institute for Environment and Development (IIED), 2004. Developing markets for watershed protection services and improved livelihoods. Report of the Implementation Phase Planning Workshop, January 28-30, 2004. London: IIED.

Kloppenburg, J.R., 1983. Group development in Botswana: The principles of collective farmer action. Research in Economic Anthropology 5, 311-333.

Leftwich, A., 1994. Governance, the state and the politics of development. Development and Change 25, 363-386.

Meinzen-Dick, R., Knox, A., Place, F., Swallow, B., 2002. Innovation in Natural Resource Management: The Role of Property Rights and Collective Action in Developing Countries. IFPRI, Washington, D.C., 317 pp.

Nemarundwe, N., Kozanayi, W., 2003. Institutional arrangements for water resource use: A case study from southern Zimbabwe. Journal of Southern African Studies 29(1), 193-206.

Ostertag Gálvez, C. F., 1999. Identifying and assessing market opportunities for small rural producers. Tools for Decision-Making in Natural Resource Management 7. CIAT, Cali, 173 pp.

Ostrom, E., 1990. Governing the Commons: The Evolution of Institutions for Collective Action. Cambridge University Press, Cambridge, 270 pp.

Pandey, S., Yadama, G.N., 1990. Conditions for local level community forestry action: A theoretical explanation. Mountain Research and Development 10(1), 88-95.
Postel, S., 1997. Last Oasis: Facing Water Scarcity. W. W. Norton and Company, New York, 239 pp.
Postel, S.L., Daily, G.C., Ehrlich, P.R., 1996. Human appropriation of renewable fresh water. Science 271, 785.
Gleick, P.H., 2000. The World's Water: 2000-2001. Island Press, Washington, D.C., 335 pp.
Ramírez, E., Berdegué, J., 2003. Collective action to improve rural living conditions. Fondo Mink'a de Chorlaví, Santiago, 6 pp.
Reddy, V.R., 2000. Sustainable watershed management institutional approach. Economic and Political Weekly (September, 2000), 3435-3444.
Rhoades, R., 2000. The participatory multipurpose watershed project: Nature's salvation or Schumacher's nightmare? In: Lal, R. (Ed.), Integrated Watershed Management in the Global Ecosystem. CRC Press, London, 327-343.
Rodwell, M.K., Woody, D., 1994. Constructivist evaluation: The policy/practice context. In Sherman, E. and Reid, W. (Eds.), Qualitative Research in Social Work. Columbia University Press, New York, 315-327.
Shah, A., 1998. Watershed development programmes in India: Emerging issues for environment-development perspectives. Economic and Political Weekly (June, 1998), A66-A79.
Turton, C., Farrington, J., 1998. Enhancing rural livelihoods through participatory watershed development in India. ODI Natural Resource Perspectives 34, 1-4.
UNCED, 1992. Agenda 21: Programme of Action for Sustainable Development. The United Nations, New York, 294 pp.
van der Linde, H., Oglethorpe, J., Sandwith, T., Snelson, D., Tessema, Y., 2001. Beyond Boundaries: Trans-Boundary Natural Resource Management in Sub-Saharan Africa. Biodiversity Support Program, Washington, D.C., 166 pp.
Wittayapak, C., Dearden, P., 1999. Decision-making arrangements in community-based watershed management in northern Thailand. Society & Natural Resources 12, 673-691.

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