Impact Monitoring for Watershed Management

Concept Note

prepared by

Christoph Feldkötter

Vientiane, September 2006

MRC-GTZ Cooperation Programme
Agriculture, Irrigation and Forestry Programme
Watershed Management Project (WSMP)

Table of Contents

Impact Monitoring for Watershed Management

Christoph Feldkötter, Technical Advisor
MRC – GTZ Cooperation Programme
Watershed Management Project

Abstract

Orientation towards impact has received growing attention in international development cooperation in recent years, as evidenced for instance by the UN Millenium Declaration. Prompted by these developments, this paper discusses some fundamental design aspects of a broadly applicable operational impact monitoring system for watershed management in the Lower Mekong Basin. The paper examines local and external impacts and gives examples for both categories. It concludes that operational impact monitoring for watershed management should primarily focus on external impact on water flow and quality measured at the outlet point of a watershed, accompanied by monitoring of local impact within the watershed, using methods matched on a case by case basis to the type of development intervention being implemented. While a definitive set of parameters to be operationally monitored can not be identified in this paper, it is obvious that, in order to avoid redundancy, the establishment of an operational impact monitoring system needs to build as much as possible on existing efforts and experiences of national agencies in the Lower Mekong Basin countries.

1. Introduction

Orientation towards impact, or management for development results, has received growing attention in international development cooperation in recent years, as evidenced for instance by the *UN Millenium Declaration* [1], the *UN Millenium Development Goals* [2] and the related *Road Map* [3], and more recently the *Paris Declaration on Aid Effectiveness* [4].

Prompted by these developments, this paper discusses some fundamental design aspects of an operational impact monitoring system for watershed management in the Lower Mekong Basin, which could be broadly applied in the Basin's watersheds. Doing so, it attempts to serve a dual purpose:

- To establish fundamental design elements of a monitoring system to observe the impact of interventions supported by MRC's Watershed Management Project.
- To contribute to creating a replicable model that may be broadly applied in other watersheds as well.

It is hoped that the reflections made in this paper may in future help to establish a monitoring system and related toolkit, elements of which local decision makers could ultimately use to evaluate and guide their own watershed management related interventions.

2. Rationale for Impact Monitoring - Why Monitoring?

There seems to be considerable ambiguity regarding the definition of impact and its monitoring, and definitions abound. For the purpose of this paper, we will follow the definitions given in [5]:

- *Impacts* are in general terms defined as changes in a situation brought about by an intervention. Only those changes that obviously derive from an intervention can be described as impacts of that intervention.
- *Impact monitoring* is in general terms defined as the collection, evaluation and documentation of information on the impacts of an intervention that is relevant to further steering.

In order to determine what this general definition of "impact" would imply with regard to MRC and specifically to its work related to watershed management, a brief look at some of MRC's fundamental documents seems appropriate.

Key passages from MRC's founding document (the 1995 MRC Agreement [6], in particular articles 1, 3, and 7) and related documents (in particular the MRCS mission[1] as outlined e.g. in [7]) suggest that whichever activities MRC involves itself in should have a clear link to management of water and related resources. The term "related resources" is only loosely defined in the 1995 MRC Agreement[2] and the related commentary [8]. For the purpose of this document we therefore assume that related resources are natural resources the status or utilisation of which[3]:

- Impact on water flow (quantity and temporal variation) – such as vegetation cover and its human induced change, or
- Impact on water quality - such as land development through industrialised agriculture with input of fertilisers or pesticides.

This reflects the overall understanding that the status of the watershed (or catchment) has an indirect yet major impact on river health and thus on human welfare depending on it.

The use of the term "mutual benefit" in the 1995 MRC Agreement (for instance in Article 1), the doctrines of "sovereign equality and territorial integrity" (see Article 4 of the MRC Agreement and [8]), as well as the principles of subsidiarity and decentralisation / deconcentration (see e.g. [9]) further suggest that MRC, being a trans-national organisation, would not normally involve itself in domestic issues of its member countries, *unless* such issues at least potentially created externalities of trans-boundary nature, i.e. had an identified or to-be-expected trans-boundary impact on water or related resources.

These basic assumptions and premises – involvement of MRC only if clearly linked to potential externalities of trans-boundary nature pertaining to water and related resources – lead to a number of consequences for watershed management as supported by the MRC:

- Watershed management obviously needs to aim at achieving impact at the local scale – most importantly at improving local rural livelihoods through optimising the use of water and related resources. However, achieving impact at the local scale would not in itself be sufficient to justify a continued involvement of MRC.
- Rather, watershed management at the local scale, besides benefiting the local population, would be expected to have a measurable external impact on the flow

[1] "To promote and coordinate sustainable management and development of water and related resources for the countries' mutual benefit and the people's well-being by implementing strategic programmes and activities and providing scientific information and policy advice."

[2] Article 1: "… including, but not limited to irrigation, hydro-power, navigation, flood control, fisheries, timber floating, recreation and tourism…"

[3] Note that water related natural resources could also be water bound resources such as fish stocks. Such resources are however not the immediate concern of watershed management as understood in this paper.

and / or quality of water leaving the watershed, and thus to plausibly contribute to trans-boundary management of water or related resources, securing or even improving livelihoods downstream.

This understanding of the need to achieve external impact is reflected in the working definition of watershed management as used within the context of the Watershed Management Project: "Watershed Management is the process of people guiding and organizing water, land and forest resource use on a watershed in order to provide desired goods and services without adversely affecting water, soil and vegetation resources. Embedded in this concept is the recognition of the ecological interrelationships among land use, soil and water, and the *ecological, social and economical linkage between upstream and downstream areas*." (e.g. [10]).

Achieving "measurable impact" in this context does not necessarily imply an improvement of the flow and / or quality of water, and does not even mean preservation of their present (undisturbed) state, but could comprise the maintenance of agreed minimum standards while other resources in a watershed are being developed.

Conclusion: Why Monitoring?

Impact monitoring is essential to give feedback on the effectiveness of watershed management. It needs to cover the local as well as the external impacts of watershed management. Impact monitoring needs to assess the impact of watershed management related interventions in various fields (governance, institutional development, planning, implementation) on the maintenance of watershed functions, i.e. on the provision of desired goods and services, prominent among which from MRC's trans-boundary point of view is a sufficient water flow over time with a minimum required quality [10].

3. Impact Categories and Levels - What can / should be monitored?

This section extends the general considerations made in the previous section, attempting to determine the scope of impact monitoring in greater detail by analysing which potential impacts watershed management can have at different scales. It further analyses which of those impacts can be monitored with generic methods, i.e. methods applicable in every watershed and independently of its individual characteristics, and which require specific monitoring methods devised to match local conditions or types of interventions. In doing so, this section also addresses the question of where (in geographic terms) impact monitoring needs to take place.

Our current understanding of watershed management, in line with the principles of sustainable development, differentiates three watershed functions that watershed management is meant to maintain [11]:

- *Ecological*: Provision of sufficient water flow over time with a minimum required quality. Provision of other goods and services: erosion control, soil fertility, biodiversity, clean air, carbon sequestration.
- *Economic*: Provision of sufficient natural resource products: food, fuel wood, timber, water, fish, etc. Provision of hydraulic energy (hydro power). Creation of income generating opportunities.
- *Social*: Maintenance of social structures. Protection and development of knowledge and lifestyle arrangements. Maintenance and revitalization of cultural identity and values. Recreational opportunities.

These three watershed functions determine the broad *observation categories* within which watershed management may have an impact. Depending on the watershed function considered, watershed management may further have an impact at different *scales*:

- *Local*: in the watershed itself.
- *External*: outside the watershed.

In line with the definitions of impact and impact monitoring made in the previous section, comprehensive impact monitoring would entail the collection, evaluation and documentation of information on changes in any aspect of any of the above three watershed functions at any of the above two scales brought about by watershed management related interventions. The following table attempts to provide an overview of the plethora of impacts that may potentially occur depending on observation category and level considered:

	SCALE	
	Local	**External**
OBSERVATION CATEGORY	Changes in:	
Economic	• Provision of natural resource products / services: food, fuel wood, timber, water, fish, hydro power, etc • Income generating opportunities.	• Availability of natural resource products / services: food, fuel wood, timber, water, fish, hydro power, etc
Ecological	• Water quality (sediment, nutrient, etc load) • Water flow (quantity and timing) • Air quality • Carbon sequestration • Erosion control • Soil fertility • Biodiversity (e.g. distribu-tion and composition of vegetation cover)	• Water quality (sediment, nutrient, etc load) • Water flow (quantity and timing) • Air quality • Carbon sequestration
Social	• Health (e.g. occurrence of water borne diseases) • Social structure and stability (e.g. conflicts) • Recreational opportunities	• Health (e.g. occurrence of water borne diseases) • Social stability (especially conflicts)

Obviously, it will not be possible to operationally monitor all of the above potential impacts in any given watershed. Rather, we will need to identify those impacts that can be monitored broadly with generic methods, i.e. in every watershed and independently of its individual characteristics, versus those which require specific monitoring methods devised to match local conditions or types of interventions.

Local Impact

Local impact may occur anywhere within the watershed itself. Its monitoring in detail strongly depends on the measures being implemented, which may greatly differ in focus (agriculture, irrigation, forestry, etc) and location (uplands, lowlands), and address rather different target groups (individual farmers, forestry enterprises, local industries, etc). Monitoring local impact in detail, including for instance the design of base line surveys that may be required to document the status prior to an intervention, is therefore highly specific and situation-dependent, and thus requires specific monitoring methods. In this context, monitoring costs are an important consideration that often rule out monitoring of local impact in detail altogether.

Besides monitoring the local impact watershed management has on specific aspects of watershed functions, monitoring of its impact on overall poverty alleviation is of critical importance and needs to be addressed. This could be achieved by using local adaptations of generic poverty or poverty-environment indicators, such as those suggested in recent World Bank [12] or DFID [13] publications. Also, poverty data and indicators compiled by other organisations, which are often readily available, might be suitable. The drawback would likely be that this approach might be too highly aggregated in order to yield sufficiently specific “information on the impacts of an intervention that is relevant to further steering”. It might not allow attributing changes to interventions as required for operational impact monitoring [14], but might rather reflect the impact of external factors, such as changes in macro-economic framework conditions.

For the various reasons pointed out above, an in-depth discussion of monitoring local impact is beyond the scope of this paper. However, the issue can and must be taken up on a case by case basis once the focus, location, and target groups of specific watershed management related interventions have been determined. Also, monitoring external impact at the outlet point of a watershed may significantly reduce requirements for monitoring local impact in detail, as will be discussed below.

External Impact

External impact occurs outside the watershed itself. They may be geographically *unspecific*, occurring anywhere outside the watershed (e.g. changes in the availability of most natural resources products, air quality, carbon sequestration), or may be geographically more or less *specific* in the sense of being confined to downstream areas (water flow and quality).

Monitoring geographically *unspecific* impact, although different in scope, is subject to similar restrictions as is monitoring local impact. Changes in the availability of natural resources products (e.g. in markets external to the watershed, but originating from it) could only be monitored once the focus of specific interventions had been determined, and would perhaps anyhow better be monitored at the point of origin i.e. locally. Changes in public goods, such as air quality, would in all but a few exceptional cases not be attributable to interventions in any particular watershed. Monitoring geographically unspecific impact is hence difficult to operationalise, and is thus not explored any further in this paper.

Geographically *specific* impact confined to downstream areas can occur in close proximity to the watershed (e.g. a change in water quality at its outlet point), or can be a "far field" impact occurring remotely (e.g. a change in the occurrence of water borne diseases far downstream due to changes in water quality). In the case of "far field" impact, the problem of its not being attributable once again prevents its operational monitoring in all but a few exceptional cases, and normally limits its being addressed by watershed management to plausibility considerations.

Thus, monitoring of external impact occurring in close proximity to the watershed is left as the immediate focus of a generic operational impact monitoring system for watershed management. This might appear narrow, but occupies a crucial junction: without external impact being measurable here, there can be no plausible contribution to trans-boundary management of water or related resources, and hence no impact on livelihoods further downstream. The most obvious impacts to be monitored are changes in water flow (quantity and timing) and water quality (sediment, nutrient, etc load) at the outlet point of the watershed. Flexible and cost-efficient methods for such monitoring exist, which in many parts of the world are being applied by local communities themselves (see e.g. [15]). They will need to be adapted to suit the conditions in remote rural watersheds of the Lower Mekong Basin.

Note, however, that in order to allow those changes to be attributed to interventions implemented in the watershed, certain essential framework conditions that influence water flow and quality need to be monitored, as has been pointed out in numerous earlier works (e.g. [16], [17]). These are in particular: rainfall, land cover changes, water abstractions (such as irrigation), development of water polluting industries (both organic[4] and anorganic[5]), and changes in amount and treatment of human waste. In most watersheds of the Lower Mekong Basin, only a subset of these framework conditions may need to be monitored: in the absence of polluting industries and large concentrations of human population, the important framework conditions would be rainfall and land cover changes.

The results of monitoring external impact at the outlet point of a watershed obviously reflect the cumulative impact of all measures taken in the watershed[6]. Therefore, far reaching conclusions about local impact (i.e. the health of the watershed itself) can be drawn from monitoring external impact, such as: if an improvement in water quality is measured at the outlet point, there must be a corresponding improvement in water quality within the watershed itself. This may significantly reduce requirements for monitoring local impact in detail.

Conclusion: What can / should be monitored?

The design of a broadly applicable operational impact monitoring system for watershed management, in the light of current knowledge, should primarily focus on monitoring external impact at the outlet point of a watershed, where changes in water flow (quantity and timing) and water quality (sediment, nutrient, etc load) would need to be monitored. In addition, in order to attribute impact to interventions implemented in the watershed, certain essential framework conditions need to be monitored, in particular: rainfall and land cover changes. Such monitoring of external impact needs to be accompanied by monitoring of local

[4] Organic pollution could originate e.g. from pig, poultry, or also in-stream fish farming.

[5] Anorganic pollution could include e.g. effluents from chemical or mining industries.

[6] For instance, significant reductions in the use of fertilisers could be reflected in an improvement of water quality monitored at the outlet point.

impact within the watershed, using methods matched on a case by case basis to the type of development intervention being implemented.

4. Outlook

National agencies in the riparian countries of the Lower Mekong Basin already practice monitoring with varying degrees of intensity, in close cooperation with the MRC whenever issues of regional relevance as defined in the 1995 MRC Agreement [6] are concerned. Some rules and procedures for basin-wide monitoring, agreed between the riparian countries, are already in place (e.g. [18]). In order to avoid redundancy, the establishment of an operational impact monitoring system for watershed management should obviously build as much as possible on these existing efforts and experiences.

A definitive set of parameters to be operationally monitored can not be identified in this paper, but will need to be developed through dialogue with the various stakeholders involved – MRC itself, the government sectors of the riparian countries, NGOs, and civil society. Considering that the watersheds of the Lower Mekong Basin are mostly remote rural areas, an obvious imperative is to use appropriate monitoring technologies - well established, cost efficient and sufficiently simple to be used by local administrations and communities.

Additional research that can support the dialogue on development of an operational impact monitoring system for watershed management with scientific evidence is on-going, for example in the Water Utilisation Programme, the Environment Programme, and the Watershed Management Project of MRC.

Annex 1: Sources Consulted

[1] United Nations 2000: Millenium Declaration. http://www.un.org/millennium/ Accessed April 2006.

[2] United Nations 2000: Millennium Development Goals http://ddp-ext. worldbank.org/ext/GMIS/gdmis.do?siteId=2&menuId=LNAV01HOME1 Accessed April 2006.

[3] United Nations 2001: Road map towards the implementation of the United Nations Millennium Declaration. http://www.un.org/documents/ga/docs/56/ a56326.pdf Accessed 24 April 2006.

[4] Paris High-Level Forum 2005: Paris Declaration on Aid Effectiveness. http://www1.worldbank.org/harmonization/Paris/FINALPARISDECLARATION. pdf Accessed April 2006.

[5] GTZ 2004: The World of Words at GTZ.

[6] Mekong River Commission 1995: Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin.

[7] Mekong River Commission 2004: MRC Work Programme 2005. http://www.mrcmekong.org/download/programmes/work_program_05.pdf Accessed April 2006.

[8] Radosevich, Dr George E. 1995: Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin – Commentary & History

[9] Mekong River Commission 2006: Strategic Plan 2006 – 2010 – Draft.

[10] Mekong River Commission, Watershed Management Project 2006: Programme Document.

[11] Tuyll C. 2005: What is Watershed Management all about?

[12] Shyamsundar P. 2002: Poverty – Environment Indicators. World Bank, Environmental Economics Series, Paper No. 84.

[13] Nunan F. et al 2002: Poverty and the Environment: Measuring the Links. A Study of Poverty-Environment Indicators with Case Studies from Nepal, Nicaragua and Uganda. DFID, Environment Policy Department, Issue Paper No. 2.

[14] GTZ 2004: Results-based Monitoring - Guidelines for Technical Cooperation Projects and Programmes.

[15] Streamwatch 2004: The Streamwatch Manual - 3rd Edition. https://www.streamwatch.org.au/streamwatch/resources/file/eb8e114ef084 85a/StreamwatchManual.pdf Accessed 12 Feb 2006

[16] Thailand Development Research Institute + Harvard Institute for International Development 1995: The Economics of Watershed Management: A Case Study of Mae Taeng.

[17] Walker A. 2002: Forests and Water in Northern Thailand. Resource Management in Asia-Pacific Program, Australian National University: Working Paper No. 37.

[18] MRC Water Utilisation Programme 2005: Technical Guidelines for the Implementation of the Rules for Water Quality.