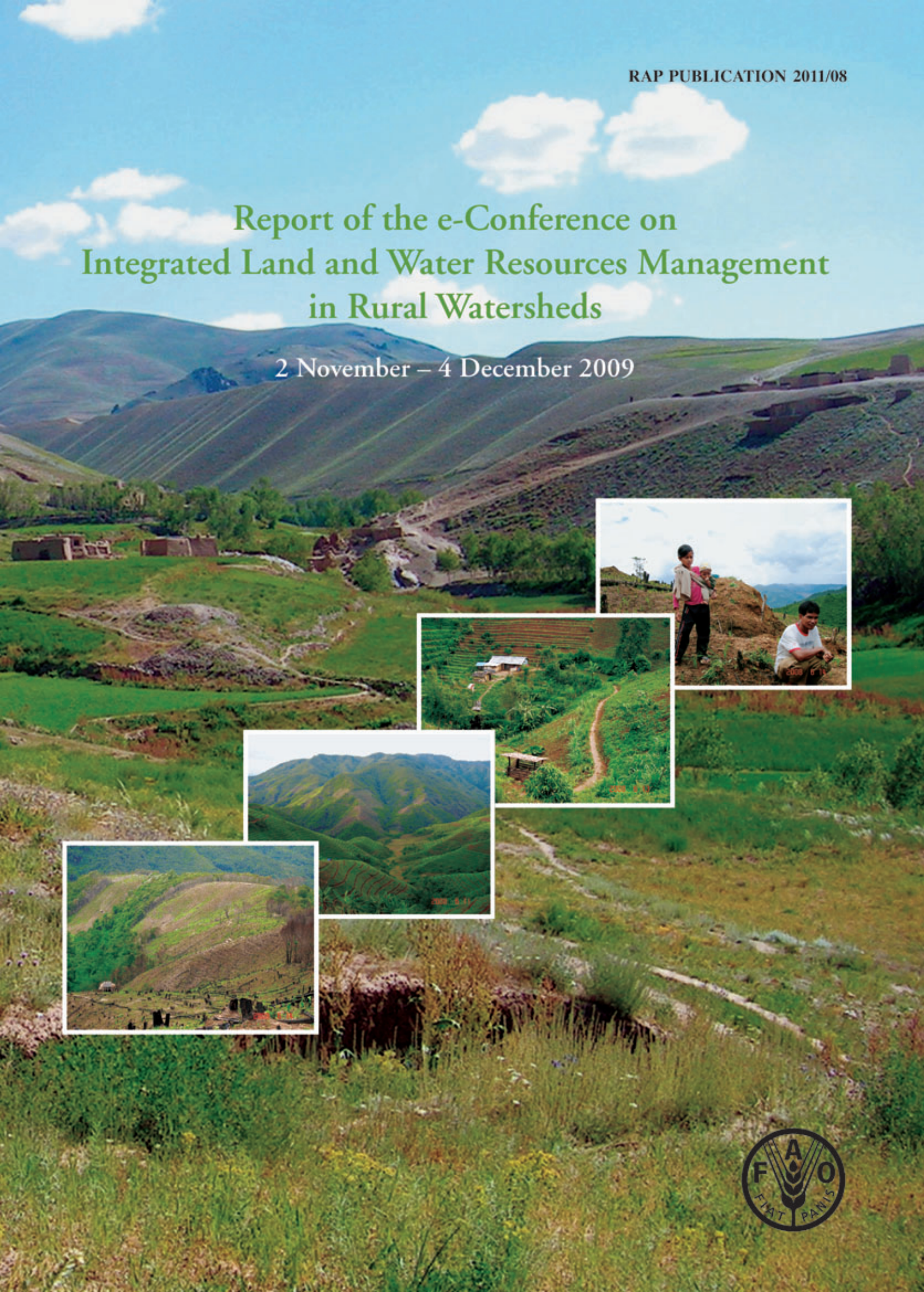
RAP PUBLICATION 2011/08

Report of the e-Conference on Integrated Land and Water Resources Management in Rural Watersheds

2 November – 4 December 2009



RAP PUBLICATION 2011/08

Report of the e-Conference on Integrated Land and Water Resources Management in Rural Watersheds

2 November – 4 December 2009

Des McGarry and Yuji Niino

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
REGIONAL OFFICE FOR ASIA AND THE PACIFIC
Bangkok, 2011

ISBN 978-92-5-106907-3

For copies write to:

Yuji Niino
FAO Regional Office for Asia and the Pacific
Maliwan Mansion, 39 Phra Atit Road
Bangkok 10200
THAILAND
Tel: (+66) 2 697 4000
Fax: (+66) 2 697 4445
E-mail: Yuji.Niino@fao.org

Foreword

The rapid degradation of rural watersheds has been a major concern for governments and civil society in the Asia-Pacific region. A root cause is the segmented management of land and water resources. This is exacerbated by the increasing pressure on natural resources to meet the food, fuel and water needs of a growing population as well as demand on land from biofuel production and increasingly protein-rich diets. The expected adverse impact of climate change in the coming decades has worsened the situation.

The immediate need is the wider promotion and uptake of integrated land and water resource management with focus on rural watersheds to ensure their sustainability while improving local livelihoods. For this purpose, the Regional Office for Asia and the Pacific of the Food and Agriculture Organization of the United Nations (FAO-RAP), in partnership with the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), the Asia-Pacific Water Forum (APWF), the International Water Management Institute (IWMI) and Global Water Partnership (GWP), organized an e-Conference on "Integrated Land and Water Resources Management in Rural Watersheds" which ran for five weeks from 2 November to 4 December 2009. It attracted 401 registered delegates and 6 700 "visitors" to its Web site, who posted 20 conference interventions and submitted 39 reports.

The principal aim of the e-Conference was to review recent and current watershed management initiatives to help promote wider implementation of "best of best" practices across the Asia-Pacific region. The e-Conference had two principal outcomes: submitted reports and case studies which are available at the e-Conference www site at http://faorap-econf.org/ and this report which reviews the submitted case studies against an analytical framework, comprising 33 "critical elements". It is envisaged that these critical elements of successful watershed management will be utilised in future watershed programmes to ensure focused preparation and successful implementation. The analytical framework can also be used to evaluate current or recent projects.

The submissions during the e-Conference show that wide adoption of integrated land and water resource management, particularly in rural watersheds, has strong potential to promote improved and robust land and water sustainability as well as improve food and rural livelihood security. It is hoped that the e-Conference will promote uptake of integrated land and water resource management in the region to boost productivity and incomes of small and marginal farmers.

Hiroyuki Konuma
Assistant Director-General and FAO
Regional Representative for Asia and the Pacific

Contents

Abbreviations and Acronyms

ADB	Asian Development Bank
AEZ	Agro-ecological zoning
CA	Conservation agriculture
CGIAR	Consultative Group on International Agricultural Research
DAI	Development Alternatives Inc.
ES	Environmental service
ESP	Environmental Service Programme
FAO	Food and Agriculture Organization of the United Nations
FFS	Farmer field school
GIHREX	Gestion intégrée, hydrogie, ressources et systèmes d'exploitation
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ICZM	Integrated coastal zone management
ILWM	Integrated land and water management
ILWRM	Integrated land and water resource management
IWRM	Integrated water resource management
IWMI	International Water Management Institute
MoNRE	Ministry of Natural Resources and Environment
MRC	Mekong River Commission
MSEC	Managing Soil Erosion Consortium (Laos)
NRM	Natural resource management
PES	Payment for environmental services
PWMC	Philippine Watershed Management Coalition
RBO	River basin organization
RMD	Resource management domain
RRBO	Red River Basin Organization
SAT	Semi arid tropics
USAID	United States Agency for International Development
WMRK	Watershed Management Resource Kit
WTP	Willingness to pay
WUA	Water user association

1. Background and aims

Rural watersheds in the Asia-Pacific region face rapid degradation which is a major concern for governments and civil society. Segmented management of land and water resources is one of the root causes as is population growth with its associated increased requirement for food, fuel and water. Other factors include changing pressures on land from biofuel production, increased demand for protein-rich diets and the anticipated adverse impacts of climate change in the coming decades. The outcome is a scarcity of arable land as well as reduced access to water, including naturally renewed surface and artesian water supplies.

There is an immediate need for priority attention to widespread promotion and implementation of integrated land and water resource management with a focus on rural watersheds to ensure their sustainability while assuring improved local livelihoods and food security. In support of this, the FAO Regional Office for Asia and the Pacific of the Food and Agriculture Organization of the United Nations (FAO-RAP), in partnership with development partners, organized an online forum for brainstorming and sharing of views, experiences and best practices on the topic.

The e-Conference "Integrated Land and Water Resources Management in Rural Watersheds" was held from 2 November to 4 December 2009. A total of 401 delegates from about 25 institutes, including universities, CGIAR (Consultative Group on International Agricultural Research) centres, regional organizations and non-governmental organizations (NGOs), took part. The e-Conference Web site drew 6 700 "visitors" who posted 20 interventions and submitted 39 reports which were accessed online by 3 556 individuals.

2. Objectives

The principal aim of the e-Conference was to review recent and current watershed management initiatives to help promote wider implementation of "best of best" practices across the Asia-Pacific region. To this end, this synthesis report employs a two-step approach. Firstly, a small number of key papers on watershed management, that were submitted or referred to during the e-Conference, are reviewed, specifically to identify the critical elements in their design and implementation that drove their success, or otherwise. Secondly, this framework of critical elements is used to analyse the reports submitted during the e-Conference to determine which of these critical elements were employed, in order to understand the strengths and weaknesses of the approaches followed by those projects. This report thus seeks: (i) to present watershed initiatives that were apparently successful, (ii) to comprehend the mechanisms of these successful initiatives, (iii) to provide the critical elements of success for more targeted guidance and sharing of successful experiences, (iv) to build a regional consensus to facilitate future presentation of watershed initiatives in more synergetic, cumulative, integrated and regionally agreed modalities, and (iv) to assure attainment of future funding and successful design, implementation and adaptation of successful watershed management interventions across the Asia-Pacific region.

3. e-Conference structure

To aid the 'e-delegates' in sequentially focusing on common, set topics and goals, the e-Conference posted the following five Topics, one in each week: (1) strategic planning for integrated land and water management (ILWM); (2) legal and policy settings for ILWM, (3) institutional arrangements for ILWM; (4) technical measures and tools for ILWM; and (5) enabling environment for ILWM.

To provide a common focus to the e-discussions over the five weeks, respondents were requested to address the following four indicative questions for each Topic: (i) what are the current status and

challenges? (ii) what practices and experiences can be shared? (iii) what are the major constraints and gaps? and (iv) what to do and where to go from here?

4. The structure of this report

The e-Conference was marked by a total of 20 actual interventions while 39 reports on completed or ongoing watershed management projects, and three collations of country and regional work in watershed management were submitted. This final synthesis focuses on analysis of the submitted reports, conducted as follows.

Early in the e-Conference, three publications posted on the e-Conference Web site stood out as key watershed management initiatives. The first is an FAO publication[1] widely recognised as the flagship publication of recent and current watershed initiatives and strategies, which provides a synopsis of almost "all works to date" on watershed management, as well as the inputs provided by 150 watershed management experts from four continents during four regional workshops in four continents and an international conference. The second is a set of related publications of the Indonesian Environmental Service Programme (ESP) implemented in Java, North Sumatra and Aceh (USAID; 2005a, 2005b, 2009a, 2009b, 2010). The focus here will be on two of these – the first[2] synthesizes the latest ESP project initiatives and actions while the other is an executive summary of the ESP initiative[3]. The third e-Conference submission analysed here is a report of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) based on a case study in the rainfed areas of India's western Rajasthan state[4]. The three submissions are summarised in Appendix 1 reflecting their importance in the broader understanding and investigation of the modalities of watershed management.

The key initiatives of each of these reports were synthesised and tabulated as "critical elements" in terms of rationalising what constituted and were required for successful watershed management programmes (see Boxes 1 to 3). The additional 32 reports submitted to the e-Conference were then evaluated against this analytical framework of critical elements to consider if further critical elements could be identified as well as to rationalise successes and shortfalls in design and implementation through inclusion or omission of key elements.

This is not intended as an exercise in criticism *per se*. Rather, the aim is that analysis of past watershed studies and specification of their key operational elements should help ensure more successful watershed management projects in future, in terms of design, funding, implementation, local acceptance and gains, and achieving life beyond the original project, aiming to upscale to areas beyond the original project with alternate (new) funding sources.

This exercise also does not imply that incorporation or implementation of all the critical elements is required for a successful watershed initiative. Rather, the elements may be regarded as a "wish list" or "check list" with the aim of incorporating as many of these as possible with emphasis on achieving the all important interactions of these initiatives, with more to be gained from the sum of the parts than any one part in isolation.

---

[1] FAO (2006). The New Generation of Watershed Management Programmes and Projects. FAO Forestry Paper 150. FAO, Rome. pp. 128.

[2] USAID (2010). The Environmental Services Program Final Report – Executive Summary. DAI Project Number: 5300201. pp. 47.

[3] USAID (2010). The Environmental Services Program Final Report – Executive Summary. DAI Project Number: 5300201. pp. 47.

[4] Pathak, P., Wani, S.P., Sudi, R., Chourasia, A.K., Singh, S.N., Kesava Rao, A.V.R. (2007). Rural Prosperity through Integrated Watershed Management: A case study of Gokulpura-Goverdhanpura in Eastern Rajasthan. Global Theme on Agroecosystems, Report No. 36. ICRISAT, Patancheru, India. pp. 46.

A brief synthesis of all papers submitted to the e-Conference will be presented to highlight the principal subject matter of each and where possible, to comment on the apparent success of the initiative. The aim is to better guide readers in selecting subject areas of interest for in-depth reading of the actual reports themselves.

BOX 1: **Synthesis of major critical elements in the FAO (2006) report**

Successful watershed management interventions incorporate and/or take consideration of the following 20 elements according to the FAO (2006) report:

1. **Integrated*** – the watershed initiative addresses each of, and the linkages between land, water, economic, policy and social opportunities
2. **Collaborative*** – pluralist; mutual learning, shared knowledge, exchange of ideas, negotiation
3. **Participatory*** – negotiation and partnerships; involve locals, give decision-making capacity, recognize participation is a long process
4. **Intersectoral*** – need to move from compartmentalized multi-sectoral efforts to full intersectoral integration
5. **Sustainable development** – linked to environmental protection; in watershed management – incorporated but not biased towards it
6. **Mainstream** watershed management in policy derivation, decisions and implementation.
7. **Not single step**, **simple*** solutions (for what is known to be a complex problem)
8. **Downstream** and **upstream** impacts considered – each not in isolation, and actioned accordingly
9. **Human ecology** (population dynamics) – good watershed positively impacts human/social/infrastructure growth, poverty reduction; with softer environmental impacts/demands
10. **Compatibility*** – needs and requirements, local *vs* external needs/demands, assure local livelihoods while gaining common good, local actions provide gains for others (external)
11. **Capacity building*** – all levels where required; informed participation of stakeholders
12. **Financing** – seek many/mixed sources, long-term, locally financed (for engagement), and market-based to reduce donor dependency
13. **Tenure** – often pluralistic, mix of local culture and State-enforced
14. **Scale** – requires consideration as impacts all items, here; geographic variability, too.
15. **Watershed economics** – consideration of public goods (difficult to give monetary value)
16. **PES** (payments for environmental services – external persons (beneficiaries) pay providers
17. **Embedded*** – linked, watershed management schemes, e.g. common good funding of sustainable development, natural resource management, poverty reduction
18. **Micro-macro*** links;
    a. **scaling up** best practice for basin-scale positive impacts,
    b. "**adapting mosaic**" (see Box 1 in Appendix 1.1), and
    c. **transboundary** (inter-country) initiatives of large watersheds and basins
19. **Action research** – links science, human ecology, policy; creates dialogues, interactions
20. **Enabling policies*** – full intersectoral integration; NOT compartmentalized multisector

* **Note**: though not specifically referred to in the FAO Report, the combination of these ten critical elements ensures a "holistic" approach to watershed management – where emphasis is placed on the whole watershed system and attainment of the interdependence (rather than separation) of its parts.

BOX 2: **Synthesis of additional critical elements from the ESP reports (USAID)**

The following list presents the main critical elements (11) of the ESP Reports (USAID: 2005a, 2005b, 2009a, 2009b, 2010). As such, these are seen as additional, complementary and adding value to the 20 elements obtained from the FAO (2006) Report (Box 1).

The USAID (United States Agency for International Development) reports add the following elements to successful watershed management initiatives as identified in the FAO (2006) report:

21. ***GIS-based analytical approach*** – a matrix for site selection with several physical, social and political "filtering" levels (see USAID, 2005b for the matrix)
22. ***Science delivery support –*** similar to the "action research" of FAO (2006), particularly through community-based field schools
23. ***Leverage and ramping up*** – describes micro-macro level upscaling; from subcatchment to basin/ catchment levels
24. ***Legacy of impact*** – leverage placed on partners in latter stages of project to ensure programmes are sustained and expanded after the life of project
25. ***Fractal*** approach – start small in many small subcatchments, gain success, then upscale
26. ***Immediate and tangible –*** benefits and results; to show local communities potential for rapid, achievable, positive outcomes towards stimulating wider uptake
27. ***Water as the key entry point*** – gain benefits in a wide range of NRM and public issues, cognisant that achieving a good water supply (potable or irrigation) is very tangible on a day to day basis
28. ***Community level, equitable voice, informed confidence*** – true community representation at the multistakeholder table
29. ***Field school approach*** – non-formal, community education in NRM and water supply
30. ***Empower*** leaders and communities – put decision-making in their hands as outcomes are for their benefit
31. ***Management rights*** – to clarify roles and responsibilities

BOX 3: **Synthesis of additional critical elements of the Pathak *et al.* (2007) report**

Two important, additional critical elements came from Pathak *et al*. (2007); again seen as additional, complementary and adding value to the 31 points listed in Boxes 1 and 2.

32. ***Monitoring*** and assessment methodologies – introduce an inbuilt set of monitoring tools to assess success or otherwise of introduced WS initiatives
33. ***Iteration*** – whereby new initiatives are sequentially assessed and improved upon – forever honing them for maximum, widespread positive outcomes (sometimes termed "reflective learning")

5. Critical elements of selected watershed management initiatives

The FAO publication comprehensively reviewed watershed management concepts, processes and practices to the early 2000s. It is a resource book of rich and varied analysis emanating from the input of 150 watershed management experts from four continents who contributed to four regional workshops across four continents and an international conference. It was written primarily for field-level watershed management practitioners and local decision-makers at the district level. However, it was also presented as a useful resource and synthesis of information on "new generation" watershed management for higher level practitioners.

The overall objective of the report was to identify the paradigm, approach and methods behind new generation watershed programmes and projects, and to promote exchange of experiences in implementing watershed management between 1990 and 2000. As such, the authors clearly state the report does not and cannot present the "final truth". Rather, it provides the state-of-the-art (to the early 2000s) in watershed management experiences and practical approaches, to aid reflection and creative thinking for further development of watershed management programmes and projects.

In terms of this initiative, the FAO report provided 20 critical elements for successful watershed management implementation (see Box 1). A more detailed explanation of the elements is provided in a synthesis of the report (see Appendix 1.1). The fact that 20 elements emanated from this one report clearly shows the combined practical experience of the report's contributors and the wide ranging nature of the works to date that were reviewed.

The reports of the Indonesian Environmental Service Programme (ESP) (USAID; 2005a, 2005b, 2009a, 2009b, 2010) provided an additional 11 critical elements for successful watershed management implementation (see Box 2). The ESP is a programme funded by the United States Agency for International Development (USAID) in Indonesia's Java, Sumatra and Aceh provinces and implemented by the company "Development Alternatives Inc." (DAI). In mid-2009, DAI produced a five-volume "toolkit of watershed management initiatives" based on the inputs of ESP staff and partners, drawing from nearly five years of field experience.

Though only available in the Bahasa Indonesian language[5], a three-page English summary is available (USAID, 2009a) as too is a recent executive summary (USAID, 2010) and six annual work plans[6]. The ESP programmes employed almost all the critical elements identified in the FAO publication (see Box 1) and additionally developed a further 11 (see Box 2). A synthesis and more detailed explanation of the ESP programmes (USAID; 2009b and 2010) and the additional critical points they provided are given in Appendix 1.2.

An ICRISAT report by Pathak *et al*. provided a further two critical elements for successful watershed management implementation (see Box 3), resulting in a total of 33 critical elements. The report, presenting a case study from the rainfed region of eastern Rajasthan, India – a poor, agriculture dependent area with erratic rainfall, recurring droughts and high unemployment, provided a comprehensive set of data, collected both pre- and post-watershed management interventions to widely assess their impact.

A synthesis and more detailed explanation of the ICRISAT programme and the additional critical points it provided are given in Appendix 1.3.

[5] Downloadable from: http://www.esp.or.id/2009/10/26/wsm-toolkit/

[6] For workplans, to date, see: http://www.esp.or.id/category/pub-en/wp/

6. Analysis of the cases studies (reports) submitted during the e-Conference

A total of 32 case studies were submitted to the e-Conference. These are reviewed and analysed here in order of the topic for each of the five weeks of the e-Conference. The case studies are reviewed alphabetically by principal author under each topic in two ways.

Firstly, Table 1 presents a matrix of all submitted reports against the 33 critical elements (listed in Boxes 1 to 3) where the symbol (•) denotes inclusion of this critical element in the report.

Secondly, brief summaries of the reports in each topic are presented. Attention is also drawn to three other compendiums of papers and reports related to watershed management: (i) the MRC-GTZ "Watershed Management Resource Kit" with 207 articles at present, split into six modules[7], (ii) the "bright spots" initiative of the International Water Management Institute (IWMI) presenting 14 papers and reports[8] exemplifying where "individuals and communities have found ways to reverse natural resource degradation; thereby uncovering the key to their success and finding ways to popularize them with the prime goal of enhancing food security for millions in the poor south", and (iii) the CASELETS document[9] from the Philippines, synthesising the Philippine Watershed Management Coalition's (PWMC) mini studies or "caselets" covering some 20 watersheds, where the PWMC was a partner in the field for up to ten years, using a localized watershed approach.

WEEK 1 – Strategic planning for integrated land and water management (ILWM)

Twelve reports, reviewed below, were received under this topic, by far the greatest number of submissions. The three reports from which the 33 critical elements were identified were also submitted in the first week.

1. **Dixit *et al.* (2005)**[10] reported a study of crop varietal selection and village seed bank establishment, developed in the context of the watershed project in Madhya Pradesh, central India. This is a good example of a micro-based watershed intervention that exhibited many of the critical elements – collaborative, participatory, supported by action research, taught through farmer field schools, with micro-macro upscaling of successful practices (and seeds), then monitoring of seed health with immediate and tangible benefits that ensured legacy of impact.

2. **FAO (2002a)**[11] presented an analytical summary with two lengthy Discussion Papers of an e-Conference held in 2000 with early discussions on topics such as: "which biophysical processes impacted most on upstream/downstream land uses and water resources?"; "what is the current knowledge of assessment of these processes to focus required decision-making?"; "how to value costs *vs* benefits for up stream/downstream impacts and related populations?"; and "what are the mechanisms (including early ideas on using environmental criteria; PES) to both pay for and share these benefits between up- and down-stream water users." Linkages between land and water were investigated by establishing 12 indicators of the biophysical impact of land use practices on water resources (and vice versa), emphasising that applying these at different scales, though important, should not lead to unchecked

[7] http://wiki.mekonginfo.org/index.php/Main_Page

[8] The 14 papers and reports are listed at: http://www.iwmi.cgiar.org/brightspots/index.asp with an Executive summary provided by Andrew Noble (IWMI).

[9] http://spmwater-asiapacific.net/econf/images/fbfiles/files/CASELETS.pdf

[10] Dixit, S., Wani S.P., Ravinder Reddy, Ch., Somnath Roy, Reddy, B.V.S., Sreedevi, T.K, Chourasia, A.K., Pathak, P., Rama Rao, M., Ramakrishna, A. (2005). Participatory varietal selection and village seed banks for self-reliance: lessons learnt. Global Theme on Agroecosystems Report No. 17. Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics. pp. 20.

[11] FAO (2002a). Land-water Rural Linkages in Rural watersheds. Proceedings of the electronic workshop organized by the FAO Land and Water Development Division 18 September – 27 October 2000. pp. 90.

upscaling (extrapolation) of negative impact from small to large scale. The need for integrated and participatory approaches that engage stakeholders in watershed management were briefly covered.

3. **FAO (2005)**[12] aimed to separate fact from fiction on issues related to forests and water, to dispel misconceptions about the role of forests in flood mitigation, to partition the roles of nature and human activities, to contribute to the development of sound watershed and river-basin management, and flood mitigation policies for the Asia-Pacific region for successful flood mitigation. It was recognised that this would be best achieved through an integrated, action research-supported, iterative and "all of watershed" approach, and that watershed management is a transboundary process with many stakeholders involved, where private interests are commonly aligned and interlinked with the public good.

4. **IWMI (2010)**[13] provided research data and analysis of erosion and water quality from 27 small catchments in Indonesia, Lao PDR, Philippines, Thailand and Viet Nam. Experimentation showed that traditional slash and burn systems provided only 1 tonne/ha/yr of sediment, whereas commercial cash crops such as maize and cassava gave 6-13 tonnes; hence the former systems were more sustainable as long as the fallow phase on the rotation was sufficiently lengthy (8-15 years), and the cropping phase was short (1-3 seasons). It was concluded that policy development is needed to ensure that appropriate conservation methods become part of commercial crop production, perhaps based on PES incentive-based mechanisms.

5. The **Mekong River Commission (MRC)** submitted a short report[14] to the e-Conference of a study of watershed functions as influenced by irrigation and water management which was conducted by a professional from Viet Nam in the southern part of the Srepok river basin in the central highlands of the country. The new approaches and subsidies significantly increased production but with serious negative impact on water quality and fish population. The conversion of wetlands led to a loss of wildlife, but no reliable quantitative data were available. Before the government's intervention, the irrigation systems were fairly well managed but after intervention, only a few of the activities of the water user association (WUA) were maintained. Additionally, the construction of dams created conflicts on water availability for irrigation. For the future, to redress the negative impact of the government intervention and change in practices, it was proposed to strengthen the WUA and ensure it became part of the broader based watershed committees. Also, farming techniques should be more ecologically oriented and water sharing regulations need to be agreed upon.

6. **Noborio *et al*.** submitted a research study[15] during the e-conference, to be published later after review. The study from the Kitakami River Basin, northern Honshu, Japan investigated the impact of various land use types (forest, rice paddy fields, and upland fields) on nitrate concentration in river water from near the river source to the ocean. In terms of nitrate (NO_3), the study's results showed the complexity of directly interpreting change in NO_3 concentrations. For example, rice paddies caused decreases through denitrification which is a positive as it reduces coastal eutrophication but a negative as incomplete denitrification in paddy fields may emit nitrous oxide (N_2O) – a high impact greenhouse gas. Upland fields discharged NO_3, and forests were a source of NO_3 through nitrification of ammonium (NH_4).

---

[12] FAO (2005). Forests and Floods – Drowning in Fiction or Thriving on Facts? RAP Publication 2005/3, Forest Perspectives 2. Food and Agriculture Organization of the United Nations Regional Office for Asia and the Pacific, Bangkok, Thailand and the Center for International Forestry Research Jl. CIFOR, Bogor, Indonesia. pp. 40.

[13] IWMI (2010). Land and water resources management for upland farms in Southeast Asia: some lessons learned. Colombo, Sri Lanka. IWMI Water Policy Brief 33. International Water Management Institute (IWMI). pp. 4.

[14] MRC (2009). The Mekong River Commission: Case Study - Improvement of Irrigation Water Management Performance in Assessing the Maintenance and Restoration of Watershed Functions in the Southern Krong Ana Watershed (SKAW), Viet Nam. Paper submitted to the e-Conference. pp. 3.

[15] Noborio, K., Mizota, C., Harashina, K., Tsukiji, K., Orisaka, M. (2009). Effects of Land Use in a Watershed on River Water Quality. Paper submitted to the e-Conference. pp. 5.

7. **Penning de Vries *et al.***[16] covered many of the critical elements (see Table 1) in seeking research-based, policy-supported, community-relevant and driven solutions to ecosystem degradation caused by poor land management by arresting land and water degradation for enhanced food security and ecosystem protection.

8. **Prasad *et al.***[17] provided an institutional history of watershed research-based initiatives from ICRISAT, demonstrating the change in focus of research from improved agricultural productivity (the Green revolution) to also include poverty reduction and environmental sustainability. The aim was to focus science design and research findings to understand underlying institutional constraints to the required transitional change, in particular, to better address the needs of poor farmers. From the outset, watershed-oriented research at ICRISAT had an integrated, collaborative, farmer-participatory and action research approach to ensure the farm-pertinence of the work. Iteration, though not explicitly stated, was implicit to the ICRISAT research, with much to-and-fro between farmer-run farm trials and scientist-run experimental station trials, and later, with the involvement of NGOs, seeking the best modalities for farmer-acceptable, sustainable and productive cropping systems within broader, integrated watershed management systems.

9. **Rego *et al.***[18] presented, what at first appeared a somewhat specialised report on the benefits of boron, zinc and sulphur applications in the semi-arid tropics (SAT). However, the paper was written in the context of "the new watershed model" emphasizing water management as an entry point for improving livelihoods through convergence of natural resource-based activities. Previous, community-based watershed research in Asia revealed that soils in SAT subsistence agricultural systems were depleted in both macro- and micronutrients such as studied here with most below critical levels. The project conducted initial benchmarking to identify constraints to increased crop productivity and then scaled these up to a total of 50 watersheds in the project. In each watershed, specific biophysical and social indices were monitored in a stratified, random array and subsequently validated in participatory, farmer field schools that facilitated data collection from on-farm trials. Additionally, the report clearly enunciated a series of "beyond project requirements" for future research and development needs to continue the positive outcomes.

10. **Sreedevi *et al.***[19] reported a science-based farmer participatory consortium model of ICRISAT that aimed at efficient management of natural resources for improved rural livelihoods in the Adarsha watershed in Andhra Pradesh, India. A rare feature, among the reports reviewed here, was that water was the key entry point for the initiative. This work was also presented as a move from a focus on natural resource conservation to a focus on topics that were "people-centred" and integrated – farmer-centric and based on community involvement with continuous monitoring and evaluation to achieve sustainability, poverty alleviation and gender equity. An iterative approach was not explicitly mentioned but, maybe preferably, the report said its methodologies "provided space for reflection, refinement and development of needs-based, concurrent technologies." Also, on the institutional front a consortium of research organizations, university, development workers, policy-makers and farmers was established.

---

[16] Penning de Vries, F.W.T.; H. Acquay; D. Molden; S.J. Scherr; C. Valentin; O. Cofie. 2003. Integrated land and water management for food and environmental security. Comprehensive Assessment of Water Management in Agriculture Research Report 1. Colombo, Sri Lanka: Comprehensive Assessment Secretariat. pp. 74.

[17] Prasad, C.S., Hall, A.J., Wani, S.P. (2005). Institutional history of watershed research: The evolution of ICRISAT's work on natural resources in India. Global Theme on Agroecosystems Report No. 12. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) Patancheru, Andhra Pradesh, India. pp. 40.

[18] Rego, T.J., Wani, S.P., Sahrawat, K.L., Pardhasaradhi, G. (2005). Macro-benefits from boron, zinc and sulfur application in Indian SAT: A step for Grey to Green Revolution in agriculture. Global Theme on Agroecosystems Report No. 16.: International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) Patancheru, Andhra Pradesh, India. pp. 24.

[19] Sreedevi, T.K., Shiferaw, B., Wani, S.P. (2004). Adarsha watershed in Kothapally: understanding the drivers of higher impact. Global Theme on Agroecosystems Report No. 10. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) Patancheru, Andhra Pradesh, India. pp. 24.

Practical farm-level interventions included the construction of water storages and gully control structures, beds and furrows with contour planting, village afforestation, integrated pest and nutrient management, nitrogen-rich green manures and earthworm composting. The project aimed for positive, immediate and tangible results, including up to a 2.5-fold increase in maize production; a four-fold increase in pigeonpea intercropping, with associated large increases in benefit-cost ratios; a 60 percent decline in cotton area with simultaneous increases in maize and pigeonpea. Data collected both within and outside the watershed found that the interventions achieved 45 percent greater returns with irrigation and 200 percent in rainfed situations, mainly attributed to the introduction of improved cultivars of cereals and pulses in association with improved water management and soil fertility. Also, this is one of the very few reports to present tangible evidence of the legacy of impact of the project with farmers developing their own strategies such as maintaining the watershed storages, expanding and diversifying the earthworm-composting initiative.

11. **Sreedevi *et al.***[20] considered watershed development as a critical strategy for the sustainable development of rainfed drylands; exemplified by a micro-level case study from the Shekta watershed in Maharashtra, India. Starting with the statement that "only 35 percent of the watershed programmes (in India) are performing above average", the Shekta example was cited as a specific detailed case study that sought to assess the impact of successful watershed programmes and document the learning from rainfed lands. This was cognisant that 91 percent of coarse cereal production in India is rainfed and the adoption of integrated watershed technologies has the potential to increase crop yields two- to three-fold, that watershed development programmes not only enhance crop productivity but also minimize the risk of degradation of the natural resource base. The on-site impact of watershed development at the village level was assessed over the five years of the project (1999-2004). Interventions and treatments within the watershed initiative included crop cultivation (contour bunds/broad-bed furrows/farm bunds/ soil bunds); afforestation and continuous contour trenches with refilling of the trenches, water absorption trenches, stone bunds, stone gully plugs; horticulture plantation, animal husbandry; loose boulder, repair of *nala bund*, check weir and check dam. The initial 24 months focused on capacity building and establishment of local organizations with key activities including voluntary labour, community demonstrations of new practices on the principle of "seeing is believing", "ridge-to-valley" activities, incorporating farmers' ideas in development plans, construction of 19 rainwater harvesting structures and several soil and water conservation measures. The cumulative outcomes included better groundwater recharge with a 48-percent increase in the number of wells functioning properly and for longer periods; an increase of 96 percent in seasonally irrigated land with marked improvement of crop productivity in the watershed developed area of up to 188 percent over district averages; and increased crop diversity, particularly higher value crops. Household numbers increased by 15 percent and literacy by 83 percent due to dissemination of information on health and education through different channels of watershed development, particularly information dissemination through females. Expenditure on food and health also improved and the number of poor reduced from 61 to 17 persons. An *ex-ante* economic analysis of the project's benefits showed a benefit-cost ratio of 1.5, indicating project investment was profitable.

12. **Wani *et al.***[21] provided a comprehensive assessment of watershed programmes in India. As with Sreedevi *at al*., the focus was on rainfed areas and reviewed works by the Government of India, ICRISAT and others. It was concluded that community watershed programmes could serve as growth engines for the development of rainfed areas with prospects of doubling productivity. In this regard,

[20] Sreedevi, T.K., Wani, S.P., Sudi, R., Deshmukh, H.K., Singh, S.N., D'Souza, M. (2008). Impact of Watershed Development in the Low Rainfall Region of Maharshtra – A Case Study of Shekta Watershed. Global Theme on Agroecosystems Report No. 49. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) Patancheru, Andhra Pradesh, India. pp. 48.

[21] Wani, S.P., Joshi, P.K., Raju, K.V., Sreedevi, T.K., Wilson, M., Shah, A., Diwakar, P.G., Palanisami, K., Marimuthu, S., Ramakrishna, Y.S., Meenakshi Sundaram, S.S., D'Souza, M. (2008). Community Watershed as Growth Engine for Development of Dryland Areas – Executive Summary. A Comprehensive Assessment of Watershed Programs in India. . International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) Patancheru, Andhra Pradesh, India. 39 pp.

watershed development was seen more as a business model and not merely as a soil and water conservation structure. This is termed the Watershed Development Model as developed in India since the 1950s and continuing to the present. The evolution of the watershed approach began with single discipline interventions of specific aim – primarily starting with soil and water conservation and moving to achieving increased food production from higher yielding crop varieties. These initiatives broadened to a "whole of cropping system" approach and then to the farming system of crops, grazing, forest and income generating enterprises. The mid-1990s focused on people of the watershed and their livelihoods, especially the poor, with the realisation that land and water-focused activities of WS programmes excluded significant numbers of landless. This led to a requirement for increased consideration to pro-equity, pro-women, pro-poor and non-land based income generation activities. At the time of report writing, the best practices embraced the total environment of the watershed and the livelihoods of all the people within it. This evolution has also embraced and gained from initiatives such as: constitutional amendments to give more local responsibilities; unifying watershed guidelines; developing public-private sector partnerships in watershed execution; adjusting watershed budgets to transfer almost 30 percent funds to women; participation of villagers, enabling their empowerment; employment and income generation by enterprise generation; fusion of R&D at the entry point with participatory approaches; promoting climate change resilience in the watershed; and planning for post-project interventions. The model has led to profound farming system changes, improved food self-sufficiency, expanded employment and commerce, and enhanced incomes. However, in some instances, indifferent execution has necessitated consultation by implementing agencies with locals to ensure they catch up with and implement best practice(s) and markets to improve local livelihoods.

WEEK 2 – Legal and policy settings for ILWM

This topic received five submissions. By nature the reports were somewhat restricted in the number of the critical elements they addressed as their focus was almost solely on policy and legal settings for successful watershed management.

13. **Clement *et al.***[22] sought to identify drivers of forest transition in a watershed protection area (restricted to limited exploitation forestry, only) in a province of northwest Viet Nam from 1993 to 2000. The study involved statistical analysis of data from the watershed area derived from remote sensing as well as a statistical census, supported by an in-depth knowledge of the area and the political context. The analysis showed that during the time period considered, afforestation was largely driven by state organizations on protected state-owned land, and that forestry was not a significant component of household economic activities. The results questioned the positive influence that the state policies had in increasing forest cover. Both global and local models, applied to the data, suggested that during the three- to six-year period which followed its implementation, the allocation of long-term land-use rights and land contracting for protection to households had zero or negative impact in terms of increasing forest cover. The impact of state-led afforestation campaigns was difficult to ascertain as it might have been only partly captured by the proxy used in the model (the distance to State Forest Enterprises which were in charge of the campaign's implementation). However, the study's results did challenge the success of state initiatives in Viet Nam in making forestry an important economic activity for households.

14. **Echavarria**[23] reported an example of a public-private partnership in southwest Columbia that (for the early 2000s) broke the standard of watershed interventions being funded solely by public entities. In the geographic region covered, 12 WUAs established in the late 1980s and early 1990s took action on growing concerns over supply of irrigation water to fund the implementation of watershed

[22] Clement, F., Orange, D., Williams, M., Muller, C., Epprecht, M. (2009). Drivers of Afforestation in Northern Viet Nam: Assessing local variations using geographically weighted regression, Applied Geography, 29, 561-576.

[23] Echavarria, M. (2002), Water user associations in the Cauca Valley, Colombia – a voluntary mechanism to promote upstream-downstream cooperation in the protection of rural watersheds. FAO Land-Water Linkages in Rural Watersheds Case Study Series. FAO, Rome. pp. 15.

management plans. The WUAs worked in collaboration with the local government environmental authority which had the legal mandate and added resources to protect the watershed. Each WUA collected voluntary fees based on water consumption to mobilise funds for environmental protection, specifically to protect forests and vegetation cover in the highlands in order to increase water flow and stabilize discharge during the rainy season.

15. **Hayward (2005)**[24] reported findings from a cluster of research projects in Costa Rica, Grenada, India, South Africa and Tanzania that employed modern instrumentation, mathematical modelling of climatic and hydrological data, and Geographical Information System (GIS) to test the scientific grounding of the hypothesis that deforestation and forest land degradation was a principal cause of floods, landslides, silting of rivers dams and irrigation systems in several project areas. The study thus questioned the need for and the efficacy of the immense funds spent on afforestation, including sourcing such funds from PES incentives and the construction and maintenance of soil and water conservation structures. The following conclusions were reached with their stated policy implications (in brackets): in arid and semi-arid catchments there was no scientific evidence to support the view that forests increased or stabilised water flow (if water shortages are a problem as in dry countries, impose limits on forest plantations); soil degradation can cause localised flooding in rainy periods and reduce dry season flows (if upland forests are cleared for cultivation, provide farmers with guidelines for best agricultural practices), Integrated land and water resource management (ILWRM) can only be achieved if governance is holistic and evidence-based, using decision support systems to assess the impact of alternative land practices on water resources and socio-economic conditions, and ensure that proposed market mechanisms are adequately pro-poor.

16. **Lestrelin and Giordano (2007)**[25] used a political ecology framework to examine land degradation and livelihood change in a Laotian village, located near an experimental watershed of the Managing Soil Erosion Consortium (MSEC). The study combined household survey data, physical measurements from ongoing MSEC work and secondary information sources such as economic and policy changes. The results indicated that despite an explicit government policy aimed at improving both socio-economic and environmental conditions, the livelihood systems change has contributed to deterioration in working conditions with mixed impact on the environment. This has occurred as villagers' efforts to adapt to changing environmental conditions have been constrained by an artificial reduction in land availability and increased population density as a consequence of resettlement and land policies. As a result, farmers have been forced to intensify land use, potentially undermining the long-term viability of the resource base. The study thus highlighted the value of using integrated methods to gain insights into 'technical' problems such as soil erosion and revealed how the idea of environmental degradation often conveys particular political views and serves particular political objectives.

17. **Wani *et al.* (2009)**[26] considered community watersheds as growth engines for rainfed area development. The particular focus was integrated watershed management for improved food and livelihood security and environmental protection as well as addressing equity issues. However, to ensure widespread benefits of watershed management and in view of the vulnerability of the rural population and poorly allocated governmental funds it was imperative to improve current policies. This would require community-level and knowledge-based activities for tangible benefits, institutional strengthening

[24] Hayward, B. (2005). From the Mountain to the Tap. How Land Use and Water Management can Work for the Rural Poor. United Kingdom Dept for International Development (DFID). pp. 64.

[25] Lestrelin, G., Giordano, M. (2007). Upland development policy, livelihood change and land degradation: interactions from a Laotian village. Land Degradation and Development. 18, 55-76.

[26] Wani, S.P., Kumpf, B., Sreedevi, T.K., Joshi, P.K., Raju, K.V., Wilson, M.J., Shah, A., Diwakar, P.G., Palanisami, K., Marimuthu, S., Jha, A.K., Ramakrishna, Y.S., Meenakshi Sundaram, S.S., D'Souza, M. (2009). Integrated Watershed Management in India: Strategic Policy and Institutional Options – New Priorities for Agricultural Research in Asia. Policy Brief No. AES-01. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) Patancheru, Andhra Pradesh, India. p. 8.

to implement and manage the programmes, a multidisciplinary approach with capacity building at all levels, inclusion of all stakeholders in decision-making, and the monitoring of selected benchmark watersheds in every district for ongoing assessment and planning future interventions.

WEEK 3 – Institutional arrangements for ILWM

Only two reports were submitted on this topic.

18. **Fares (2009a)**[27] in this paper submitted specifically for the e-Conference, specified that effective land and water resource management requires development of appropriate institutional arrangements to guide and govern community activities to achieve common goals. Such institutions include water users' organizations, river basin organizations, land and water management institutions within government departments, and non-governmental organizations (NGOs), especially those working on food security and environment issues. Where possible these should be drawn from both public and private entities as well as individuals. Capacity building, human resource development and strengthening of managerial systems were seen as critical modalities to ensure proper functioning of all institutions sustainable use of infrastructure. It was well recognised that each of these is a long-term holistic and integrated process, requiring legal and policy support, and needing suitably skilled persons.

19. **Freier (2009)**[28] in this paper submitted specifically for the e-Conference, presented selected experiences and case studies on institutional arrangements for ILWM, exploring coordination mechanisms and capacity building of relevant institutions at national river basin and watershed levels. This was illustrated with a GTZ-supported study from India and three studies from the Mekong River Commission (MRC). The Indian study showed the role of carefully designed watershed management programmes in promoting livelihoods and reducing poverty. The first case study from the MRC was a multilevel, national approach to ILWM with the development of institutional links between watershed and river basin levels. The second study showed development by local institutions of a watershed plan of action supported by higher level institutions. The last study presented institutional benefit-sharing and PES arrangements, based on royalties from hydropower, as implemented in Asia. The author stated three major points, emanating from the e-Conference and the submitted papers. Firstly there is no "one size fits all" approach to watershed management as institutional and regulatory settings differ across countries. Secondly, there are challenges in terms of the mandates and competencies of river basin commissions and watershed development committees, particularly horizontal coordination between institutions for integrated watershed issues to achieve sector and development plans. Thirdly, whereas most countries have national policies on institutional arrangements for watershed management, large-scale implementation is rare, as are clear mandates for local administration to coordinate watershed management and the allocation of finances for implementation.

WEEK 4 – Technical measures and tools for ILWM

Three submissions were made which, given the nature of the topic, tended to be limited in terms of critical elements, consisting mostly of targeted research to measure and support potential changes in land use in catchments and the resultant impact.

---

[27] Fares, A. (2009a). Institutional Arrangements for Integrated Land and Water Management. Paper submitted to the e-Conference. pp. 7.

[28] Freier, I. (2009). Institutional arrangements for integrated land and water management: water users' organizations, river basin organizations and land and water management institutions within government departments, coordination mechanisms and their capacity building. Paper submitted on Topic 3 of the FAO e-Conference; posted on the e-Conference www site. GTZ, Vientiane, Lao PDR. pp. 24.

20. **Fares (2009b)**[29] in this paper submitted specifically for the e-Conference, enunciated the vital and integrated role of land and water management for sustainable development. As stated by the author, a sound scientific basis to a participatory planning and implementation process are vital to bring together stakeholders for widely implementable ecological and human activities to meet long-term water needs and the assure watershed health. The report recommended site-specific solutions for more holistic and integrated approaches to managing land and water resources, cognizant that this will require contributions from physical, biological and social sciences. Access to information and technology is important for taking the initial steps towards ILWM. However, and particularly in developing countries, basic information is missing, mainly because of lack of appropriate technologies, weak institutional infrastructure and a shortage of skilled staff to collect and analyse it. There is need for a critical evaluation of the factors in land and water degradation. These include (i) growing demand for food and other agricultural products due to population increase; (ii) subsidies and inappropriate pricing systems that provide incentives for inefficient and wasteful use of land and water resources, fertilizers, and pesticides; (iii) sectoral approaches that maximize the benefits of one sector without taking into account the implications for other sectors; (iv) farming systems or agronomic practices unsuited to local soil and water conditions; and (v) lack of secured tenure or access rights, discouraging stakeholder investment in improved land and water management.

21. **Kam *et al*. (2006)**[30] reported an application of the resource management domain (RMD) concept to support diversification of production activities, necessitated by increased salinity intrusions of rural coastal communities in the eastern coastal zone of the Mekong Delta, Viet Nam. The RMD concept is a construct of researchers concerned about sustainable natural resource management and presents a means of formalizing and integrating information about the main driving factors of resource use for rural development. RMD goes beyond the more commonly applied agro-ecological zoning (AEZ) where natural land units are identified that are characterized by biophysical potential and limitations. The authors argued that technology transfer requires people-based domains at the local level these then need linking with longer term national level goals, rather than the natural potential of AEZ that does not consider the human element. In the case study, RMD was used to investigate the best outcome of a conflict in the study area between continuation of rice production requiring fresh water, and a radical change in use of rice land to shrimp production, utilising large amounts of brackish water in the area. Resolving such a conflict required rethinking the land-water-use policy and the management implications. The RMD-based investigation was multidisciplinary, utilised GIS and air photo/satellite images, as well as participatory rural appraisals at village level. The results supported land and water management zoning for combined shrimp and rice, as well as shrimp- and rice-alone production systems, thereby reversing an earlier policy of solely intensifying rice production through full salinity exclusion.

22. **Orange and Noble (2009)**[31] in this paper submitted specifically for the e-Conference, stated that scientists and land managers have made significant progress in the development of technologies, methods and techniques to promote sustainable agriculture and water resource management, and in the delivery of ecosystem services. In current terminology, these technologies are presented as conservation agriculture (CA) and integrated watershed (catchment) development. They stated the case for the conservation and utilization of land and water resources, particularly a non-divisive and integrated approach in order to assure supply of agricultural products and ecosystem services that are critical in

[29] Fares, A. (2009b). Technical Measures and Tools for Integrated Land and Water Management. Paper submitted to the e-Conference. pp 7.

[30] Kam, S.P., Nhan, N.V., Tuong, T.P., Hoanh, C.T., Be Nam, V.T., Maunahan, A. (2006). Applying the Resource Management Domain (RMD) Concept to Land and Water Use and Management in the Coastal Zone: Case Study of Bac Lieu Province, Viet Nam. Environment and Livelihoods in Tropical Coastal Zones (eds. C.T. Hoanh, T.P. Tuong, J.W. Gowing and B. Hardy). CAB International 2006. p. 193-201.

[31] Orange, D., Noble, A. (2009). Technical methods and tools for integrated land and water management, to deal with issues related to conservation and utilization of land and water resources and systems. Paper submitted to the e-Conference. pp. 8.

meeting the needs of society and enhancing the quality of life. As such, the principles and techniques embedded in CA and ILWM form the basis of these approaches to conserve the natural resource base with the long-term objective of achieving sustainability and stability. Particularly, for smallholder farming, debate continues on the technical implementation of CA and the ecological and socio-economic conditions to which it is best suited. In addition to, and often complementary to CA, there is a wider range of relatively well known sustainable land use practices that can be employed to achieve ILWM such as agro-ecologically sound forest plantation, agro-forestry systems and tree-based land use alternatives.

WEEK 5 – Enabling environment for ILWM

Ten submissions were made under this topic. Submissions addressing payment for environmental services (PES) are also included here although submitted across several weeks of the e-Conference, as their content seems to fit in with the week 5 themes of multidisciplinary cooperation, multi-sector coordination and information sharing.

23. **FAO (2004a)**[32] reported a summary of the discussions of an Electronic Forum on PES in watersheds conducted by the Latin American Network for Technical Cooperation in Watershed Management. This forum was a follow-up from FAO (2004b) reported below, with a view to validate conclusions and recommendations, promote discussion and exchange experiences on PES, seen as an innovative tool for financing sustainable management of land and water resources. Specifically, the forum aimed to compile experiences with design, implementation, and assessment of PES schemes in watersheds in Latin American and the Caribbean, on six themes: definition and scope of PES in watersheds, design execution and impacts of PES schemes, sensitisation and awareness-raising of PES, and PES legislation. The report noted PES schemes are flexible mechanisms, adaptable to different conditions that provide payment or direct compensation for the maintenance or provision of a specific environmental service by users to providers of the services. The PES schemes in watersheds normally include the implementation of market mechanisms to compensate upstream land holders in order to maintain or modify a specific land use which affects the availability and/or quality of water resources downstream. The compensation usually comes from downstream water users. PES schemes compensate providers for increasing the quality and quantity of environmental services, and do not constitute a payment for the environmental resources in itself. PES essentially aims to encourage landowners to implement practices which conserve specific natural resources. Examples of PES implementation were given from several South American countries, including successes, problems and methods of problem resolution, together with many recommendations by the Forum for improvements of PES schemes.

24. **FAO (2004b)**[33] presented a report of the Regional Forum on Payment Schemes for Environmental Services in Watersheds (Arequipa, Peru; June, 2003). This forum preceded FAO (2004a), above. The main objectives were to exchange experiences in PES systems in watersheds in Latin America, particularly for water resources, and identify criteria and formulate recommendations for appropriate economic valuation of water services as well as design and successful execution of PES schemes in watersheds. The following were identified by Forum participants: (i) PES systems in watersheds have been applied at very different levels and for various objectives in Latin America, ranging from micro-watershed level and focused on a very specific NGO-managed service to national-level, state-controlled programmes; (ii) while some countries have specific legal PES frameworks at national or regional level, most schemes operate without a specific legal basis; (iii) as compared to other world regions, Latin

[32] FAO (2004a). Electronic Forum on Payment Schemes for Environmental Services in Watersheds. Food and Agriculture Organization of the United Nations (FAO) and the Latin American Network for Technical Cooperation in Watershed Management (REDLACH). 12 April – 21 May 2004. Santiago, Chile. pp. 27.

[33] FAO (2004b). Payment Schemes for Environmental Services in Watersheds. Land and Water Discussion Paper 3. Regional Forum, 9-12 June 2003, Arequipa, Peru. Organized by the FAO Regional Office for Latin America and the Caribbean, Santiago, Chile. pp. 95.

America has a significant number of examples for PES application for water-related services which have not yet been inventoried, with few studies on the socio-economic and environmental impacts of these systems; (iv) significant uncertainties exist in terms of the cause-effect relationship between land use and the services; (v) in some cases, service providers showed interest in PES schemes as an informal mechanism to establish property rights for land and natural resources; (vi) state role in PES schemes for water-related services in Latin America has varied significantly – in several cases, the public institutions involved in the schemes are local rather than national; and (vii) there is potential to replicate PES experiences presented in the Forum, but they need to be adapted to the particular contexts. The report concluded with a summary of the Forum presentations.

25. **George *et al.* (2009)**[34] presented a report based on two case studies from northern Thailand and Lao PDR. The objectives of this scientifically based, data-rich and statistically founded work were to assess whether conditions existed for the establishment of PES at the watershed level in the uplands of mainland Southeast Asia and to examine limitations to direct transfer of the PES concept, as well as institutional adaptations and support required for successful PES markets in this regional context. The principal findings include: (i) acceptance of PES principles and constraints were directly related to stakeholders' perception of their land rights, irrespective of their actual rights; (ii) willingness to pay (WTP) was very low among local stakeholders, making unlikely the emergence of a PES market without external support; (iii) the classical scheme for watershed services hardly applied in its original form because environmental service (ES) providers and buyers were generally the same people; (iv) where potential ES buyers felt that ES providers were richer than them, they did not have any WTP for ES; and (v) good governance, including strong liaising at various levels between people and the authorities was a strong prerequisite for successful establishment of PES markets, even without direct government funding.

26. **Gowing *et al.* (2006)**[35] presented a synthesis report on trends, problems and approaches to managing change in the inland coastal zone, focussing on identification of key messages from a wide range of previous research and development experience, and considering supporting evidence for these messages. Coastal zones are home to 40 percent of the world's population and support much of the world's food production and industrial, transportation and recreation needs, while also delivering vitally important ecosystem services. Located at the tail-end of river systems, coastal zones suffer the impact of upstream river basin development. Changed flow regimes, sediment yields and pollution loads all add to the direct local pressure on the coastal zone. Arguably, the health of the coastal zone can be seen as an indicator of river basin health. Coastal environments are under pressure and have undergone rapid change in recent times. A key issue is land use change, in particular the rapid growth of shrimp aquaculture with extensive conversion of natural habitats – mainly mangrove forests and salt marshes – to shrimp farming and other uses. This has also encroached on coastal agricultural lands that are commonly used for high yield rice production. The authors presented production statistics for the top 25 countries with coastal zone shrimp production. Recent changes have been made in this production system in response to the need to develop sustainable management guidelines in the context of conflicting demands of different stakeholders depend upon this resource base. Towards this, this report discussed trends, conditions, responses and scenarios for the coastal zone, followed by a problem analysis that examined the main environmental and social impact of change. As part of their conclusion, the authors noted it is crucial, for a more sustainable approach to coastal zone management, to have an appropriate evidence-based policy, including identification of knowledge gaps towards development and implementation of strategies for integrated coastal zone management (ICZM).

---

[34] George, A., Pierret, A., Boonsaner, A., Valentin, C., Orange, D., Planchon, O. Olivier (2009). Potential and limitations of Payments for Environmental Services (PES) as a means to manage watershed services in mainland Southeast Asia. International Journal of the Commons, Vol. 3, No. 1.

[35] Gowing, J.W., Tuong, T.P., Hoanh, C.T. (2006). Land and Water Management in Coastal Zones: Dealing with Agriculture-Aquaculture-Fishery Conflicts. Environment and Livelihoods in Tropical Coastal Zones (eds. C.T. Hoanh, T.P. Tuong, J.W. Gowing and B. Hardy). CAB International 2006. p. 1-16.

27. **Kosoy *et al.* (2007)**[36] presented a study on PES implementation in three locations in Costa Rica, Honduras and Nicaragua towards improving the design, functioning and local impact of PES schemes which are relatively new, seeking to support positive environmental externalities through the transfer of financial resources from beneficiaries of environmental services to the providers of these services or the fiduciaries of environmental resources. Each scheme reviewed was an example of voluntary direct payments by downstream water users to upstream providers of water-related environmental services, through an intermediary agency. Generally, the benefits foregone from land use, alternative to forest cover were larger than the amount paid, and trade-offs between different environmental and social goals were likely to emerge in PES schemes, raising some doubts as to their ability to be multipurpose instruments for environmental improvement and rural development. Additionally, PES schemes may work as a conflict-resolution instrument, facilitating problem-solving between downstream and upstream, but at the same time they might change social perceptions of property rights.

28. **Mayrand and Paquin (2004)**[37] presented results of a survey of 25 PES schemes across 15 countries in the western hemisphere and analysed their main differences/similarities, strengths/limitations and effectiveness/efficiencies; seeking, in part, experiences with potential to be PES "best practices", backed by good science as a critical, basic requirement. Examples of each of the four categories of PES schemes for which there is a market demand – water services, carbon sequestration, biodiversity conservation and landscape beauty – were reviewed. As Table 1 shows, successful PES schemes, as reported by these authors, encompassed about half of the stated critical elements with this report touching on 15.

29. **Molle and Hoanh (2009)**[38] reported that Viet Nam, in common with many Southeast Asian countries, has in the last decade remodelled part or all of its water policies. Development banks and multilateral cooperation agencies have been influential in supporting the adoption of policies and reforms that embody principles held as modern and internationally sanctioned. This includes the drafting of national policy and laws, the creation of "apex bodies", the establishment of river basin organizations (RBOs), the privatization of public companies, and increased financial contribution from users for e.g. through water pricing and the formation of water user groups. While these principles and reforms provided sound and useful guidelines for national water policies at a certain level of generalization, their confrontation with reality has, more often than not, yielded disappointing results. This report focused on the establishment of the Red River Basin (of Viet Nam) Organization (RRBO), but expanded its analysis to the wider transformations of the water sector that impinge on the formation and effectiveness of this organization. A few reflections on the policy process were drawn from this analysis, albeit in a tentative form given the relatively limited period of time considered here (1998-2002). The report showed that the promotion by donors of integrated water resource management (IWRM) icons such as RBOs has been disconnected from the existing institutional framework. The RRBO was established on the premise that a RBO was needed, but it was soon found that basin-wide participation was both difficult and unnecessary, with the focus being shifted to lower sub-basin levels. The report also showed that if policy reforms promoted by donors and development banks have triggered some changes, these changes may not have come as a result of the reforms themselves but, rather, due to the institutional confusion they have created confronted with the emergence of the Ministry of Natural Resources and Environment (MoNRE), which itself was established mainly to solve land rather than water issues. In conclusion, institutional change was shown to result from the interaction between endogenous processes and external pressures, in ways that are barely predictable.

---

[36] Kosoy, N., Martinez-Tuna, M., Muradian, R., Martinez-Alier, J. (2007). Payments for environmental services in watersheds: Insights from a comparative study of three cases in Central America. Ecological Economics, 61(2-3), pp. 446-455.

[37] Mayrand, K., Paquin, M. (2004). Payments for Environmental Services: A Survey and Assessment of Current Schemes. UNISFERA – Centre International Centre. Montreal, Canada. For the Commission for Environmental Cooperation of North America. pp. 60.

[38] Molle, F., Hoanh, C.T. (2009). Implementing integrated river basin management: Lessons from the Red River Basin, Viet Nam. Colombo, Sri Lanka: International Water Management Institute. (IWMI) Research Report 131. pp. 33.

30. **Orange (2002)**[39] reported the aims and results of the GIHREX[40] project that aimed to (i) bring research and action together following scientific experiments by ORSTOM[41] in the Inner Niger Delta in Mali and (ii) to respond to a major development challenge – going from use of natural resources to managing them, considering the long-term dynamics of physical, biological and anthropological systems, while accounting for the needs and uses of local populations. As such, the GIHREX project aimed to understand the natural dynamics of the delta, including organisation and human land use modes and analyse their sustainability. The study touched on such diverse questions like the dynamics of water resource, aquatic ecosystems and demography, the means of social organisation, the dynamics of agricultural, pastoral and fish production, environmental dynamics, and finally, resource allocation competition in the function of these diverse dynamics. Rather than adopting a research-based knowledge transfer, the project investigated application of a schema of co-construction, defined as a set of partnership-type relations between research, development and the association of objects, knowledge and questions. Within this framework, integrated modelling was applied to assure the coherence and integration of interrogations and knowledge, to maximise group efficiency and create a discussion tool rather than a decision-making tool. In conclusion, for purely scientific or technological aspects, the project met its objectives, though the research team broke up on cessation of funding, precluding complete development of all the model's capacities. Additionally, with communicative tests on the model and fishing observatory, we were able to prove that well organized scientific knowledge and integrated modelling can work together to improve the dynamic process of strategic choice definition.

31. **Orange *et al*. (2010)**[42] discussed the design of an incentive-based framework for the promotion and possible up-scaling of a biogas-based pilot scheme in a small agricultural village in northern Viet Nam to manage soil fertility and erosion control on sloping lands, with a focus on policy implications. Soil and water degradation across Southeast Asia has been the environmental cost of the doubling of production in most commodity groups. The authors' research has shown that indirect methods, in this case introducing new technology to facilitate intensive livestock production and enhance smallholder income, can act as a catalyst to the delivery of environmental services. Based on these results and through dialogue with local farmers, two biodigesters were built in 2007 within two farming systems in Dong Cao Village as pilots to inform the design of a PES framework. Biodigesters not only rid the environment of odorous and potentially disease carrying untreated waste spread as fertiliser, but also produce methane as a clean source of cooking and lighting fuel, before the digester slurry becomes a cleaner and more efficient crop fertiliser. Introduction of the biodigesters uncovered some drawbacks. However, with upscaling, training and improved technical control, as well as the potential to link the initiative to a PES scheme, the initiative scheme has the potential to lead to better control of the use of untreated waste and increase household income through intensive agricultural production. Investment opportunities for an incentive-based framework were considered with such bodies as the local government, private firms interested in downstream water quality such as electricity producers and international backers seeking climate change mitigation opportunities.

32. **WMRK (2009)**[43] – the Watershed Management Resource Kit of GTZ and the MRC – contains this study, cited by an e-Conference delegate in recognition that in many parts of Southeast Asia, the draining of peat lands is an important consideration to the whole of watershed dynamics. As such, this case study provided a more singular approach to considerations of WS management, than the more holistic

[39] Orange, D. (2002). Aims and results of a sustainable development research project in the Inner Niger Delta: the GIHREX project. pp. 11. (Translation of Orange D., 2002 – Projet Gihrex: ambitions et acquis d'un projet de recherche pour le développement durable du delta intérieur du Niger. Colloques et séminaires, IRD, 2002: 953-967.)

[40] The French acronym for "*integrated Management, hydrology, resources and operating systems"*

[41] "Office de la Recherche Scientifique et Technique d'Outre-Mer"

[42] Orange, D., Dardenne, L., Geier, P., Duy Phuong, N., Jouquet, P., Duc Toan, T. (2010). Using a Biogas Scheme to Control Soil Erosion on Sloping Lands in North Viet Nam. Mountain Forum Bulletin January 2010. pp. 4.

[43] WMRK (2009). The Conversion of Tropical Peat Swamp Forest into Oil Palm Plantations – Cases from Indonesia and Malaysia. In: The Watershed Management Resource Kit. MRC and GTZ.

Table 1: **Matrix of all (32) submitted reports, against the 33 critical elements**
Symbol (•) denotes inclusion of this critical element in the report

Critical element:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	***21***	***22***	***23***	***24***	***25***	***26***	***27***	***28***	***29***	***30***	***31***	***32***	***33***
Report:Week 1: Strategic planning																																	
1. Dixit (2005)		•	•								•	•						•	•			•	•	•		•		•	•	•		•	
2. FAO (2002a)	•		•					•						•		•		•															
3. FAO (2005)	•			•			•	•						•	•			•	•	•		•	•										•
4. IWMI (2010)	•				•		•	•								•			•			•											
5. MRC (2009)	•	•	•				•							•																•			
6. Noborio (2009)								•						•							•							•					
7. Penning deVries (2003)	•		•	•	•			•			•	•		•					•	•		•							•			•	
8. Prasad (2005)	•	•	•	•	•		•	•			•						•	•				•				•		•				•	•
9. Rego (2005)	•	•	•		•		•	•			•			•				•	•			•	•	•		•		•	•	•		•	
10. Sreedevi (2004)	•	•	•		•	•	•		•		•						•	•	•			•		•		•	•	•	•		•	•	•
11. Sreedevi (2008)	•	•	•		•		•				•					•			•	•		•				•		•	•	•		•	
12. Wani (2008)	•	•	•		•		•		•	•	•	•					•		•	•		•	•			•	•					•	
Week 2: Legal & policy																																	
13. Clement (2009)					•																•											•	
14. Echavarria (2002)	•	•	•	•	•		•	•	•								•	•										•		•			
15. Hayward (2005)	•	•	•	•	•	•	•	•		•					•	•	•		•	•	•	•				•						•	
16. Lestrelin (2007)	•	•	•			•	•	•											•	•		•										•	
17. Wani (2009)	•	•	•	•	•	•	•	•	•	•						•	•		•	•		•	•	•		•		•		•		•	
Week 3: Institutional																																	
18. Fares (2009a)	•	•	•	•			•				•																	•		•			
19. Freier (2009)	•	•	•	•		•					•	•								•								•		•			
Week 4: Technical																																	
20. Fares (2009b)	•	•	•	•	•	•	•				•			•				•	•			•					•					•	
21. Kam (2006)	•	•	•	•	•		•											•	•		•	•						•				•	
22. Orange (2009)	•			•	•		•	•								•		•				•	•										

Table 1: **(continued)**
Symbol (•) denotes inclusion of this critical element in the report

Critical element:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	***21***	***22***	***23***	***24***	***25***	***26***	***27***	***28***	***29***	***30***	***31***	***32***	***33***
Week 5: Enabling																																	
23. FAO (2004a)	•	•	•	•	•	•	•	•	•	•		•			•	•	•	•					•					•					
24. FAO (2004b)	•	•	•	•	•	•	•	•	•	•		•			•	•	•	•					•					•				•	
25. George (2009)	•				•			•								•			•														
26. Gowing (2006)	•	•	•	•	•	•	•							•						•							•						
27. Kosoy (2007)																•		•	•			•											
28. Mayrand (2004)	•		•	•			•				•	•		•	•	•		•	•	•		•						•				•	
29. Molle (2009)	•	•	•	•		•	•	•				•		•						•													
30. Orange (2002)	•	•	•				•										•		•			•											
31. Orange (2010)	•	•	•	•	•		•	•		•						•								•									
32. WMRK (2009)					•			•										•									•						

Note: *both the weekly topic titles and the authors' citations (to the principal author) have been abbreviated, for ease of tabulation.*

approach in many of the other posted reports. Tropical peat swamp forests throughout Asia are under tremendous pressure from agriculture and forestry with an estimated 16 to 25 million ha of peat soils in Indonesia and 2.4 million ha in Malaysia. Hydrology is a key factor that determines the unique ecology of the increasingly threatened habitats of these catchment ecosystems, such that watershed management plays a key role in maintaining their functions. This study from Sumatra, Indonesia was of a typical Southeast Asian peat swamp. Additionally, the area, being within a site covered by the Ramsar Convention (1971 Convention on Wetlands), has elements of scale to attract national action and international cooperation for the conservation of wetlands and their resources. The swamp lies at the centre of the watershed, threatened upstream by expansion of oil palm and downstream with agricultural, urban and industrial zoning. The study modeled three hydrological scenarios: (i) expansion of oil palm production upstream, (ii) expansion of agriculture in downstream, coastal areas, and (iii) continuing fire damage. The results showed that all three projected scenarios caused a lowering of groundwater levels due to drainage; peat surfaces are predicted to subside by three to four metres in the next 50 years due to soil drainage from oil palm growth, with a consequent reduction and change in direction of water flow towards local rivers, possibly leading to a decoupling of rivers with implications for water availability and quality for agricultural, domestic and animal use, saline intrusions, as well as increased flooding and forest fires. The authors conclude that the worrying outcomes of this detailed study in terms of watershed health and local land, water and social sustainability, could be repeated in many peat lands in Southeast Asia, as production demands increase, particularly for fossil fuel replacement crops.

7. Discussion and conclusions

The e-conference was organised in the light of continuing and rapid degradation of rural watersheds in the Asia-Pacific, principally caused by segmented management of land and water resources, greatly exacerbated by the cumulative and linked effects of continuous population growth and increased requirements for food, fuels and water, changing pressures on land from biofuel production and increased demand for protein-rich diets. The expectation is that impending climate change will accelerate and magnify the negative impacts of all the former. The submissions during the e-conference show that wider uptake of integrated land and water resource management, particularly in rural watersheds, appears to have strong potential to redress many of these issues, in particular to promote improved and robust land and water sustainability as well as improve food and rural livelihood security.

The e-Conference had few actual interventions from delegates, and many submitted reports on current and recent-past watershed management initiatives (39 in total). A two-step approach was adopted where a small number of key papers on watershed management were reviewed and the critical elements that led to their success tabulated; a total of 33. This framework was then used to analyse the reports submitted during the e-Conference – seeking which critical elements they employed, towards presenting the strengths and weaknesses of their approach, to (where possible) rationalise their degree of success. It is hoped that such an analysis will aid the design and implementation of future watershed programmes, region wide, where programmes would endeavour to utilise as many of the critical elements as possible, to ensure rapid project commencement based on previous, rationalized successes for more widespread and successful outcomes.

The imbalance between the number of submitted reports and actual e-Conference interventions (a 2:1 ratio) may be due to the topic being the subject of substantive discussion in the past of watershed management. The impression from the e-Conference was that the subject matter had been reported and investigated widely over the past two decades at many different levels, including previous fora and conferences on the subject matter. This may explain why, the over 400 registered e-Conference delegates had little new to add – and thought it more pertinent to draw other delegates to previously published works. Hence the relatively large number of submitted reports.

Obviously, the 39 submitted reports represent only a small portion of the available papers on watershed management. This is exemplified by the reference (section 6 above) to the MRC-GTZ "Watershed Management Resource Kit" that currently hosts 207 articles on the same theme. However, it is felt that the reports submitted during the e-Conference provided a good cross-section of both time line, showing the development of ideas on watershed management and the wide variety of topics, scales and geographic areas where the projects were implemented.

Among all the documents submitted, the flagship FAO (2006) report "The New Generation of Watershed Management Programmes and Projects" provided the greatest number of critical elements of successful watershed management (see Boxes 1 to 3) – a total of 20. Perhaps even more impressive were the 11 additional critical elements from the series of ESP (USAID) reports. These were in addition to the FAO (2006) elements as the ESP work already utilised most of those in its published works. Lastly, it is worthy of note that apart from two additional critical elements from Pathak *et al*. (2007), no further critical elements were gained the 32 other reports. This, again, seems to indicate that the 33 critical elements represent an "historical entity", clearly enunciated in this e-Conference, of what a successful watershed project should consist of.

In terms of matching the 33 critical elements, the four ICRISAT reports (Rego *et al*. 2005, Sreedevi *et al*. 2004, Wani *et al*. 2008 and Wani *et al*. 2009) scored the greatest number of "hits" – between 17 and 21. This demonstrates the wide "remit" of these reports, from the broad resource and science base of ICRISAT where multi-level, on-farm trial work and farmer training was integral to each of the four projects. Also scoring 17 and 18 "hits" were the two FAO (2004a and 2004b) reports that presented the outcomes of a previous forum on watershed management; hence drawing on inputs of the many conference delegates. At the other end of the scale, some reports by their very nature achieved few critical elements such as Clement, 2009; George, 2009 and Kosoy, 2004. Rather than a shortcoming, these reports, and others submitted, reported more specifically tailored work focused on specific outcomes or goals and played the important role of supporting the more generic watershed studies which saw far more "hits".

The following three critical elements scored very few "hits" among the submitted reports: element 24, "Legacy of impact"; element 26, "Immediate and tangible benefits and results"; and element 33, "Iteration" – five, eight and three, respectively. The moderators regard each of these as the most important elements in achieving wider and longer lasting – three to five years beyond the life of the project – implementation and uptake of concepts and practices developed in the projects. This is seen as an important consideration in the design and implementation of future projects.

Worthy of note, is that in terms of "matching" with the critical elements in Table 1, it was impossible to set any "achievement-level conditions" whereby a report was deemed to have achieved a critical element. As an example, some studies presented work where some of the critical elements were established, fully implemented and data collected or local persons activated to perform due roles, then trained to pass these to other areas or persons. Other studies, that achieved the same critical elements, simply mentioned the critical need for them, commonly with case studies to support this. Each of these scenarios, and others, would also have scored the • symbol. To improve this necessary level of generalisation, readers are urged to use this synthesis report to help them focus on reports of interest. Towards this, all possible Internet links to individual reports are given in the reference list.

8. References

Clement, F., Orange, D., Williams, M., Muller, C. & Epprecht, M. 2009. Drivers of Afforestation in Northern Viet Nam: Assessing local variations using geographically weighted regression. *Applied Geography*. 29: 561-576.

Dixit, S., Wani, S.P., Ravinder Reddy, Ch., Somnath Roy, Reddy, B.V.S., Sreedevi, T.K,

Chourasia, A.K., Pathak, P., Rama Rao, M. & Ramakrishna, A. 2005. Participatory varietal selection and village seed banks for self-reliance: lessons learnt. *Global Theme on Agroecosystems*. Report No. 17. Patancheru 502 324, Andhra Pradesh, India, International Crops Research Institute for the Semi-Arid Tropics. 20 pp.

Echavarria, M. 2002. Water user associations in the Cauca Valley, Colombia – a voluntary mechanism to promote upstream-downstream cooperation in the protection of rural watersheds. *Land-Water Linkages in Rural Watersheds Case Study Series*. Rome, FAO. 15 pp.

FAO. 2002a. *Land-water Rural Linkages in Rural watersheds. Proceedings of the electronic workshop organized by the FAO Land and Water Development Division 18 September – 27 October 2000*, Rome, FAO. 90 pp.

FAO. 2004a. *Electronic Forum on Payment Schemes for Environmental Services in Watersheds organized by FAO and the Latin American Network for Technical Cooperation in Watershed Management (REDLACH), 12 April – 21 May 2004*. Santiago, Chile, FAO. 27 pp.

FAO. 2004b. *Payment Schemes for Environmental Services in Watersheds. Land and Water*. Discussion Paper 3. Regional Forum, 9-12 June 2003, Arequipa, Peru. FAO Regional Office for Latin America and the Caribbean, Santiago, Chile. 95 pp.

FAO. 2005. Forests and Floods – Drowning in Fiction or Thriving on Facts? RAP Publication 2005/3, Forest Perspectives 2. FAO Regional Office for Asia and the Pacific and Center for International Forestry Research Jl. CIFOR, Bogor, Indonesia. 40 pp.

FAO. 2006. *The New Generation of Watershed Management Programmes and Projects*. FAO Forestry Paper 150. Rome, FAO. 128 pp.

Fares, A. 2009a. *Institutional Arrangements for Integrated Land and Water Management*. Paper submitted to e-Conference. 7 pp.

Fares, A. 2009b. *Technical Measures and Tools for Integrated Land and Water Management*. Paper submitted to e-Conference. 7 pp.

Freier, I. 2009. *Institutional arrangements for integrated land and water management: water users' organizations, river basin organizations and land and water management institutions within government departments, coordination mechanisms and their capacity building*. Paper submitted to e-Conference. Vientiane, Lao PDR, GTZ. 24 pp.

George, A., Pierret, A., Boonsaner, A., Valentin, C., Orange, D., Planchon, O. & Olivier. 2009. Potential and limitations of Payments for Environmental Services (PES) as a means to manage watershed services in mainland

Southeast Asia. *International Journal of the Commons*, 3(1).

Gowing, J.W., Tuong, T.P. & Hoanh, C.T. 2006. Land and Water Management in Coastal Zones: Dealing with Agriculture-Aquaculture-Fishery Conflicts. *Environment and Livelihoods in Tropical Coastal Zones* (eds. C.T. Hoanh, T.P. Tuong, J.W. Gowing and B. Hardy). CAB International: 1-16.

Hayward, B. 2005. *From the Mountain to the Tap. How Land Use and Water Management can Work for the Rural Poor*. London, United Kingdom Department for International Development (DFID). 64 pp.

IWMI. 2010. *Land and water resources management for upland farms in Southeast Asia: some lessons learned*. Colombo, Sri Lanka. Water Policy Brief 33. IWMI. 4 pp.

Kam, S.P., Nhan, N.V., Tuong, T.P., Hoanh, C.T., Be Nam, V.T. & Maunahan, A. 2006. Applying the Resource Management Domain (RMD) Concept to Land and Water Use and Management in the Coastal Zone: Case Study of Bac Lieu Province, Viet Nam. *Environment and Livelihoods in Tropical Coastal Zones* (eds C.T. Hoanh, T.P. Tuong, J.W. Gowing and B. Hardy). CAB International 2006: 193-201.

Kosoy, N., Martinez-Tuna, M., Muradian, R. & Martinez-Alier, J. 2007. Payments for environmental services in watersheds: Insights from a comparative study of three cases in Central America. *Ecological Economics*, 61(2-3): 446-455.

Lestrelin, G. & Giordano, M. 2007. Upland development policy, livelihood change and land degradation: interactions from a Laotian village. *Land Degradation and Development*, 18: 55-76.

Mayrand, K. & Paquin, M. 2004. *Payments for Environmental Services: A Survey and Assessment of Current Schemes*. Montreal, Canada, UNISFERA – Centre International Centre For the Commission for Environmental Cooperation of North America. 60 pp.

MRC. 2009. *The Mekong River Commission: Case Study – Improvement of Irrigation Water Management Performance in Assessing the Maintenance and Restoration of Watershed Functions in the Southern Krong Ana Watershed (SKAW)*, Viet Nam. Paper submitted to e-Conference. 3 pp.

Molle, F. & Hoanh, C.T. 2009. *Implementing integrated river basin management: Lessons from the Red River Basin, Viet Nam*. Colombo, Sri Lanka: International Water Management Institute (IWMI). Research Report 131: 33 pp.

Noborio, K., Mizota, C., Harashina, K., Tsukiji, K. & Orisaka, M. 2009. *Effects of Land Use in a Watershed on River Water Quality*. Paper submitted to e-Conference. 5 pp.

Orange, D. 2002. *Aims and results of a sustainable development research project in the Inner Niger Delta: the GIHREX project*. 11 pp. (Translation of Orange D., 2002 – Projet Gihrex: ambitions et acquis d'un projet de recherche pour le développement durable du delta intérieur du Niger. *Colloques et séminaires*, IRD, 2002: 953-967.)

Orange, D., Dardenne, L., Geier, P., Duy Phuong, N., Jouquet, P. & Duc Toan, T. 2010. Using a Biogas Scheme to Control Soil Erosion on Sloping Lands in North Viet Nam. *Mountain Forum Bulletin* January 2010: 4 pp.

Orange, D. & Noble, A. 2009. *Technical methods and tools for integrated land and water management, to deal with issues related to conservation and utilization of land and water resources and systems*. Paper submitted to e-Conference. 8 pp.

Pathak, P., Wani, S.P., Sudi, R., Chourasia, A.K., Singh, S.N. & Kesava Rao, A.V.R. 2007. Rural Prosperity through Integrated Watershed Management: A case study of Gokulpura-Goverdhanpura in Eastern Rajasthan. *Global Theme on Agroecosystems*, Report No. 36: 46 pp. Patancheru, India. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT).

Penning de Vries, F.W.T.H., Acquay; D., Molden, S.J. Scherr, C. Valentin & O. Cofie. 2003. Integrated land and water management for food and environmental security. *Comprehensive Assessment of Water Management in Agriculture* Research Report 1: 74 pp. Colombo, Sri Lanka: Comprehensive Assessment Secretariat.

Prasad, C.S., Hall, A.J. & Wani, S.P. 2005. Institutional history of watershed research: The evolution of ICRISAT' s work on natural resources in India. *Global Theme on Agroecosystems* Report No. 12. 40 pp. Patancheru, India. ICRISAT.

Rego, T.J., Wani, S.P., Sahrawat, K.L. & Pardhasaradhi, G. 2005. Macro-benefits from boron, zinc and sulfur application in Indian SAT: A step for Grey to Green Revolution in agriculture. *Global Theme on Agroecosystems* Report No. 16: 24 pp. Patancheru, India. ICRISAT.

Sreedevi, T.K., Shiferaw, B. & Wani, S.P. 2004. Adarsha watershed in Kothapally: understanding the drivers of higher impact. *Global Theme on Agroecosystems* Report No. 10: 24 pp. Patancheru, India. ICRISAT.

Sreedevi, T.K., Wani, S.P., Sudi, R., Deshmukh, H.K., Singh, S.N. & D'Souza, M. 2008. Impact of Watershed Development in the Low Rainfall Region of Maharshtra – A Case Study of Shekta Watershed. *Global Theme on Agroecosystems* Report No. 49: 48 pp. Patancheru, India. ICRISAT.

USAID. 2005a. First Annual Work Plan and Life of Project Plan. *Environmental Services Program*. DAI Project Number: 5300201: 70 pp.

USAID. 2005b. Matrix of site selection in Krueng Aceh Watershed. *Environmental Services Program*. DAI Project Number: 5300201: 11 pp.

USAID. 2009a. *ESP Watershed Management Toolkit Introduction* (Draft 1). 3 pp.

USAID. 2009b. ESP Annual Work Plan Program Year 5, 2009. *Environmental Services Program*, DAI Project Number: 5300201: 281 pp.

USAID. 2010. *The Environmental Services Program Final Report – Executive Summary*. DAI Project Number: 5300201. 47 pp.

Wani, S.P., Joshi, P.K., Raju, K.V., Sreedevi, T.K., Wilson, M.J., Shah, A., Diwakar, P.G., Palanisami, K., Marimuthu, S., Ramakrishna, Y.S., Meenakshi Sundaram, S.S. & D'Souza, M. 2008. *Community Watershed as Growth Engine for Development of Dryland Areas – Executive Summary. A Comprehensive Assessment of Watershed Programs in India*. Patancheru, India. ICRISAT. 39 pp.

Wani, S.P., Kumpf, B., Sreedevi, T.K., Joshi, P.K., Raju, K.V., Wilson, M.J., Shah, A., Diwakar, P.G., Palanisami, K., Marimuthu, S., Jha, A.K., Ramakrishna, Y.S., Meenakshi Sundaram, S.S. & D'Souza, M. 2009. *Integrated Watershed Management in India: Strategic Policy and Institutional Options – New Priorities for Agricultural Research in Asia. Policy Brief No. AES-01*. Patancheru, India. ICRISAT. 8 pp.

WMRK. 2009. The Conversion of Tropical Peat Swamp Forest into Oil Palm Plantations – Cases from Indonesia and Malaysia. *The Watershed Management Resource Kit*. MRC and GTZ.

Appendix 1

Synopsis of the three key reports used as reference materials during the e-Conference from which the 33 critical elements were drawn

Appendix 1.1

The New Generation of Watershed Management Programmes and Projects

This FAO (2006) publication comprehensively reviews watershed management concepts, processes and practices, to the early 2000s. The report is a resource book of rich and varied analysis that arose from the input of 150 watershed management experts from four continents who had contributed to four regional workshops across four continents and an International conference. It was written primarily for field-level watershed management practitioners and local decision-makers at the district level. However, it was also presented as a useful resource and synthesis of information on the "new generation" of watershed management for higher level practitioners. The overall objective of the report was to identify the paradigm, approach and methods that lay behind the new generation of watershed programmes and projects, to seek out and promote an exchange of experiences in implementing watershed management conducted from 1990 to 2000. As such, the authors state clearly that the report does not and cannot present the "final truth". Rather, it provides the state of the art (to the early 2000s) in watershed management experiences and practical approaches, to aid further reflection and creative thinking for further development of watershed management programmes and projects.

From the outset, the FAO report sets the scene by stating that a high priority in many countries over the past several decades and continuing to present, is the conservation, use and sustainable management of watershed resources to meet the demands of growing populations. From the 1990s, integrated and participatory (local participation) watershed management approaches have been seen as a popular approach for conserving water, land and biodiversity, enhancing local livelihoods, reducing poverty; while being driven by and concomitantly achieving broader sustainable development (SD) processes at the farm, township, national and river basin (geographic) levels.

The publication addresses each of three complementary parts of watershed management: 1. History, 2. Rethinking watersheds (conceptual background), and 3. New approaches to watershed management (ongoing changes) for successful implementation. Many case studies, specific methods and resources for successful watershed management are also presented throughout the text and in Annexes. This synthesis and critical review will follow the three complementary parts.

1. History. In addition to providing a historical perspective to watershed management, this section of the report introduces the basis of many watershed concepts and modalities. As such, these are the underlying principles and practices that constitute watershed management initiatives, to at least the early 2000s. Others may be added and these refined but these are presented as the pillars of any consideration of watershed management initiatives. The core focus of watershed management is stated as "controlling the flow of water and runoff materials" carried down slopes by gravity in an applied and multidisciplinary fashion. The disciplines to be engaged and improved upon for common good cover almost all fields of science and management: physical, policy, ecological and social. Consideration of these can be conducted both "*a priori and a posteriori*". That is, each disciplinary area may be addressed in terms of the prediction of potential negative and positive impacts from watershed interventions, the measurement of these, and subsequent monitoring of change with time or alterations to practice. Scale and geography are also pertinent; each assessment can be conducted from micro-watersheds to transboundary (international) river basins as well as in terms of local, upstream and downstream impacts.

For at least 5 000 years, from commencement of the first agricultural practices, there has been concurrent manipulation of water bodies and slopes for more assured and more bountiful crop and forest practices with subsequent socio-economic and political spillovers. To the 1960s, the focus of these interventions tended to be on the mechanics of building irrigation systems as well as reclaiming and draining lands in conjunction with hydro-electric schemes; hence co-achieving agricultural development with water and energy supply. Little consideration was given to social and environmental costs. Problems soon arose in protecting artificial basins and channels from runoff and siltation, causing both practitioners and policy makers to realise the importance of up- and down-stream linkages in their schemes, as well as social and economic considerations (impacts); in these ways spawning the "integrated watershed management" approach.

The 1970s saw the beginnings of realisation of environmental threats affecting the planet, including management and conservation of natural resources, as part of SD. A significant development was the Bruntland report of 1987 that promoted the dual, interlinked roles of economics and natural resource development – particularly that sustainable practices of development are important for and inexorably linked to assured environmental protection. The prime aim was "sustainable development" where the needs of humans are achieved without compromising the environment, hence the chances of future generations. The nature and role of SD was further popularized in 1992 by Agenda 21 of UNCED (UN Conference on Environment and Development). Of particular relevance, Chapter 13 on Sustainable Mountain Development promoted integrated watershed development and established a framework for appropriate land-use planning and management to prevent soil erosion, increase biomass and maintain the ecological balance; promote alternative income-generating activities; improve infrastructure to protect livelihoods of locals; and mitigate the effects of natural disasters related to poor watershed management. Of greatest pertinence to the current e-Conference objectives, Agenda 21 stressed that successful watershed management must be based on the informed participation of local stakeholders in all aspects of proposed development strategies – thereby initiating integrated and participatory approaches to many watershed management projects and programmes, and ensuring that such concepts were involved in future SD-type global events.

From the 1980s, FAO began implementing several field projects in watershed management, as well as documenting best practices and lessons in several publications. In all of these, FAO has supported an integrated and participatory approach, as well as mainstreaming watershed management and sustainable mountain development in policy. The document being reviewed here is a prime example of these FAO publications.

2. **Rethinking watersheds.** This section reviews relevant issues for the next generation of watershed management programmes and projects. The emphasis is on the impact of land use, particularly change in land use, on the hydrological regime and water quality both within and upstream/downstream of a watershed. In the past, the realisation of key environmental factors and their interaction was poorly understood, particularly the specificity of each watershed. In particular, watershed deforestation had long been blamed for erosion, flash floods and sedimentation. This demonstrated the early watershed management approach of "singular, simple solutions" based on perception not fact (scientific and economic measures), thereby missing the complex interaction of diverse watershed ecosystems that composed and regulated watersheds, that in turn require an integrated and multidisciplinary approach. Scale, too, introduces another level of complexity to watershed management; for e.g. the hydrology of a large watershed is less affected by change in land use and more by natural factors like extreme rainfall. The downstream impacts of change in land use in a large watershed is more difficult to retro-source and may not be due to one area or practice but an additive effect across the whole watershed. However, in a watershed with large agricultural areas, poor land practices can lead to erosion and consequent water body siltation, eutrophication and concentration of agricultural pollutants downstream with negative ecological impact. It is possible that some of the latter may originate from point-scale sources for e.g. cattle feed lots.

Watershed considerations go far beyond water, land and vegetation. Human ecology, i.e. human population dynamics, is also strongly influenced through watershed interventions (for e.g. building dams and irrigation schemes) and subsequent changes (both positive and negative) in land use, water availability and quality. The success and failure of both are tightly interwoven. For example, the successful implementation of a large-scale irrigation scheme producing bountiful food and marketable crops, that concurrently provides potable water to locals, will encourage population growth, reduce poverty and out-migration and create an associated social infrastructure like shops, markets, schools and roads. In such environments, the pressure on a watershed can be reduced as a balance between needs and requirements is achieved, reducing excess water use or slash and burn mentalities in agriculture. On the other hand, incorrectly located schemes that, for example, lead to salinisation with dramatic crop losses will rapidly depopulate the watershed area. It is also possible that a watershed or area within a watershed can be "too successful" and grow beyond its carrying capacity – with potential for social problems from subsequent migration upstream or downstream in less bountiful areas. Another scenario is local interests confronted by external demand for watershed products such as timber, food and fuelwood or mining within the watershed or building of recreational facilities for outsiders. While efforts are made to ensure compatibility, threats to local livelihoods or watershed integrity may ensue. In all cases, rights of incumbents must be considered sensitively as they have no other home.

The economics of a watershed is a critical consideration, considering that it provide many goods and services which cannot be monetized such as clean water, erosion control, livelihoods, tourism and conservation of biodiversity. These are commonly termed "public goods" shared by many or all. However, the concept of public goods implies that one person's consumption does not negatively impact another person's ability to access and benefit from it. Watersheds also have positive externalities such as reducing erosion and improved off-site water quality from individual actions such as planting trees or retaining crop residues. Such externalities are also difficult to monetize, which is, however, rarely considered by individuals when considering or enacting a change in land use. It is common for only local conservation and water issues to be considered and rarely, the composite effect or cost of several changes to land use practices. However, society greatly values such positive externalities and will take action, commonly at policy level, to ensure these are provided, available and conserved. An example is the urban population in the vicinity of a large aesthetically pleasing watershed which is used as a weekend retreat. The linking of the (local) community which implements land use change that provides such externalities and those (not locally resident) who enjoy these is a continuing quandary. One modality where beneficiaries of externalities or services are able to pay the providers is a "payment for environmental services" (PES). This has two categories – *local*, where providers and beneficiaries occupy the same watershed, the latter generally being downstream municipalities or companies; and *national*, where government programmes commonly finance incentives for land users through cross-sectoral subsidies such as taxes on fuel or energy production.

3. **New approaches to watershed management.** In parallel and associated with worldwide changes in general and specific environmental, socio-economic and policy considerations, watershed management has undergone a paradigm shift to the practices of the 1980s and 1990s. This is an emerging and continuous process, so at present[44], the "new approaches" usually consist of a mix of old and new practices, seeking the best of both.

Integrated[45] watershed management of the late 1980s is considered a forerunner of **sustainable development** as advocated at the 1992 UN Conference on Environment and Development in Brazil. There is much overlap and similarities between the two, particularly in that each aims to generate benefits for people and environment, and further that there is an intimate interaction between the biophysical and social inputs to achieve long-term environmental care for persons who both require and

[44] This was written in the early 2000s

[45] In this section (*New approaches…*), each of the 20 initiatives of Box 1, in the main body of the text, are introduced and the key word (e.g. **Integrated**) highlighted in **bold** text.

benefit from it, and those who interact with it. However, though at one level it appears difficult to separate integrated watershed management from sustainable development, this co-approach has not always brought the intended positive impact on livelihoods and the environment. The risk is that too much commitment to sustainable livelihoods and poverty alleviation goals will push the role of watershed management programmes into the background. The following questions remain: should watershed management programmes (i) provide benefits and services that are not directly related to resource management – considered as "programme-led" integrated watershed management? (ii) or should they be embedded in broader sustainable development (SD) processes by ensuring SD considers watershed land and water issues? This dilemma increases when considering watershed programmes that focus only on natural resources as these usually have a limited impact on livelihoods and poverty. However, the poor and illiterate are likely to use natural resources without concern for sustainability in order to meet their daily survival needs. Seeking **compatibility** among many, apparently opposing issues is the key in many areas of successful watershed management such as: balancing needs and requirements; local *vs* external needs and demands; assuring local livelihoods while gaining common good; and ensuring local actions provide gains or are rewarded, while providing gains for those outside the watershed.

Embedded watershed management is restricted to affluent countries where necessary social services through the public sector, subsidies and incentives are available, and environmental conservation is a public concern. Since the mid-1990s, however, there has been growth in the number of partnerships in developing and transitional countries between watershed management programmes and development processes such as poverty reduction, sustainable livelihoods and public-private partnerships.

A **participatory** approach, together with integration, has been another essential attribute of good watershed management practice since the mid-1980s. This is based on the following basic tenets: natural resource management (NRM) cannot be successful and sustainable without support and participation of natural resource users; participants should have decision-making capacity; and recognition that ensuring participation is a long and time consuming process. Furthermore, watershed programmes should collaborate with civil society entities such as user groups, non-governmental organizations and private companies. The varied nature of such cooperators has necessitated a shift in the participatory approach from one of awareness raising and social mobilization to negotiation and seeking partnerships. This has been necessitated and supported by the widespread decentralization of government administration in the 1990s to regional areas. **Capacity-raising** of these personnel on technical aspects of watershed management is a continuing requirement for embedding watershed management in territorial governance. However, downstream (beyond the watershed region) impacts require horizontal linkages and mutual agreements between inter-regional authorities, private companies and affected local groups.

The involvement of many levels and types of personnel and institutions in watershed management requires a **collaborative** approach in association with and supportive of integration and participation. Collaboration is pluralist, based on mutual learning, shared knowledge, social ownership, exchange of concepts and practices, and negotiation, mainly among those with diverse interests and concerns, including primary producers, technical experts and policy-makers. Collaboration, in association with integrated, participatory and intersectoral approaches, recognizes the complexity of successful watershed interventions. Consequently, the solutions are never **single-step** or **simple**. Gaps remain in this push for effective collaboration, particularly between science and practical expertise, i.e. between scientists and stakeholders. An approach is needed to link local and scientific knowledge with sound **action research** incorporated into collaborative watershed management. The aim is to reflect and address local priorities with site-specific solutions for local stakeholders. End-users participate and guide the science and the outcomes are readily implementable, locally relevant and comprehensible, while remaining scientifically sound. The phrase "simple yet robust" was coined in the FAO-LADA (Land Degradation Assessment in Drylands) initiative and seems apt here. **Action research** is a multistakeholder and long-term learning process with dissemination and replication of successful results, as well as truthful rationalization of

failure. Best local practices should be assessed and modified as required, and included in demonstration sites and local training exercises. The development of user-friendly tools to assess the impact of watershed interventions to aid locally conducted assessment of interventions and a "2nd time-around will be better" modality is important. As such, flexibility in programme design is fundamental to the collaborative, locally enabling and empowering approach within a progressive planning agenda, able to adapt to local vagaries, successes and failures. The vision, therefore, by necessity is intuitive, iterative and mid- to long-term. There are no "magic wands". **Collaborative** watershed management should be the responsibility of local, lower-level institutions but if "heavier" more fixed institutions are the managers, greater effort is required to ensure local adaptation, implementation and the inclusion of local institutions.

The **scale** of watershed management programmes covers all levels, from small upland to entire trans-country river basins. **Collaborative** programmes tend to flourish in relatively small area units where activities can be intensive and up-close interaction with local stakeholders is easier. The impact of such small-scale interventions at the watershed or river basin level may be small, so scaling-up of successful local experiences from the **micro** to **macro** levels is a critical modality in the generation of new watershed management programmes. **Scaling up** also takes governance and, perhaps, financing to higher levels, seeking a level of permanence to watershed management initiatives and institutions. It is not possible to dictate universally, the level of watershed management initiative to be implemented that would be successful; there is too much variability along with multi-level problems and requirements. However, small-scale local initiatives should also consider up- and downstream impacts for a larger view. Vice versa, large-scale watershed programmes should consider the local impact as well as seeking collaboration and input/activity at the local level. It remains axiomatic that it is a case of "no one size fits all" in watershed management. But the players at various levels should remain vigilant of each other's needs and the potential impact of their actions and inactions!

Tenure of land and water rights in a watershed is critical to sustainable development. Usually, tenure rights tend to be pluralistic, being a mix of local culture- and state-enforced, thereby creating complex tenure regimes, overlapping interests and conflicting rules with important implications for environmental and socio-economic processes in the watershed. Scale is important in larger watersheds, commonly having a greater mix, complexity and interplay of on- and off-site land tenure and associated socio-economic interests, and a greater need for regulation and arbitration. This highlights a common problem of managing larger watersheds that are strategic assets for national or regional economies, yet populated by all social scales, ranging from individual farms to villages and towns. At the largest scale, river basins crossing several countries require transboundary management agreements and interventions, seeking equity for all. This is a most challenging task.

The report states that, at the time of writing, the "new generation of watershed management is still in its infancy". Or, at best, in its adolescence. This gives rise to a highly pertinent question in this review – "Did the infant grow up and nurture?" There were, at that time, some partial local and self-contained watershed management programmes in different regions of the world – demonstrating the potential of **embedded**, **collaborative** approaches that still faced challenges in **scaling up**. The constraints were not related to programme design; rather these were seen related to the policy and institutional environment in which the innovative programmes developed, necessitating political and institutional changes for new generation watershed management to mature and widen. The required changes included: policy reforms to allow multiple roles of watershed management in sustainable development and create an **intersectoral** framework for implementation, and ensuring the **mainstreaming** of watershed management into policy derivation. It was also recognised that new watershed management interventions must aim to be community driven and oriented, ensure updating and improvement of laws on watershed management, enhance institutional mechanisms that link local with relevant national-regional policies, strengthen capacity building at all levels, and create mechanisms for long-term financing of collaborative watershed management processes.

Enabling policies to promote sound watershed management are integrally linked with achievement of the Millennium Development Goals that emphasize accelerating poverty eradication, improving access to basic services and sustainable use of natural resources. Specifically, by enhancing availability and use of land and water resources for food security and economic development, watershed management can significantly contribute to eradicating poverty and hunger. Sustainable development policies now use watershed management as a multipurpose approach to be incorporated in a range of sectoral and subsectoral approaches. This is cognizant of the inexorable multiple linkages between poverty and NRM as rural and urban poverty often contribute to watershed degradation, so watershed and NRM policies need to be interwoven for shared and additive impact on watershed and NRM management. Policies should address watersheds as planning and management units where natural resources can be used to achieve equity goals. However, this requires a true "unity of intentions" for success and a fully integrated approach that moves from compartmentalized multisectoral efforts to full **intersectoral** integration.

The water sector should be the core focus for environmental policies to harmonize the priorities of other sectors such as agriculture, forestry and irrigation, moving towards a wider review and harmonization of policies of all sectors and practices affecting water use and availability. Intersectoral collaboration and equitable allocation of funds is poor due to watershed management legislation and regulatory measures being generally inadequate or outdated. This is worsened by either the absence of legislation or inadequate enforcement of laws, which is a constraint to embedding watershed management principles in conservation and development policies. As a result, watershed authorities lack the power to harmonize rights and enforce decisions.

Micro-macro linkages are an important watershed management tool. Even in programmes covering large land units, collaborative watershed management focuses on intensive interventions in small geographical areas, generally subwatersheds. Large watershed programmes are commonly constituted by federations of such site-specific microinterventions. This micro approach to a large-scale programme reflects the complexity and specificity of watershed processes which is best captured and resolved at the local level. Additionally, micro-projects addressing watershed degradation tend to be more cost-effective than extended control/influence systems like transboundary river basins. A micro-level approach aiming at long-term global macro-level impacts of integrated NRM and SD initiatives has been described as an "adapting mosaic" environmental policy scenario – one of the four Millennium ecosystem assessment scenarios. (See Box 4 for an explanation of the adapting mosaic approach.) This approach is expected to be the most cost-effective for key watershed variables, firmly based on collaborative watershed management with minimum input requirements for sustainable development.

Scaling up of micro-experiences of mosaics of self-contained, subwatershed initiatives embedded in local societies and cultures will require more than scaling-up policies at the local level if these are to noticeably restore and improve environmental goods and services. Governments need to link decentralization policies to national frameworks that mobilize the central-level inputs required for sound, territorial watershed governance. Flexible and adaptive national guidelines should define the autonomy of local initiatives and the support they can expect from central government and higher-level institutions. Furthermore, watershed management policies of national governments should harmonize local institutions and establish institutional linkages at the regional and national level. Policies should include criteria for funding local initiatives and clear procedures for prioritizing critical watersheds. Local project objectives and strategies should be based on national watershed guidelines and strategies.

Transboundary (inter-country) watershed management requires establishment of strong international and regional fora to promote negotiation among **downstream and upstream** administrative units or countries, particularly where local interventions have wider potential upstream or downstream impact as well as in transboundary watersheds and across river basins. The fora should be mechanisms for regional integration based on synergy among national agencies and ruled by ad hoc international river basin management agreements. Such fora can identify priority areas and establish networks of local

collaborative watershed management initiatives. The exchange of knowledge and experiences among countries sharing a river basin should be facilitated to develop a common policy framework and ensure long-term commitment and steady funding to relevant institutions.

Action research can also help reduce the current lack of linkages between science and watershed management policies. This requires ensuring that policy-makers, reluctant to accept scientifically uncertain watershed processes, do not rely on old, and often incorrect, watershed process models, leading to policy based on wrong assumptions. Improved communication between politicians and practitioners is key to resolving the issue. Practitioners should formulate precise and science-based statements for policy-makers on key watershed processes requiring attention, and aim for commonality in data recording and reporting, including database entries. There is a need for mechanisms to identify priority areas and hotspots based on sound data collection and monitoring as well as for relevant and readily explainable (to politicians) indicators of the problems. **Economic** facts derived from sound environmental economic assessments are essential to convince decision-makers of the relevance and value of watershed management investments.

BOX 4: **Collaborative watershed management's contribution to a sustainable future**

Adapting mosaic

This scenario of Millennium Ecosystem Assessment depicts regional watershed-scale ecosystems as the focus of political and economic activity, and foresees the rise of local ecosystem management strategies and the strengthening of local institutions.

Investments in human and social capital focus on improving knowledge about ecosystem functioning and management, resulting in improved understanding of the resilience, fragility and local flexibility of ecosystems. The scenario is optimistic about people's capacity to learn, but prepared for suboptimal management of ecosystems.

Styles of governance vary greatly among nations and regions, with some investigating adaptive management alternatives, while others use bureaucratically rigid methods to optimize ecosystem performance. Outcomes are diverse: some areas thrive while others face severe inequality or ecological degradation. Initially, trade barriers for goods and products increase, but information barriers almost disappear because of improved communication technologies and rapidly decreasing costs. Eventually, the focus on local governance leads to failures in managing global commons.

Global environmental problems, such as climate change, marine fisheries and pollution, intensify. Communities cannot manage their local areas because of infringing global and regional problems, and communities, regions and nations develop networks for better management of global commons. These networks adopt solutions that have been locally effective, particularly in areas with mutually beneficial opportunities for coordination, such as along river valleys. Sharing good solutions and discarding poor ones improves the approaches to addressing social and environmental problems ranging from urban poverty to agricultural water pollution. Service provision improves as more knowledge is collected from successes and failures.

Watershed management should incorporate more cost-benefit analyses and other economic valuation methods. Similarly, the **human ecology** of the investigative area should also be clearly expressed to policy-makers in order to provide a thorough understanding of watershed stakeholders' views, logic and knowledge as the basis for sound watershed management policies. For instance, it is important to consider the role of local technologies, practices, knowledge and customs in local land and water management systems. Watershed management policies tend to emphasize research-based knowledge at the expense of indigenous knowledge. There is scope for evaluating the benefits and sustainability of local watershed management cultures and incorporating these into policies. This facilitates intercultural dialogue and social negotiation which forms the basis of sound, collaborative watershed management.

Capacity building and awareness-raising are needed at many levels for implementing the next generation of watershed management, for e.g. strengthened technical and communication skills of watershed professionals, and raised awareness among local stakeholders and the public. This includes: reform of and additions to educational curricula for student (entry)-level watershed practitioners at local and regional levels (for e.g. practical university courses and technical schools), and raising public awareness of needs, current actions and positive outcomes using a wide range of media. Field schools for local practitioners at key project sites will promote both local awareness and potential scaling-up through spontaneous uptake or new and improved modalities, ex-project site.

Assured and continuing **financing** of watershed management programmes is essential continuing application of advised and implemented practices. Public sector funding is the most common source, reflecting the public goods-nature of many watershed interventions. However, non-profit and private sector sources should also be tapped. Watershed infrastructure is costly and usually financed by national governments. Similarly, core funding for local collaborative watershed programmes should come from national governments but with local cost-recovery mechanisms to generate complementary funds. Where government funds are not available, public sector funding should be sought although this is getting increasingly scarce. Changes of local government personnel over time and the usually short-term nature of donor support, often results in programmes having a five-year lifespan. Donor-funded programmes have proliferated in Africa, Asia and Latin America with national government interaction with donors often just enough to assure funding. Bilateral and multilateral cooperation policies must be harmonized based on clearly defined fund contribution and sharing, as well as long-term agreements with firm outcomes and timelines. Watershed trust funds are capital asset funds established through central government allocations, donor grants and local tax revenue. These are invested in financial markets to ensure a steady source of funds for watershed management programmes. Capital disinvestment is restricted by the trust fund holder (the government), but collaborative watershed management institutions receive the interest generated by the fund. Some countries have established environmental or forest trust funds to finance watershed management activities.

Developing countries should consider market-based **financing** mechanisms and sources of finance for watershed management to decrease donor dependency. They should also consider industrialized country mechanisms for transforming watershed environmental services such as water, power and carbon sequestration into cash for collaborative management processes, including through **PES** schemes. However, the potential for such private sector involvement in developing countries remains somewhat unclear and untapped.

Appendix 1.2

The Indonesian Environmental Service Programme – ESP

There are several available publications of the Indonesian Environmental Service Programme (ESP) (USAID; 2005a, 2005b, 2009a, 2009b, 2010). The focus here, for derivation of further critical elements, will be on the two more recent ESP documents available, and as such, hopefully presents the latest project initiatives and actions.

The ESP is a United States Agency for International Development (USAID)-funded programme, implemented in Indonesia's Java, Sumatra and Aceh provinces by the company Development Alternatives Inc. (DAI). In mid-2009, DAI published a five-volume set comprising this toolkit which is available only in Bahasa Indonesia, although a three page English summary is available (USAID, 2009a) as well as a longer executive summary. The toolkit is based on inputs from ESP staff and partners and draws from nearly five years of field experience.

The key best practices and lessons learned, presented in these publications, clearly show that the ESP programme addresses almost all the critical elements of the FAO (2006) publication (see Box 1). Furthermore, ESP has developed and achieved several more initiatives that will be reported here, aiming for their wider uptake in regions and programmes beyond the ESP.

The prime focus of the Watershed Management and Biodiversity Conservation Component of ESP is to contribute to stabilizing and improving water supply to urban and peri-urban population centres in Java, North Sumatra and Aceh. This is achieved through a landscape approach (hence **intersectoral**) to improved land stewardship that integrates three **sustainable development** initiatives: the conservation of high value forests, rich in biodiversity; restoration of degraded forests, especially adjacent to water recharge zones; and sustainable utilization of agricultural lands. The programme emphasises a range of **enabling** conditions for land stewardship including policy support for land **tenure** – required for responsible community-based (hence **integrated**, **collaborative** and **participatory**) forest management, multistakeholder management at the watershed level, as well as **financing** options to reward upstream communities' support to ensuring stable downstream water supply – nicely integrating **downstream/ upstream** concerns, **compatibility**, **capacity raising** and **embedded** (common good actions) initiatives.

A new ESP initiative is the use of a "***GIS-based analytical process"*** [46] for programme site selection[47]. This is then followed by a series of integrated field activities that include **capacity raising** and development of **action research** ("***science delivery support"***) through community-based field schools, development of multi-stakeholder action plans to improve subcatchment ecological functions, and monitoring and evaluation to ensure that action plans have continuing impact on a wide range of **intersectoral** factors that directly and indirectly affect water quality, including land rehabilitation, biodiversity conservation, and community-level and service delivery considerations – clean water, sanitation and solid waste management systems. The latter interventions are in consideration of the **human ecology** impacts of the ESP interventions.

To achieve this broad gambit of interventions and the associated **enabling policies**, ESP works with a broad **scale** of field-based partners, both individuals and institutions – local communities, government agencies, municipal water companies and the private sector. It thus aims for **micro-macro** links, described as ***"leverage"*** and **"*ramping up*"**, to ensure subcatchment achievements are scaled up to

[46] In this Appendix ("Environmental Services Programme") each of the 11 initiatives of Box 2, in the main text, is introduced and the key word (e.g. ***GIS-based analytical processes***) highlighted in ***bold*** italic text.

[47] The GIS "Matrix of Site Selection" includes such filtering factors as local water quality (well and river) native and agricultural vegetation, biodiversity and more social indicators like returning (civil unrest affected) communities and political will. (USAID, 2005b)

a broader basin level. A vital ESP initiative aims at ***"legacy of impact"*** where, during the last two years of a three-year programme, ESP increases its leverage of partners to sustain and expand the work by strengthening local and national leadership as well as through development, distribution and teaching of the Toolkit developed by the five-year programme. A mostly **participatory** approach as the toolkit was developed locally, it should be readily upscaled and outsourced to similar areas in the region.

Other new ESP initiatives include:

(i) A ***"fractal"*** approach to watershed management interventions, whereby the programme selects key subcatchments (rather than an entire watershed) that are indicative of overall watershed management opportunities and constraints, and demonstrate a reasonable level of political will and interest among local communities, government agencies, municipal waters supply companies and others. A prime reason – and new approach here – to this type of ESP intervention is the achievement of relatively "***immediate and tangible***" results in terms of improved water resources. This demonstrates to locals, the potential for rapidly achievable, positive outcomes in order to stimulate adaptation of this integrated approach for upscaling/out-sourcing to other subcatchments in the same watershed.

(ii) Somewhat similar to a concept in the FAO (2006) report, but having a key, action-based focus in ESP is the use of "***water as the key entry point***" for addressing a range of NRM and public service delivery issues. Potable water is a critical human need and ESP translates the attainment of this axiom to choices in land management practices. These range from safeguarding forest areas, rehabilitating degraded land near recharge areas and stabilization of water flows (structure building), particularly to lessen landslides and flooding. Water delivery is being used as a meaningful and tangible proxy for local communities to achieve delivery of key environmental services (for e.g. more tangible than biodiversity or carbon increases). Water delivery has a tangible impact on people's daily lives.

(iii) Significant initial emphasis at the "***community level***" for a number of reasons: to ensure "***equitable voice***" based on "***informed confidence***" for true community representation at the multistakeholder table; successful watershed management hinges on community participation, ensuring both land use interventions and human resources to rehabilitate degraded land; local communities have the most stake in effective watershed management and their support to integrated watershed management is vital for long-term sustainability.

(iv) Firm advocacy of the "***field school approach***" using adult, non-formal education techniques and a range of participatory planning and management tools to build community understanding of and commitment to improved water resource management. The 12- to 20- week courses "***empower***" community leaders, build a sense of "***individual and collective confidence***" and lead to effective improvement of community water resources, fully capable of being upscaled from subcatchment to watershed levels. Most importantly, it has been found that school graduates are far more able (empowered) to negotiate with the government and private sector seeking investment in watershed initiatives.

(v) Lastly, emphasis on the importance of "***management rights***" of locals at many levels that clarify roles and responsibilities. This greatly improves active participation in forest, land and water protection and rehabilitation programmes. On public lands, a MOU (memorandum of understanding) between community groups and national park authorities can greatly aid clarification for conservation and rehabilitation programmes. Benefit-sharing agreements can also be drawn up to assure water supply and protection for private (company) users through better upstream land management practices by local landholders. **PES** models also need such clarification of roles and responsibilities, as do long-term monitoring and evaluation mechanisms.

Appendix 1.3

Prosperity through integrated watershed management in India

This ICRISAT report by Pathak *et al*. (2007) presented a case study from the rainfed areas of eastern Rajasthan, India – a poor, agriculture dependent area with erratic rainfall, recurring droughts and high unemployment. This work is included here as it provides comprehensive data, collected both pre- and post-watershed interventions to assess the impact of the interventions.

To maximise rainfall usage without land degradation, the Government of India initiated a watershed management strategy that has matured to include a more **collaborative** and **participatory** approach to farmers' livelihood-related issues. The basic goal was **human ecology**-oriented, principally to reduce rural poverty and improve livelihood security while protecting the environment and enhancing **sustainable development** of natural resources. A consortium model was used that was **participatory**, **collaborative** (multidisciplinary and multi-institutional), with a self-supporting, holistic systems approach drawing on the collective effort of all stakeholders for the benefit of the environment and farming communities. This ICRISAT work can thus be seen using many of the FAO (2006) critical elements in its programme.

Since 1997, various watershed management activities have been implemented, several having ***water as a key entry point focus***, for e.g. water harvesting and groundwater recharging structures. Others were based on integrated nutrient management, improved crop varieties, horticulture, vegetable cultivation, silvipastoral systems and afforestation, among others, thereby demonstrating the **intersectoral** nature of the programme and not seeking **single-step**, **single solutions** to the recognised complexities of watershed management.

A most important initiative was the inclusion of a comprehensive assessment of the impact of the newly implemented activities in the Gokulpura-Goverdhanpura watershed (1 355 ha, ~1 800 population). The aim of the monitoring was to assess and present the multifaceted watershed impact of the new activities, particularly land and water sustainability and the related agripastoral, livelihoods and employment in order to identify the most promising, cost-effective technologies for regional upscaling (***ramping up***).

The Gokulpura-Goverdhanpura watershed initiatives had several positive recorded outcomes spanning environmental, economic and social indicators. As such, this project introduces two new critical elements to the "wish list" of what a successful and all-embracing watershed management programme should include: ***monitoring***[48] of impacts, and a degree of ***iterative*** response (see Box 3). This latter item refers to a process whereby a watershed initiative is introduced, then subsequently tested (monitored) as to its success, then suitably altered, re-introduced and subsequently re-tested and further improved. The aim is to forever build on success with the aim of approaching a desired goal, target or result.

Of the several monitoring and assessment methodologies used in this project, the following six have been selected to show the nature and depth of the investigations:

(i) In the 1997-2001 period, the initiative focussed on reducing soil erosion and increasing water availability (*via* water harvesting with close farmer involvement) – resulting in 20 check dams, benefiting ~250 wells which irrigated 343 ha. A cost analysis showed that large size structures, particularly earthen ones are more cost-effective in terms of cost per m^3 of groundwater recharging.

[48] In this Appendix ("Prosperity through integrated watershed management") each of the two initiatives of Box 3, in the main text, are introduced and the key word (e.g. ***monitoring***) highlighted in ***bold*** italic, underlined text.

(ii) Prior to the interventions, only 88 groundwater wells had water for 8-12 months a year. This increased to 187 after the intervention. The average water depth in the wells was 4.5 mt before and 9.5 mt after the intervention. This led to an increase in well pumping (diesel and electric) with a highly positive social and livelihood impact as it greatly reduced reliance on laborious, hand operated, water lifting devices.

(iii) Increased availability of well water led to a 66 percent increase in the area under irrigation, including a new 35-ha horticulture (irrigated) area, a marked reduction in crop failures and farmer confidence in using improved agricultural inputs.

(iv) Consequent to the initiatives, the area of cropped land, productivity and production of important crops have all increased – particularly high-value crops (vegetables and horticulture) as the risk of loss (drought) was greatly reduced.

(v) During the study period, the number of households increased by 25 percent, population by 24 percent and the per capita income of farmers by 28 percent.

(vi) Poverty declined due to the watershed development as measured by three poverty indicators with marginal and small farmers gaining the most.

In terms of the e-Conference, this project provided the most comprehensive set of measures of the impact (pre vs post) of watershed initiatives. However, little seems provided on the actual cost of the initiatives, the source of the funds and the modalities of introducing them to practitioners (for e.g. ***field school approach, community level and equitable voice***), whether **financing** was 100 percent grant-based or funded through **PES** or **embedded**. There was no mention of further expansion of these initiatives beyond the reported area, particularly privately-funded, spontaneous uptake elsewhere – ***legacy of impact***.

ISBN 978-92-5-106907-3

I2282E/1/06.11