Water catchments – issues and options for research

Selecting locations and target populations for hydrological research

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1. Background

1.1 DFID and FRP research priorities

DFID has recognised the need for reliable mechanisms to capture and distribute the costs of improved forest management activities to deliver better water. It knows that better hydrological data is needed to support such mechanisms. It would like to see the development of decision support systems to enable land-use managers to value catchment water values holistically. This includes:

- Taking in different stakeholder views.
- Working out how to downstream users can compensate upstream land-managers for changed activities.
- Recognising that the process of developing systems, mechanisms and values is at least as important as the end value itself.

FRP is willing to support relatively long-term study into the effects on water flows and quality of land-use change in water catchments with significant cloud forest cover. It wishes to see hydrological research backed up by work that will help land use decision makers to come to sensible decisions about different management and policy options and their effects on up- and down-stream stakeholders.

FRP is looking for original thinking and experimental research in this area. Observational case studies are not adequate. It wants to see work that turns theoretical research into understanding of practical impacts on livelihoods.

1.2 Terms of reference

The consultant was to make use of available documents and human resources (email and telephone) to derive criteria for:

- choosing physical locations of hydrological research, and
- characteristics of the human populations which should be addressed.

Populations should include both upstream forest managers and downstream users of water.

These criteria should then be applied in order to propose locations and populations for research.

Whilst there is no limit to the number of sites, it is anticipated that 1-3 will be finally selected.

1.3 Main research issue

The main hydrological research issue to be addressed by this cluster is: *Quantification of the relationship between changes in tropical montane cloud forest (TMCF) land-use and dry season water flows.*

2. Criteria for selecting locations

2.1 Forest and watershed criteria

***Forest/land-use type*:** Is the catchment at least 33% montane forest?

Why? TMCF is known to have a positive role in increasing water flows, compared to other forest types. It can be expected that removing cloud forest will have a significant effect on downstream flows. To be able to see definitive relationships between land-use and dry season water flows, about one-third of the catchment should be covered in TMCF and its associated montane forest.

Watershed size. Is the catchment less than 1000km^2?

Why? - Larger watersheds mean that there is more disassociation between upstream land-users and downstream water-users.

- Land-use/water linkages can only be reliably determined at the small-scale and these findings cannot easily/reliably be extrapolated to entire basins. Several small scale efforts are likely to be better than one large-scale?

- Impacts of land-use changes are more likely to predominate over human/natural impacts in small watersheds.

- Impacts in a small watershed are more likely to be seen over the time period of research. The larger the watershed, the longer the potential time lag between cause and effect.

- Changes in dry season flows can be attributed to land-use change only up to this scale.

***Scale of land-use change*:** Is land-use change a significant proportion (25%) of the watershed area?:

Why? If potential land-use change is only a small proportion of the total land area, then impacts on the water resource will be limited, and more likely to be influenced by natural or other events. It may not be worth intervention.

Is there a diversity of land-use change?

Why? A site where TMCF is being converted to only one alternative land-use will hold fewer lessons for other sites and other land-uses demands.

Representative: Is the site representative of others?

Why? Water quality and quantity issues are highly site specific. Most value will be gained from studying sites that are not unusual and from which results can be extended to other sites and catchments.

2.2 Relevant available information

***Existing information*:** Is there good existing hydrological data?

Is there good existing management data?

Why? Use of existing data adds to the efficiency of research and provides a baseline and history against which to compare current data, and guidance to forecasting the future. Rainfall and geology data is especially important.

Downstream work: Can upstream work link to ongoing efforts downstream?

Why? Conducting upstream research where there is already research or other catchment management activities ongoing to link into and build upon will optimise the value of this research, and help to make it immediately useful and applicable. It will help the results to be clearly and quickly seen.

Surface/Ground water: Is surface water more important than groundwater?

Why? Groundwater routes of movement are more difficult to follow and consequently quantify. Where they are a dominant part of the hydrology, they will make linking land-use to water quantity and quality more challenging. 'Easy to follow' water routes are preferable for efficient and reliable hydrological studies.

2.3 Local issues

Local demand: Is there an expression of interest in water catchment research in the area?

Why? If there is no local interest in learning more about the state of water resources there will be no support or commitment to the work or to changing practices or to negotiating and introducing payment or compensation mechanisms. Relevant issues include: high downstream water demands (aridity, scale/type of demand population); recognition of land-use change as a problem to dry season flows; secure land tenure; enabling and supportive policy environment.

Participation: Is local participation in the research possible?

Why? For effective long-term research it is helpful if local stakeholders are willing to participate in measurements and monitoring. Existing local institutions or social structures (e.g. watershed associations) may be helpful in facilitating such participation.

Capacity: Is there adequate local institutional and counterpart capacity to support the research?

Why? For optimum efficiency and local impact, the research should rely on local capacity for much of its work. Both individuals and institutions (universities, research institutes) should be available to support the work.

Stability: Is the location in a politically stable environment?

Why? There is little point conducting research in areas where researchers are at risk or may have to be withdrawn, and where research results will not feed into an enabling policy environment.

Location: Is the catchment in a DFID forest partner country* or region?

Why? Current activities in these countries may help to fund research and provide a basis for a more co-ordinated action research effort.

* Belize, Bolivia, Brazil, Cameroon, C. America, E.Caribbean States, El Salvador, Ghana, Guatemala, Guyana, Honduras, India, Malawi, Nepal, Nicaragua, Nigeria, South Africa, Uganda, Zimbabwe.

3. Shortlisted locations

3.1 Suggested shortlist

Possible shortlisted locations have been suggested by the literature and participants at the workshop. Further information about some of these sites is available in the annex. They are:

1. Brazil - Atlantic Coast range
2. Costa Rica - Monte Verde
3. Colombia - Cauca Valley
4. Sri Lanka - Mahaweli
5. Guatemala - Sierra de las Minas
6. El Salvador - El Imposible
7. Venezuela - Merida
8. Uganda/Kenya - Mount Elgon
9. Cameroon - Mount Cameroon
10. Tanzania - udzungwa mountains
11. Costa Rica - Talamanca
12. Honduras - La Tigra
13. Bolivia - Tarija

During the workshop, these suggestions were compared against the location selection criteria, and given a score:

- -1 (do not meet criteria), or
- 0 (unknown), or
- 1 (meet criteria adequately) or
- 2 (meet criteria well).

The total score for a location can be used to suggest its priority as a research site for this FRP research cluster.

Locations shortlisted so far have been gathered from the quick review of suggestions based on knowledge available in literature and through workshop participants. At this stage they are not exclusive. Others may be suggested and have the criteria applied to them.

3.2 Ranking/scoring locations

Catchment criteria	1	2	3	4	5	6	7	8	9	10	11	12	13
33% montane forest	1	2	1+	-1	2	0	1	1	1	0	1	1	
Representative	1	1	1	1	1	1	1	0	1	1	1	1	
Max. 1000km^2	1	1	1	1	1	1	1	1	1	1	1	-1	
25% land-use change	1	1	1	1	1	1	1	1	1	0	1	1	
Diverse land-use change	1	1	1	1	1	1	1	1	1	1	1	1	
Good info	2	2+	2	2	2	0	1-	-1	1+	1	0	1+	
Downstream work?	2	2	2	2	2	2	0	1	1	0	1	1	
'Easy to follow' water flows	1	-1	-1	1	-1	-1	0	-1	-1	1	-1	-1	
Local demand	1+	2	2	2	1	2	1	2	1+	1	1	0	
Participation	2	2	2	2	2	2	2	2	1	1	1	0	
Local capacity	2	2	2	2	1	2	1	2	1	1	1	1	
Stability	1	1	1?	1	1	1	1	1	1	1	1	1	
Score/rank	**16**	**16**	**15**	**15**	**14**	**12**	**11**	**10**	**10**	**9**	**9**	**6**	
DfID interest	1	?	0	?	1	?	-1	0	1	1	?	1	

4. Other research considerations

Hydrological research needs to consider socio-economic issues and research teams will include relevant expertise. Analysis to characterise stakeholder populations (research users) should be a critical first step. It should identify: interests; needs/demands; capabilities; conflicts; livelihood assets.

4.1 General considerations

In identifying who the demands for information are from and on whom the focus of research should be, FRP's focus is on improving equity and livelihoods through efficient research. Considerations include:

- Likelihood of success: Are the 'pre-conditions of success' in place? These might include:
  - Few, organised groups of stakeholders
  - Settled tenure and conflict issues
  - Good negotiating platforms and communication routes
  - Adequate public awareness of the concerns/issues.
  - Readiness of land/water users to accept and implement changes
  - Enabling policy environment (supportive and capable government).
- Up *and* downstream issues: Focus on local groups only ignores wider concerns for down/upstream populations (e.g. flood-control). Research cannot simply focus on benefits to upstream land-users. (The challenges of linking hydrological research at the local level to water impact at the wider level is recognised).
- Livelihood dependency: What impacts will changes in land use or water quality/quantity have on people's livelihoods? Do they have alternative options?
- Marginalised people: Are the needs of marginalised groups (such as women, landless poor) taken into account?

4.2 Types of water-users

Water users come in various forms and at various levels (up/downstream) in the catchment. Research needs to prioritise them in terms of who will be most significantly affected by land-use change, and thus identify whom it is doing the research for. This will help define the research, the outputs and the communication of outputs.

Water users can include:

- Farmers – subsistence and large-scale (irrigation)
- Fisheries – local and industrial
- Foresters – plantations, woodlots, agroforestry, reserves
- Public – domestic consumption and sanitation, recreation
- Industry demands - small and large scale
- Municipal water suppliers

- Hydroelectric power providers– dams/reservoirs
- Mining companies

4.3 Relevant characteristics

Characteristics to consider when looking at populations of land- and water-users that will be affected by land-use change in a catchment include:

- ***Communication conditions***

Level of literacy, infrastructure (telephones, roads) and strength of links into wider professional or stakeholder networks will influence:

- *awareness of external issues* (such as downstream needs for water quality and flow, or upstream land management constraints). This influences e.g. the willingness to change land-use practices or to pay for the water resources.
- *access to information* – e.g. on new theories regarding land use and water linkages, management techniques, policies etc.
- ability to mobilise stakeholder groups and lobby for their interests (i.e. *gain power and influence*).

- ***Groupings of stakeholders.***

Interventions will be easier to manage if there are few clear groups of stakeholders. e.g. fishermen/farmer example.

'Preferred' populations (i.e. those with whom interventions have more chance of efficient success) are those who are well organised and have clear groups and/or are relatively homogenous – diversity of culture and or economic status will complicate things (though is more real…).

Groups may not include everyone – generally the poorest are not represented.

- **Financial security and livelihood dependence**

Markets and profit – can the populations supply and access markets? Can they make profits?

Risk – How far does this allow them to bear financial risk? This influences the ability/vulnerability to change land-use practices or pay for access to water.

Alternative options – do they have alternative ways of survival should changes be implemented? Are these better or worse than the status quo?

- **Water demands**

Type of water use – for livelihood (e.g.consumption, sanitation) or profit (irrigation, power generation)

Importance of what element of water change (e.g. flood risks drought/dry season flows, erosion, sedimentation, quality). Different land-uses have different effects on different elements of the water resoiurce – which element takes priority?

Balance of demand – some population/users may place much higher demands on the water resource than others.

- **Rate of population growth**

It is critical know if the main forest land user populations or water demanding populations are growing to predict changing pressures on the resources.

5. Summ-up

Further details about possible research locations will inform the final selection of research locations. The criteria and ranking process used here will be used in decision-making. It is likely that there will be a single main study site, linked to additional and less detailed, 'satellite studies'.

Research users will be identified according to the research locations. Socio-economic research will be an integral part of the hydrological research and efforts will be made to link this work into wider programmes of work on socio-economic issues in water catchment management..

Annexes

Information contributing to this report includes formal literature references (below), an FAO email consultation, and responses to the draft report. The latter includes documentation on specific sites and regions.

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Additional information

FAO Electronic Workshop - Land-Water Linkages in Rural Watersheds.

FAO website (Electronic Workshop case studies and background papers): www.fao.org/ag/agl/watershed/

International Food Policy Research Institute website: www.ifpri.org/themes/mp10.html

International Water Management Institute (SWIM programme) : website www.cgiar.org/iwmi/swim/SWIM

IUCN website: http://iucn.org/themes/wetlands/tmcf.html

Mountain Forum (electronic forum)

Notes from ARCOS - The Albertine Rift Conservation Society.

Notes from IUCN regional offices - Meso America, Africa.

Notes from UNEP-WCMC's TMCF Initiative - Country database (with thanks to P.Bubb)

Notes from WWF Regional Office - Central America.

UNEP-WCMC website: www.unep-wcmc.org/forest/cloud forest