FRP Meeting 18 December 2000

Water catchments – Issues and options for hydrological research.

Summary of key points

1. Introduction

Two workshops were held by FRP to help define its plans for funding research on water catchment issues especially in tropical montane cloud forest (TMCF) areas. One (18th December) focused on hydrological issues, a second (20th December) on socio-economic issues. In each meeting discussion was based on a draft report of issues and options for research.

Discussions in the hydrology workshop of 18th December focused on possible locations of research (refining criteria for selecting and ranking locations, and applying criteria to suggested locations), with some discussion of possible approaches to research. Discussion in the workshop has contributed to additions and changes to the draft pre-workshop report, which is attached. The workshop also highlighted some concerns about the research focus, which are addressed in question-and-answer format, also attached.

2. Criteria for selecting research locations

Significant changes were made to the criteria originally proposed in the draft report. Largely, these reflected the clarification of the main hydrological research issue to be addressed: Quantification of the relationship between changes in TMCF land-use and dry season flows. The main focus was on ensuring definitive, reliable results and making the site useful for extrapolating research results to different catchments.

Criteria decided upon then considered opportunities and constraints to doing good hydrological research.

Criteria for the main research sites (further details in attached report).
The order of listing of criteria does not represent priority. The aim is the best combination of criteria, without expectation that any one site will match all the criteria.

- Is the catchment 33% montane forest cover?
- Is the site representative?
- Is the catchment less than 1000km2?
- Is there evidence of land-use change over at least 25% of the original TMCF in the catchment?
- Is there a diversity of land use change (vs conversion to a single use)?
- Is good information (long term data sets for hydrology and land management) available?
- Is there ongoing work downstream to link into and support this proposed upstream research?
- Is water in the catchment 'easy to follow'? (i.e. are surface flows predominant vs groundwater flows? The latter may be difficult to quantify because of leakage through porous rock.)
- Is there a local demand, i.e. expression of interest in research?
- Is local participation in the research possible?
- Is there adequate local counterpart and institutional capacity at or in the region of the research sites?
- Is there a stable (and supportive) political environment?
- Is it in a DFID target country or region?

3. Shortlist of possible research locations

The shortlist of possible research locations given in the draft report was examined and updated. Some were removed before applying criteria, due to inappropriate political, informational or local capacity contexts. Other suggestions were added by participants.

It is emphasised that the shortlist produced in the workshop reflects information available on the day. It is by no means the 'final' selection, as further information is needed and welcomed on these and other possibilities. In addition, outcomes of the socio-economics workshop will also influence location selection.

Possible locations for the main hydrological research:

- Brazil - Atlantic Coast range
- Costa Rica - Monte Verde
- Colombia - Cauca Valley
- Sri Lanka - Mahaweli and the Horton Plains
- Guatemala - Sierra de las Minas
- El Salvador - El Imposible
- Venezuela - Merida
- Uganda/Kenya - Mount Elgon
- Cameroon - Mount Cameroon
- Tanzania - Udzungwa mountains
- Costa Rica - Talamanca range
- Honduras - La Tigra mountain
- Bolivia - Tarija dry valley

4. Research proposals

One proposal for research was made, with additional comments from other participants. The proposal was for a single main study site, linked to additional and less detailed, 'satellite studies'.

The main research site would use a nested sub-plot approach to gather and analyse hydrological data along a gradient from upper TMCF to lower slopes of the catchment and other forest and vegetation types, comparing catchments with different levels of land-use change. This approach would be able to quantify the contribution of more or less dispersed patches of TMCF and other fragmented forest types to streamflows. It would also link into land-use studies and socio-economic work.

The aim would be to quantify the relationships between forest areas and spatial dispositions with dry season base flows, to extrapolate for use in other sites/catchments, and produce a methodology for predicting cloud water deposition rates given certain information.

5. Socio-economic considerations

In this workshop, socio-economic considerations were only discussed in terms of broad approaches to research - the participants felt that this was best left for the second workshop. The need for collaboration between hydrologists and socio-

economists was strongly noted. It was emphasised that hydrologists did not expect to work alone, but would include socio-economists on their teams for any work done.

6. FRPs approach and next steps

FRPs hydrological work will:
- include multi-disciplinary teams to ensure socio-economic issues are included.
- look at the applicability of results beyond the TMCF as soon as possible.
- include an early and rigorous problem analysis.
- build on and use existing studies and networks to optimise information sharing.

Next steps include:
- Seeking confirmation from DFID/RLD that the arguments laid out in the question-and-answer document are acceptable.

- Requesting the DFID Lead adviser for FRP to stimulate indications of interest and commitment from at least the four countries already mentioned (Grenada, India, Indonesia, RSA).

- Improving the information available on possible research locations then ensure rationalisation of location selections.

- Commissioning at least the main hydrological research consortium, nominally under an IUCN umbrella with leadership from the Free University of Amsterdam. The main site for hydrological research will be confirmed and work will be in progress during this financial year.

- Devising the protocol for the hydrological studies in elevational transects that should extend the data coverage to non-TMCF vegetation types and locations away from the primary research site(s), and agreeing protocol with other stakeholders.

- Devising and agreeing the approaches and protocols for characterising the vegetation types, land uses and populations of upstream land and forest managers and downstream users and consumers of water services.

- Starting baseline socio-economic work (in addition to DFID's work) at the same time as hydrological research at those locations. This could include:
  - at least basic 'stakeholder analysis'
  - developing lessons about enabling and negotiating processes.
  - monitoring land-use changes and their driving forces.

- Ensuring that there is (and budgeting for) a conscious steering effort between the proposed and ongoing socio-economic activities.

IUCN
The World Conservation Union

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Comments from the IUCN Regional Office for Meso América on selection criteria:

1.1 Forest and watershed criteria

***Forest/land-use type*:** Is the catchment at least **25%** (significantly) cloud forest?
The figure of 25% is fine as long as we recognize that it will depend directly on the size of catchment considered. If a catchment is proposed of 100 km2 as below, then the percentage of cloud forest cover might have to be reduced. Cloud forests are only found in upper mountain slopes, and the further downstream you go, the smaller the area of cloud forest as a percentage of total surface area. A minimum requirement of 15% cloud cover would be more realistic, otherwise the criteria become so limiting that most sites are ruled out. That is unless the size of watershed is decreased.

Watershed size. Is the catchment **100km^2** or less?
We think this number might be a little on the large side. As long as the intention of this figure is to use it as a cut off number to eliminate large watersheds, then it makes sense. In any case we think it should reduce the size to say 75km2.

1.2 Relevant available information

Historical information: Does existing data reach back 20 years or more?
It will be difficult to find this kind of long term data in Central America.

***Alternative land-uses*:** Are the land-use changes/alternatives acceptable to local people?
What changes or alternatives are meant exactly? Acceptance of alternatives can probably only be determined after data has been collected and analyzed.

***Cause of impacts*:** Is forest land-use change the main cause of impacts on the water resource? Assuming that this is the main research question the project is trying to answer it should not be used as a selection criteria.

Surface/Ground water: Is surface water more important than groundwater?
We see a problem with this criteria because by default, cloud forests are usually higher up in the landscape. This means that one of their key roles in the hydrology of a site, is their capacity for water infiltration. In addition, the people who use drinking water from cloud forests, collect the water from natural springs. So if we do not consider groundwater, then you are not really addressing what is of most concern to people, which is drinking water. We understand the limitations in the studies of groundwater, but think it is one of the essential aspects that needs to be addressed: the role of cloud forests & land use in the hydrological cycle, which includes surface and subsurface water. Otherwise you are looking at water for other purposes such as irrigation and hydropower production, which are not so important for small rural communities and not as vital for human development.

1.3 Concerns

Downstrean demand: Does the catchment feed a downstream area of high/increasing demand or scarcity?

In some places water availability is not a problem but there can be scarcity of good-quality water due to pollution.

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Uganda – Mount Elgon

David Hinchley from the IUCN Forest Conservation Programme has worked for 4 years in Mount Elgon on the IUCN Mount Elgon Conservation and Development Project. Based on information from him the site compares in the following way to DFID's selection criteria:

2.1Forest and watershed criteria

Location: Uganda is a DFID partner country

Forest/Land-use type: Watershed contains at least 25% cloud forest[1] with high biodiversity.

Watershed size: Mt Elgon forms the headwaters of several catchments flowing into Uganda and Kenya. Most of the upper catchment on both sides of the border is in protected area (National Park and Forest Reserve). The National Park on the Ugandan side is 1145 sq km., split into a number of different, smaller catchment areas. The protected areas on the Kenyan side are smaller.

Scale of land-use change: Yes, % depends on location (sub-catchments). Land-use change inside the protected areas is a result of either encroachment or excision. Land-use outside the protected areas is primarily rural small holdings.

Representative: Representative for similar mountain sites in eastern Africa; Mount Kenya, Mount Kilimanjaro, Rwanda. Unusual in the sense that it is a National Park.

2.2 Relevant available information[2]

Existing Information: Good soil data (land system maps based on vegetation and soil surveys) on Ugandan side, and vegetation maps underway on the Kenyan side. Aerial photography available for both sides. Some rainfall data but could be unreliable (old data, from Colonial times) More reliable data could might be found on the Kenyan side.

Historical information: Data does not go back 20 years. Good maps (Uganda side)

Types of land-use: In the protected areas there is both undisturbed natural forest and some areas that have suffered from agricultural encroachment in the past (currently undergoing either natural regeneration and/or replanting programs). Incidences of encroachment continue to occur from time to time for various reasons.

Existing indicators: No locally established indicators of water quality and quantity. (what kind of indicators?)

Alternative land-uses: Are land-use changes/alternatives acceptable to local people? Will obviously depend on the proposed alternatives (there is unlikely to be any changes to the boundaries of the protected areas). Two IUCN projects are working on developing acceptable land-use systems around the protected areas and on developing collaborative management

[1] e.g. For Mt. Elgon National Park, Uganda
Howard (1991) recognised four broad vegetation communities:

- mixed montane forest, up to an elevation of 2500 metres and comprising 48% of the total park area;
- bamboo and low canopy montane forest, from 2400 - 3000 metres and comprising 21 % of the park area;
- high montane heath, from 3000 to 3500 metres and comprising 7% of the park area;
- moorland, above 3500 metres and comprising 24% of the park area.

[2] More information is available, for example in the draft management plan for Mt. Elgon National Park and information held by the projects working on Mt Elgon.

arrangements between the protected area management authorities and local people (Uganda: IUCN Mount Elgon Conservation and Development Project and Kenya: IUCN Mount Elgon Integrated Conservation and Development Project. These two projects may be combined as atrans-boundary ecosystem project as of 2002 if funding is obtained)

Cause of impacts: Is forest land-use change the main cause of impacts on the water resources? Rainfall will be much more important.
Surface/Ground water: Surface water is more important than groundwater.

1.3 Concerns
Local concerns: Water availability in the watershed is generally not a problem (Ugandan side), since rainfall is usually reliable (two wet seasons per year). It can be a problem for populations only 30 km away from Mount Elgon as lack of adequate water storage and transportation infrastructure causes localised shortage of water availability in dry periods (and crops fail).
Downstream demand: Kenya hydropower systems.
Attributed disasters: Is upstream deforestation being identified as the cause of downstream disasters (flooding)?. Upstream deforestation is clearly identified as the cause for numerous landslips in wet years on steep hill slopes on farming land around the protected areas.

1.4 Socio-economic context
Land tenure: Are land tenure settled in the area? Yes. However, some people are being moved out of the National Park after having illegally moved into restricted area. Some unresolved resettlement issues in the "Benet" area, an area of land that was excised from the Park for resettling forest dwelling communities in the 1980's.
Enabling environment: Is there supportive and capable government for interventions? Capacity and support exists from; Uganda Wildlife Authority, and the District Natural Resources Departments (Agriculture, Forestry, Veterinary services, Environment Department) and the Kenya Wildlife Service, Kenya Forestry dep. However, resources for interventions are lacking. Corruption can be a significant problem, especially on the Kenyan side.
Organised groups: Are there already organised groups of land/water users? Municipal councils of towns around the mountain (water supply systems), local environmental committees, collaborative management groups, producer groups (e.g. beekeepers).
Are there conflicts between any of these groups? Not significant.
Do organised groups include all stakeholders? Most of them. However, there will always be people that are not part of one of the organised groups.
Scale of Effect. Size of populations. How many people will the land use change affect in total? Around 100,000+ people will directly be affected by land-use changes, since they live on the border of the forested National Park. 1 million people live in the larger catchment (Uganda) less than a million in larger catchment area (Kenya).

Comments:
- Research could focus on the possibilities for small river hydro-power installations. Micro-hydro projects could significantly reduce the need for fuelwood, which is a significant pressure on the forest resources of the protected areas.
- Research could also concentrate on agricultural practices, especially with regard to water management. (reducing water demand).
- Downstream-upstream compensation mechanisms would be a useful addition but will not be sufficient alone to constitute a viable alternative to deforestation or over-use of forest resources. Research should build on the combination of approaches being implemented by the management authorities and the supporting projects already working on Mt Elgon (collaborative management approaches, improved agricultural systems, added value to NTFP, environmental education, law enforcement etc.)

David Hinchley, IUCN Forest Conservation Programme – 14 December 2000

FRP water catchment workshop – 18 December 2000

Guatemala – Sierra de las Minas
IUCN member 'Defensores de la Naturaleza' are managing Sierra de las Minas Biosphere Reserve. Based on information from IUCN Regional Office for Mesoamérica this site ranks very high with regard to DFID's selection criteria. Unfortunately, this summary is incomplete because original information is in Spanish and I ran out of time translating it…

Guatemala
Sierra de las Minas Biosphere Reserve ; Guatemala's biggest single water resource. Largest unbroken extension of cloud forest in Guatemala. Contains an estimated 60 percent of Guatemala's remaining cloud forest habitat. Sierra de las Minas plays a crucial role in providing fresh, clean water to the many farms and villages in the valley below. More than 63 permanent rivers drain the reserve, making it the country's biggest single water resource. This is especially significant because the area southeast of the Sierra – the Motagua Valley – is a rain-shadow desert heavily dependent on irrigation. The dense forests in the northern part of the reserve and on mountain summits naturally filter rainwater, prevent topsoil erosion, and inhibit river siltation.

There have been various research projects carried out at the site. For instance, in 1996 there was a study done on "a valuation analysis of the role of cloud forests in watershed protection." (Jones and and Hato watersheds). This means there is an existing database of the site that can be used to build on. Numerous indigenous communities use this forest to gather non-timber forest products. It also provides their water. Downstream agriculture depend this reserve for irrigation. Extensive management data is available from Defensores de la Naturaleza, an IUCN member organisation.

2.1Forest and watershed criteria
Location: Guatemala is a DFID partner country.
Forest/Land-use type: Sierra de las Minas covers an area of approx. 236,300 ha, measuring 130km in length and 10-20 km in width. Watershed contains at least 25% cloud forest[1] with very high biodiversity. It is estimated that this Reserve includes 70% of the species found in Guatemala.
Watershed size: Sierra de las Minas has 52 *s*maller catchment areas.
Scale of land-use change: % depends on location (sub-catchments). Land-use change mostly due to advancing agricultural frontier.
Representative: Yes, e.g. Cusuco National Park, (Honduras); Sierra de Manantlán (Mexico).

[1] Sierra de las Minas, Guatemala
5 life zones according to Holdridge's life zone classification system:

1. Bosque seco premontano;
2. Bosque humedo montano bajo;
3. Bosque muy humedo montano bajo;
4. Bosque pluvial montano bajo;
5. Bosque muy humedo premontano;

According to Holdridge TMCF occurs only in zones 3 and 4 (Subtropical lower montane rain forest and Subtropical lower montane wet forest.

2.2 Relevant available information[2]
Existing Information: Defensores de la Naturaleza established an information centre, including ecological (forest cover, life zones), socio-economic (population, infrastructure, roads), legal (demarcation, private properties), physiological data (watersheds, topography). River gauging stations on six rivers exist, managed by government.
Historical information: Data does not go back 20 years. First Masterplan developed by Defensores de la Natualeza for management of Reserve was approved in 1992.
Types of land-use: The reserve is divided into four management zones: the core zone, the sustainable use zone, the buffer zone and the recuperation zone.
Alternative land-uses: Are land-use changes/alternatives acceptable to local people? Will obviously depend on the proposed alternatives. Pressures on the park: timber extraction, unsustainable extraction of non-timber forest products. Underlying causes: demographic pressure, poverty, high unemployment, unequal access to land, lack of infrastructure, lack of technology, inadequate legal framework.

Downstream demand: Sierra provides water for irrigation, domestic supply, industry, small-scale agro-industry and hydropower generation. Small farmers and numerous large commercial farms depend on this water for irrigation (corn, beans, coffee, sugar cane, melon, tobacco, cardamon, grapes, melon). Communities, agriculture and agro-industry in the arid Motagua and the San Jeronimo valleys depend heavily on water from the Reserve. In total, 37 industries are located in the Motagua valley. There is a number of local communities and farms with small hydro-power installations. Medium sized hydro-power system in Rio Hondo contributes to national energy supply. Additional hydro-power projects are being developed. In the Motagua valley, water use is unregulated. None of the companies are taking any measures to protect future water resources, despite the fact that their profits depend on this water supply.

1.3 Socio-economic context
Land tenure: Are land tenure settled in the area? It is estimated that 45% of the Reserve is public land, 50% private land and 5% municipal land.
Enabling environment: Is there supportive and capable government for interventions? Capacity and support exists. E.g. Instituto Nacional de Bosques (INAB). Municipalities collaborate with INAB.
How many people will the land use change affect in total?
140 communities within the Reserve. 110 communities outside. (info unclear). Ethnic goups: Q'eqchi (Maya are the principal group on the northern side, the Poqonchi (Maya) on the western side and the Ladinos (partial Spanish origin) on the southern side. Population is growing rapidly.

List of participants (status 15 Dec 2000) for the 2 workshops on

18th December:

1. Dr Bergkamp, Ger (IUCN, Gland, Switzerland)
2. Dr Brown, Don (ITAD, for DFID Engineering Knowledge and Research
3. Programme)
4. Dr Bruijnzeel, Sampurno (Free University of Amsterdam)
5. Dr Bubb, Philip (UNEP-WCMC, Cambridge)
6. Prof Calder, Ian (CLUWRR, Newcastle Univ.)
7. Ms Porras, Ina (IIED, London)
8. Dr Price, Martin (Perth College)
9. Dr Roberts, John (CEH/Institute of Hydrology, Wallingford)
10. Ms Steward, Helen (for Mott MacDonald, Cambridge)
11. Mr Topping, C. (same as Helen Steward)
12. Mr Toyne, Paul (WWF UK)

12. John Palmer (FRP)
13. Duncan Macqueen (FRP)
14. Ms Kirsti Thornber (LTSI, Penicuik).

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20th December:

1. Arnold, Mike (for FRP Programme Advisory Commitee/PAC)
2. Bishop, Josh (IIED)
3. Bubb, Philip (WCMC)
4. Landell-Mills, Natasha (IIED)
5. Mayers, James (IIED)
6. Porras, Ina (IIED)
7. Richards, Michael (Overseas Development Institute/ODI, London)
8. Smart, Malcolm (DFID)
9. Toyne, Paul (WWF)
10. Vermeulen, Sonja (IIED)

11. John Palmer
12. Duncan Macqueen
13. Kirsti Thornber
14. Stefanie Halfmann