KHASI HILLS FOREST-WATER CAPACITY BUILDING 5-DAY WORKSHOP

Shillong, Meghalaya, Northeast India, 10th – 15th April 2017

WORKSHOP REPORT

WeForest
Making Earth Cooler

Food and Agriculture Organization of the United Nations

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1. EXECUTIVE SUMMARY

WeForest, in collaboration with FAO's Forest and Water Programme and the Ka Synjuk Ki Hima Arliang Wah Umiam Mawphlang Welfare Society (i.e. the Federation), organised a Forest-Water Capacity Building workshop. The workshop was held at the ICSSR North-Eastern Hill University (NEHU) Campus in Shillong, in Meghalaya, India.

In response to community concerns about increasing water scarcity and spring contamination, the workshop was organised to develop the local capacity of the the Federation on forest-water interactions for improved decision-making and natural resource management of the East Khasi Hills' forest restoration project. The workshop was held over 5 days and attended by 15-18 individuals representing the project's technical and community team, government forestry officers and university staff.

As a result of the training, the Federation identified and operationalised forest-water priorities for the East Khasi Hills. The following are outputs resulting from the workshop:

- The Federation agreed and adopted achievable development objectives for the integration of a forest-water agenda in the East Khasi Hills (refer to Annexe 6 for the logical framework). The Federation's main goal will be to increase water availability during the dry season by using forest restoration methods that improve top-soil infiltration, and consequently, groundwater recharge.
- Rainfall, top-soil infiltration and streamflow data are to be collected to monitor progress and establish impact. While a monitoring plan for the first two variables is being finalised, the recording of streamflow data will require further consideration and resources.
- Four permanent rainfall gauges were installed along a northeast to southwest geographical axis transecting the project area (refer to Annexe 7 for the location of rainfall stations).
- Recording sheets for rainfall and top-soil infiltration (refer to Annexes 3 and Annexe 4).
- A protocol for rainfall data collection has been produced (refer to Annexe 5).
- A draft version of a project site selection tool has been developed (refer to Annexe 8).
- Several recommendations have been made to adapt/modify project elements based on information emerging from workshop discussions and field trip (see Section 6 of this document).

Takeaways and next steps:

The workshop received a very positive response and high appreciation from its participants. There was general consensus that it increased cohesion among stakeholders as it highlighted the importance of multi-stakeholder exchange in encouraging understanding of the challenges faced by the different parties. For example, it gave government officers a closer insight into the reality of community forestry.

The new agenda will inform project management and restoration practices. It may be used to implement forest restoration priorities where water availability is a major issue as well as facilitate the integration of applied forest-water research to address areas of interest in greater depth. A follow-up of the workshop is planned for 2018 pending funding.

To conclude, the workshop was effective, ending with the preparation of a monitoring plan and follow-up activities. The lessons learned from this workshop contribute to the collaboration between WeForest and FAO, informing FAO's Forest-water Monitoring Framework and the Forests and Water five-year action plan, as well as supporting Weforest's work on the forest-water-climate nexus.

2. INTRODUCTION

2.1. Workshop objectives

The overall objective of the workshop was to build the capacity of the Khasi Hills forest landscape restoration project on forest-water interactions for improved decision-making and natural resource management. The workshop sought to facilitate the integration of forest-water issues into the project's logical framework.

More specifically, the aim of the workshop was threefold:

1. To develop the understanding of forest-water interactions (quantity and quality)
2. To develop a forest-water monitoring plan that can work for the local context
3. To build the technical capacity of the team through practical demonstrations and exercises

The workshop was delivered through interactive lectures, individual and group work, plenary discussions, practical demonstrations, and a full-day field excursion. Three experts facilitated the delivery: Dr Victoria Gutierrez, Chief Science Officer at WeForest (United Kingdom); Elaine Springgay, Forestry Officer, Forest and Water Programme, FAO (Italy); Dr Chandra Prasad Ghimire, Dep. Water Resources, ITC University of Twente (The Netherlands).

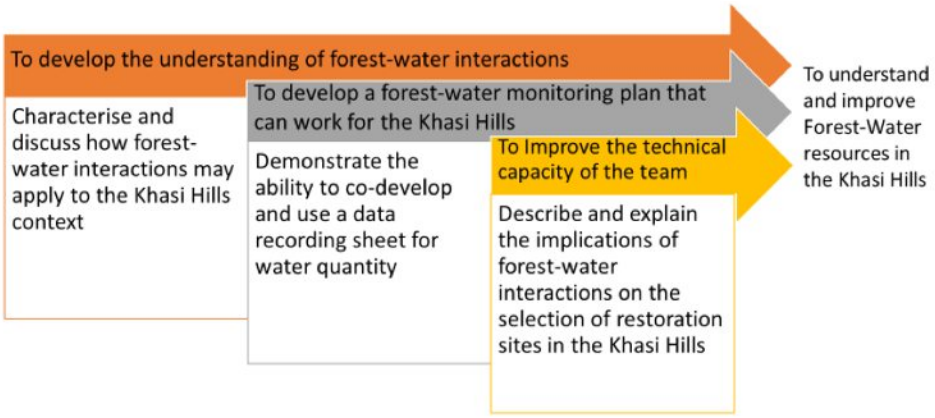

Figure 1. The aims and corresponding learning outcomes of the capacity building workshop. With these, the workshop sought to support the local community in developing their understanding of forest-water resources in the East Khasi Hills.

2.2. Workshop learning outcomes and performance criteria

At the end of the workshop participants were expected to:

- Characterise and discuss how forest-water interactions apply to the East Khasi Hills context
- Demonstrate the ability to co-develop and use a data recording sheet for water quantity
- Describe and explain the implications of forest-water interactions on the selection of restoration sites in the Khasi Hills

As a basis to gather information on the progress made by the participants, performance criteria[1] were used. Information pertaining progress was obtained through a before-after survey in-class, through group work that generated discussions, presentations and draft recording sheets resulting from group work.

[1]The specific characteristics participants should be able to demonstrate in order to achieve the learning outcomes.

Workshop's performance criteria:

- Participants will demonstrate additional knowledge related to forest-water interactions, as demonstrated by a before/after short question exercise
- Participants will produce a basic data recording sheet for water quantity
- Participants will demonstrate an appreciation of issues that matter for water availability when selecting restoration sites

Figure 2. Group work (top left and right), presentations of group work (bottom left) and draft recording sheets produced by groups (bottom right).

Figure 3. Workshop participants.

2.3. Workshop organisation and participation

The workshop was organised by WeForest, in close collaboration with FAO, and held at the North-Eastern Hill University's facilities. Funding was made available by WeForest and FAO. ITC University of Twente donated four water gauges.

Throughout the week, 15 to 18 people participated in the workshop. These included the Federation's technical team, the project's community facilitators, members of the lower working committee, forestry officers from the government department, a social scientist and NEHU university staff. Refer to workshop participation list in Annexe 2.

3. WORKSHOP PROGRAMME

The agenda was structured to progressively introduce forest-water concepts, monitoring methods and their implications for the Khasi Hills. To launch the event, a welcome and opening session with invited speakers was followed by the traditional 'high tea'. While the programme addressed both forest-water quantity and quality, increasing water scarcity was of wider concern. Accordingly, most of the sessions and field trip centred on water availability (see Annexe 1 for programme sessions and topics). We address water availability briefly in Section 3.2. The field trip took place on the fourth day. The programme for the workshop is enclosed in Annexe 1.

3.1. Official opening of the workshop

Bah Tambor Lyngdoh, the Federation's project manager, formally opened the workshop. In his remarks, he observed the need for capacity building and learning from practice. In this opening session, three guest speakers were invited to give a short speech.

- Professor B.K.Tiwari, Former Head of the Department of Environmental Studies, NEHU. Prof. Tiwari highlighted his interest and work in forest hydrology, noting NEHU's involvement in studying forest-water budgets in Meghalaya's micro-watersheds and the potential for formal collaboration with the project.
- Dr C.P Marak, (IFS) Chairman of Meghalaya State Pollution Control Board, an agency of the Indian Forest Department responsible for enforcing and framing environmental law, the prevention and control of pollution affecting water, air and the environment. Dr Marak referred to the extent of water contamination in Meghalaya and the agency's commitment to monthly monitoring (analyses of samples of water, waste water, stack emission, ambient air, bacteriological tests etc.).
- Dr Subhash Ashutosh, (IFS) Additional PCCF, State Forest and Chairman of the Climate Change Division and Training of the Indian Forest Service. His department is the development agency tasked with integrating regional information on livelihood development linked to natural resource management, with water being one of the major resources considered.

3.2. Water quality

In April 2016, water quality became a concern in the East Khasi Hills' restoration project when analyses of drinking water taken from eight collection points revealed that drinking water supplies in the project area were contaminated. All water samples were contaminated with E. coli and identified as unfit for human consumption by the central laboratory of Meghalaya's Pollution Control Board. In five springs, the presence of coliform in 100 ml of water exceeded 160 MPN.

Therefore, the workshop addressed the topic of forest and water quality, dedicated a session on sources of water contaminants, and included a visit to contaminated sites (Mawphlang) to examine likely sources of biological contamination. See Section 5.4 on conclusions and recommendations.

Figure 4. Example of one of 28 water spring constructions that were financed and developed by the project in 2015-16 under the community micro-project scheme. Samples of water are annually analysed.

3.3. Field trip

A full-day field trip was organised to put knowledge into practice and develop data collection skills. In addition, its purpose was to install four permanent rainfall gauges on a northeast to southwest geographical axis, to visit forest restoration sites, and to examine water collection points found to be contaminated. The group was joined by Professor Tiwari and Mr Basal, former ADG Forests (MoEF). Mr Basal is involved in the development of a large-scale community forestry programme in Meghalaya[2].

Figure 5. Learning to use the double ring infiltrometer (left) and practicing rainfall data recording (right).

4. WORKSHOP OUTPUTS

The workshop produced the following outputs:

- Recording sheets for rainfall and top soil infiltration data collection. See Annexe 3 and Annexe 4 for rainfall and double ring infiltration recording sheets, respectively.
- A protocol to guide rainfall data collection (see Annexe 5).
- A logical framework for integrating forest-water availability in the project management and monitoring plan. Refer to Annexe 6. The Federation agreed that their main priority is to increase water availability during the dry season by applying their forest-water understanding to the project.
- Installation of 4 rain gauges in a north-east to south-west axis across the project area. Refer to Annexe 7 for the location of rainfall gauges.
- Preliminary restoration site selection tool (see Annexe 8) to facilitate the process of applying the selection criteria and to identify sites with greater potential to increase water availability.

Figure 6. Rain gauge installed in Nongwah village. A youth volunteer, Bastilang, who lives a few meters away, will be in charge of recording rainfall daily.

[2]A 10-year community forestry programme financed by JICA is envisaged to impact 50,000 hectares in Meghalaya. The programme may start as early as 2018. Collaboration between projects will be important to optimise impact.

5. CHALLENGES, RECOMMENDED STRATEGIES AND NEXT STEPS

This section focuses on the challenges identified during discussions, group work and direct field observations. Below we note the recommendations presented to and agreed with participants on the last day of the workshop. These strategies are intended to help guide the Federation's work as well as to propose actions that help address challenges, and ultimately, meet the project's objectives. However, WeForest and the Federation will review progress to ensure that the forest-water monitoring plan is adapted as necessary.

5.1. Lack of human resources to collect impact data

While all methodology was set up to measure forest-water outcomes (i.e. top-soil infiltration), there is still a need to identify the best indicator for forest-water impact on dry-season water flow. The main constraint identified is the lack of human resource/capacity in the technical team.

Strategy to address 5.1:

There are several options to explore for recording streamflow data without adding additional pressure on the team's workload. WeForest and researchers at the Swedish University of Agricultural Sciences (SLU) are discussing the possibility to send postgraduate students to India to help collect data while completing their dissertations. Similarly, Prof Tiwari at NEHU will look at the possibility of allocating postgraduate students to this task. Moreover, WeForest, in collaboration with its scientific network intends to apply for research grants in 2017 to study the long-term impact of forest restoration on water availability in greater depth.

5.2 Mapping resources are lacking

The East Khasi Hills' project lacks suitable maps (topography and soil, local agency monitoring stations, hima/dorbar boundaries, polygons, etc.) that support planning processes such as scaling-up and development. Similarly, it has little information on the strategies and short-term objectives of external agencies (e.g. dam planning and construction in the region). Maps are said to be available within different departments or agencies, but not readily accessible or shared across stakeholders.

Strategy to address 5.2:

The project needs to maintain a network of local, regional and international relationships that can assist with vital resources such as updated local maps. WeForest sees collaboration as essential to make progress, and will, therefore, remain in contact with key actors. Similarly, we recommend the Federation uses its contacts to collaborate in ways that generate evidence that can be shared to support multiple agendas. For example, during the workshop, we learned that a large-scale community forestry JICA funded project[3] will start in 2018, with strong synergies with the Khasi Hills project. Likewise, the state of Meghalaya is planning the construction of new dams which may have important implications for the project. Local agencies are clearly interested in any data that the project generates since it can inform wider interventions (e.g. JICA programme).

[3]While in the field, a visit by Arun Kumar Bansal, former ADG Forests at the Ministry of Environment, Forests & Climate Change, informed us about current plans to invest 6,000 million rupees over 10 years to restore 50,000 hectares of community forest in Meghalaya. The project will be funded by JICA, and while still being worked out, it is likely to start in 2018. We are now in touch with Mr Bansal to exchange information on project progress and future planning.

5.3 Restoration site selection criteria not being applied

The selection of sites for forest restoration is not being conducted in accordance with relevant restoration criteria but left to the choice of dorbars, who are not trained to select sites for restoration purposes. This has led to the selection of some sites that are unsuitable for forest restoration (ANR and enrichment planting) and consequently, unlikely to produce positive restoration outcomes. Accordingly, this has implications for the selection of sites that matter for water.

Strategy to tackle 5.3:

Dobars, community governing bodies, must be informed about the consequences of the current site selection process and why site selection is important to optimise resources (restore as much degraded forest as possible) and outcomes (minimise failure/ensure that forest restoration is successful). We recommend dobars submit 2-3 site options to the Federation, who should make the decision regarding which site to select based on suitability and likelihood of restoration success. If sites submitted by the dorbars are not suitable, these should not be restored. Dorbars who understand the requirements for sound forest landscape restoration are more likely to select the right sites. Hence, we strongly recommend this aspect is given sufficient attention.

We recommend that the Federation reviews all 2016 polygons that have not yet been restored and applies the restoration criteria systematically to all sites to be selected in 2017. On an annual basis, WeForest requests that the Federation submits a rationale for the selection of sites, which should be approved by the management team prior any work on the site. To this end, we recommend using the site selection tool (see Annexe 8) as it documents the criteria for site selection and provides an overall site score.

5.4. Water contamination

Discussions held with workshop participants, field visits to contaminated water springs and observation of the local sewage system, all indicated that water contamination is likely caused by untreated sewage leakage and discharge to water bodies.

Strategy to address 5.4:

The lack of household sewage treatment and consequent water contamination is a problem of infrastructure and urban development, and therefore, beyond the scope of the project supported by WeForest. We recommend the Federation raises the matter with the relevant local agencies responsible for urban development and planning as well as with the Meghalaya Pollution Control Board (under Section 17 of the Water Act, the Pollution Control Board has been mandated to address sewage disposal to prevent water contamination).

Figure 7. Septic tank being built next to a house in Phaniewlah. Walls are left permeable, which is likely to be the main agent of water contamination.

5.5 Next steps

In addition to the strategies that address the specific challenges described above, the following actions have been agreed:

- The Federation will integrate the forest-water logical framework and monitoring plan into the project's management plan/handbook. Accordingly, it must update and adopt current project protocols, ensure systematic data entry and maintain the technical capacity of staff.
- To complete the installation of the rain stations, the Federation will fence the rain gauges for protection. Rainfall data collection will start right away.
- In selecting new sites for forest restoration, the Federation will work with communities to ensure there is a robust rationale for each intervention site. To this end, the technical team will systematically rate all new sites proposed by the dobars (village councils) by applying the site selection tool (see Annexe 8). This process ensures that only the best sites available are carefully chosen for restoration purposes, including those related to water availability. As the selection tool will be tested for the first time, it may require some adjustments.
- Further to the previous point, the Federation must review current site selection practices and the lack of awareness on the part of the dorbar users.
- To mobilise the regional network to gain/secure access to maps or layers of data that will inform the development of a solid map of the project's landscape: the hima boundaries, the local geology and micro watersheds, the regional water monitoring stations and governments' forest reforestation plan.
- In addition, the technical forestry team will gather information about the land use history of all restoration polygons in the 10 himas (i.e. what land use/ during what length of time), which should be added as a layer to the overall project map. For this purpose, the team may need to interview people who can reliably describe past land use as far in time as possible.
- WeForest will provide double ring infiltrometres for data collection (may build locally or purchase).
- To record the longer-term impact of the project on dry season water availability, Dr Chandra Ghimire will identify micro watershed sites for measuring water flows in the dry season (pending accurate maps of micro watersheds).
- The technical forestry team is to begin top soil data recording in before the heavy rains. We estimate this should take 4 to 5 days for 2 people.

6. WORKSHOP EVALUATION

To evaluate the workshop, a short pre-and-post survey and daily feedback were used. The surveys were conducted to learn about participants' understanding of forest-water interactions at the start of the workshop, participants' potential concerns, to review progress made during the week and to capture their sense of achievement at the end of the training.

The daily feedback was verbal and in written form (e.g. participants were encouraged to post questions on a query board available throughout the week). Sessions in the morning opened with a review of what each individual present had learned the previous day. The interactive format of the delivery and group discussions facilitated an open exchange of views and expectations about the workshop. Feedback was reviewed each day to guide and adapt the course content and methodology for subsequent work.

Participants claimed to be a very confident group, with 94% declaring they were confident or very confident talking to others about forest-water interactions at the start of the workshop. This high level of confidence was not necessarily evident (perhaps for cultural reasons), the participants proved to learn and verbalize an understanding of concepts quickly. Accordingly, although participants' confidence in the subject had increased in the post-survey, no statistical differences in confidence were found before and after the workshop (n.s.).

> *"The workshop was a knowledgeable one; I learnt about the forest-water relations, how to monitor and how important are forests not only to humans and wildlife but to water as well, which ultimately is the basic need of humans"*
>
> A participant.

The participants evaluated the workshop highly (i.e. 89% of respondents were pleased or very pleased). They valued the practical demonstrations, the group work and discussions and the opportunity to gain new knowledge. The approach was inclusive, allowing them to learn about other stakeholders' views. Facilitators were considered knowledgeable and accessible. Participants found the sessions rich in content and appreciated the applied nature of the sessions. Recommendations were few but included the suggestion of enlisting a translator to support the communication of those who feel shy to speak English and to organise more capacity building workshops in the future. Refer to Annexe 9 for surveys and question by question analysis.

The learning outcomes were met in that participants learned to characterise and discuss how forest-water interactions apply to the Khasi Hills context, demonstrated the ability to co-develop a data sheet for recording observations of top-soil water infiltration, and could give explanations of the implications of forest-water interactions on the selection of restoration sites in the Khasi Hills.

> *"I have learned about rain, evapotranspiration, infiltration measurement and water storage"*
>
> *"Interdependence of forest-water"*
>
> *"In this workshop I learned so many things, example, measuring rainfall"*
>
> *"In this workshop I have learned a lot about how to restore the degraded forest through discussion and training through scientific method"*
>
> Example answers to the question "What have you learned during this workshop?"

ANNEXE 1. WORKSHOP PROGRAMME

Khasi Hills Forest-Water Capacity Building 5-Day Workshop, Shillong 10th – 15th April 2017.

Day 1 (April 10):

8:30 Introduction to 5-day workshop and Khasi Hill Project (TL)

9:00 Opening session. Key speakers: Professor B.K.Tiwari (Former Head of Department Environmental Studies, NEHU); Dr C.P Marak, (IFS) Chairman Meghalaya State Pollution Control Board; Dr Subhash Ashutosh, (IFS) Additional PCCF, State Forest and Chairman Climate Change Division and Training Q&A:15 min

10:00 Tea break

10:30 Introduction to workshop structure and plan (VG)

10:40: Forest and Water issues in the Khasi Hills: pre-workshop survey and group discussion (VG)

11:40 Introduction to Forests and Water relationship (CG)

13:00 Lunch

14:00 Introduction to Forest and Water monitoring and evaluation (ES)

15:45 Tea break

16:00: Preparing a recording sheet for data collection (VG) The day will end at 17:00

Day 2 (April 11):

8:30: Welcome and introduction to the plan for the day (ES)

8:45: Introduction to Forest hydrological cycle (CG)

10:30: Tea break

10:45: Forest and Water Indicators (ES/CG)

12:00 Flying rivers video (25m), General discussion

13:00: Lunch break

14:00 Restoration site selection: taking stock (VG)

15:45: Tea break

16:00 The hydrological and soil impacts of (de-) forestation (CG)

The day will end at 17:00

Day 3 (April 12):

8:30: Welcome and introduction to the plan for the day (VG)

8:45: The hydrological and soil impacts of (de-) forestation (CG)

10:30: Tea break

10:45: Introduction to tropical montane cloud forest + video discussion (CG)

13:00: Lunch break

14:15: Water contamination in the Khasi Hills -what causes and solutions? (CG)

15:45 coffee break

16:00: Field day preparation

The day will end at 17:00

Day 4 (April 13):

7:00 -16:00 Field trip to contaminated site/s; degraded sites/restoration sites; cloud forest area

(April 14th Good Friday)

Day 5 (April 15):

9:00: Welcome and introduction to the plan for the day (VG)

9:15 Finalising the data recording sheet, group presentation and discussion (VG)

10:45 Tea break

11:00 Post-workshop survey and Group discussion (VG)

12:00 What next for the Khasi Hills? Group discussion (TL)

13:00 Lunch

14:00 Infiltration training for Tech team

WORKSHOP ENDS

ANNEXE 2. WORKSHOP PARTICIPANT LIST

	Names	Position
1	Shanskhem Passah	Forest Department
2	Ibadasuk S.L.Mawphlang	Range forest officer, Forest Department
3	Tambor Lyngdoh	CCF
4	Felix Pde	Technical Consultant
5	Meban Marbaniang	Forestry Field Assistant
6	Ebansara Shullai	State Pollution Control Board
7	Bijoy Lyngdoh	Assist. Conservator, Forest Dept.
8	Beautiful Lyngdoh	Field Reporting officer
9	Wilfringson Umdor	Community Facilitator
10	Lewis Nongbri	Community Facilitator
11	Aiborson Umdor	Community Facilitator
12	David Khasain	Community Facilitator
13	Fairbornwell Lyngdoh	Community Facilitator
14	Shailang Synrem	Community Facilitator
15	Batskhem kupor Symen	Youth volunteer
16	Esterlyne Kuanjana	Socio-economic specialist
17	Pankaj Barman	Project coordinator
18	Alanchestar Kharbhia	Community Facilitator
19	Betsing Rejujal	Lower working committee
20	Anindita Nayali	Researcher
21	Dr Subhash Ashutosh	State Forest and Chairman Climate Change Division and Training
22	Professor B.K. Tiwari	Former Head of Department Environmental Studies
23	Dr C.P Marak	Chairman Meghalaya State Pollution Control Board

ANNEXE 3. RAINFALL RECORDING SHEET

Rainfall recording sheet

Year

Kept by: Village:

Time of observation:

Month

Record every day at 9 am. At the end of the week, submit weekly data to the office.

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Submitted
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ANNEXE 4. DOUBLE RING INFILTRATION RECORDING SHEET

Double Ring Infiltration Recording Sheet

Measurement code:		Date:		Time:	
Location: area/site/transect				Head (cm):	
Collected by:		Time start saturation: (hr:min:sec)			
GPS:					
Notes/ comments:					
Ob. Nr.	Volume [l]	ΔV[l]	Time (hr:min:sec)	Time[s]	ΔT[s]
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ANNEXE 5. RAINFALL DATA COLLECTION PROTOCOL

The rain gauge

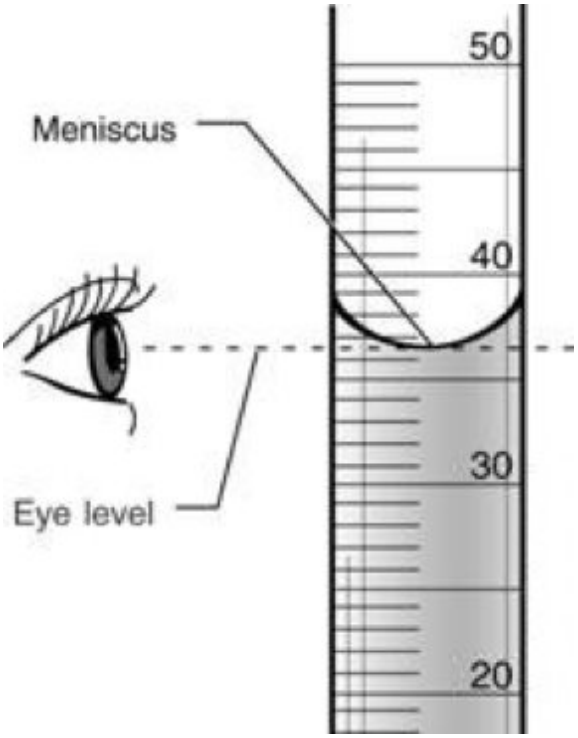
The rain gauge is composed of three parts: a funnel (pictured in green), an inner measuring tube marked in 0.5mm graduations and a capacity of 25mm, a diameter overflow tube, and a mounting bracket. The gauge has an overall capacity of 225mm. The funnel directs the rainfall into the measuring tube, which when full will overflow into the overflow tube.

All water found in the rain gauge is to be treated as rain, even if it comes from melted hail or mist.

How to take measurements

To minimise measurement errors, it is important to follow these steps:

Remove the catchment funnel and lift out the internal measuring tube. Hold the measuring tube or funnel vertically at eye level and read off your measurements. Be aware of the curved surface (called meniscus) and always read the base of the curved line (dotted line in Figure to the right). When there is water in the overflow tube, the inner measuring tube should be read and the reading noted. The contents should then be emptied and the tube filled again as often as necessary, entering the reading each time. The individual amounts should be added together to get the total measurement for the day. For example, .48 + .47 +.23 = 1.18.



If the gauge contains less than half of the minimum graduation (measurement line), record as T (trace), while if there is less than 0.1 but more than half that amount, record as 0.1. T (trace) should also be recorded when the observer knows definitely from his/her own observation that some rain has fallen since the previous recording and yet finds no water in the gauge. This can happen when small amounts of rain evaporate.

The rainfall amount should be read every day at the same time, 9 am, and the information marked down on the rainfall recording sheet (see Annexe 3). Measurements are recorded in mm.

At the end of the week, data should be sent to the office where it will be entered on electronic records. At the end of the month, the rainfall recording sheet should be sent to the office for verification and record keeping.

After reading off the rainfall amount empty the measuring tube. Replace the catchment funnel or measuring tube onto your rain gauge. Check the rain gauge daily to ensure the funnel remains clear and uncluttered.

How to mount the Rain Gauge

Choose a position in an open area such as a lawn, keeping well away from fences, buildings and trees which can prevent rain from reaching the catchment funnel of the rain gauge. As a guide, the gauge should be no closer to tall objects than twice the height of that object. i.e. if the tree height is 3m, the rain gauge should be placed at about 6m. It should be placed on level ground. Slopes, terraces must be avoided. Make sure to use a suitable post for mounting any of the rain gauges (e.g. steel tube or bamboo stick). The rain gauge should be mounted on a bracket or other suitable device and fixed using a level. It should be firmly fixed with the rim of the funnel exactly level.

ANNEXE 6. LOGICAL FRAMEWORK

Overall Project Development Objective	To support the indigenous Khasi communities to engage in the restoration and management of degraded forests, with the view to combating climate change (mitigation and adaptation) and to attain socioeconomic and gender equitable development
Forest-water Development Objective	To support the indigenous Khasi communities to restore degraded native forest for improving water availability and security in the project area

Expected Impacts	**Target(s)**	**Indicator(s)**
Increased dry-season water availability	TBC	[4]% change in water availability in dry season as measured by the # of days with flowing water in project area (TBC)
Expected Outcomes	**Target(s)**	**Indicator(s)**
Topsoil infiltration improved Restored cloud forest area increased	At least 50% in 2 yrs; 100% in 5 yrs 100 hectares per yr	% change in topsoil infiltration mm/hr # hectares of cloud forest restored
Project Outputs	**Target(s)**	**Indicator(s)**
Federation's Progress report Increased capacity to carry out monitoring on forest-water, and to collect, analyse and utilise data	2 reports (May/Nov) 90% data records	Federation completes and submits monitoring progress report, including all data/analyses/results Electronic project rainfall database submitted
Project Activities	**Target(s)**	**Indicator(s)**
a) Forest-water protocol + training of new members b) Rainfall data is recorded c) Topsoil infiltration readings in dry season	a) 2 x year b) Daily records c) 5 sites/5 measurements per site per year	a) Protocol being used; # Meeting to review progress & training b) Rainfall data in electronic records complete and submitted to office Recorded Daily (rainy season), once a week (dry season) c) Topsoil infiltration readings in electronic records submitted

[4]Provisional. The possibility to record this longer-term impact more precisely (e.g. recording actual flow) is being reviewed and is likely to depend on funding.

ANNEXE 7. LOCATION OF RAINFALL GAUGES

Table 1. Four rainfall gauges were set up along a south-west to northeast transect, and across elevations.

Rain Gauge #	Location	GPS	Elevation	Individual
1	Umlangmar	25°22'19.25"N	1612 m	Banrilang
2	Nongwah	25°24'54.51"N	1693 m	Bastilang
3	Phaniewlah	25°24'58.56"N	1682 m	William
4	Mawphlang	25°26'43.55"N	1834 m	Batskhem

Figure 8. Location of the rain gauges (R1 to R4) on Google Earth.

ANNEXE 8. PROJECT SITE SELECTION TOOL

The project site selection tool is an excel spreadsheet that ranks candidate sites on a series of essential and desirable criteria, calculating average scores that can be used for comparison and decision making. Below is a draft version that requires further review, including the operationalisation of variables and scoring.

PROJECT SITE SELECTION -Score essential criteria as YES/No and rank additional parameters on a scale of 1 to 5.

ABSOLUTE ESSENTIAL CRITERIA	Y/N	
Level of degration (i.e. 300-600 trees/ha)	Y	
Land Tenure rights (land is not privately owned)	Y	
Minimum polygon size	Y	Review performance of 2015/16
ANR or ANR + enrichment planting -can the approach work at the site?	Y	Pay attention to distribution of trees to avoid ending up with grassland
Can it be socially fenced?	Y	Is there any risk social fencing may not work?
RESULT -Is it worth selecting?	✓	

SCORING PARAMETER (1=very poor; 2=poor; 3=good ; 4=very good; 5=outstanding)	TOTAL	Comments
Conservation relevance	3	
Spatial connectivity at landscape level	4	
Cloud forest potential	5	
Water infiltration potential (proportion of bare rock, proportion of surface cover vs bare soil; evidence of surface run-off, soil depth)	5	
TOTAL	**4.25**	

Figure 9. Draft site selection tool that allows proposed sites to be rated and compared against a number of parameters while ensuring the essential criteria are met.

ANNEXE 9. WORKSHOP EVALUATION: QUESTION-BY-QUESTION ANALYSES AND COMMENTS

BEFORE INTERVENTION:

Questions about forest and water:

1. *What are the 3 most important problems that you think relate to forest and/or water in your area/village? Please cite in order of importance.*

   1. The most important problem is ……

   2. The second most important problem is ……

   3. The third most important problem is ……

While at the start of the workshop, participants referred to a broader and copious range of problems (e.g. population growth), their responses became more nuanced and focused by the end of the week (e.g. forest degradation). The most frequently cited problems at the start of the workshop were forest fire, deforestation and decreasing water levels in the area. These reduced to three problems at the end of the workshop: forest degradation, deforestation and local quarrying.

2. Do you think trees are relevant for water? ***Unanimous 'Yes' on all responses on both the before and after surveys.***

3. In what way are trees associated with water? Name any tree-water connections you can think of

At the beginning of the workshop:

- ***Roots contribute to storage of water***
- ***Conservation of forest were gaining trees to have plenty of water and pristine air***
- ***Where there is forest there is water***
- ***Trees hold water***
- ***Trees slow down run off***
- ***Trees consume water and provide water in form of water spring***
- ***They depend on each other***

Responses offered at the end of the workshop:

- ***When trees are cut, the soil quality degrades which leads to more run-off during rains. Less water infiltration affects negatively to water bodies***
- ***Less water bodies in degraded land***
- ***Restoration in a degraded place, trees absorb water through rainfall and more infiltration***
- ***Forests mean water, water means bread and bread means life***
- ***Evapotranspiration, surface flow, infiltration***
- ***Trees help making water clean; act as filters, reviving streams***
- ***Trees help water infiltration***
- ***Trees absorb water through rainfall and it also flows down and infiltrates to groundwater so that we can get water all through the year***
- ***Trees provide stability to water temperature***

4. How confident are you talking to others about forest-water interactions? Tick where appropriate.

1 =not at all confident ☐ 2 =not very confident ☐ 3=neither confident nor unconfident ☐ 4=confident ☐ 5=very confident ☐

Participants said they were confident or very confident talking about forest-water interactions from the outset. The number of 'very confident' participants increased by the end of the workshop, but the difference in confidence between before and after responses was not statistically significant (Z=-1.00, p>0.05). **Mean response before =4.19; Mean response after =4.44**

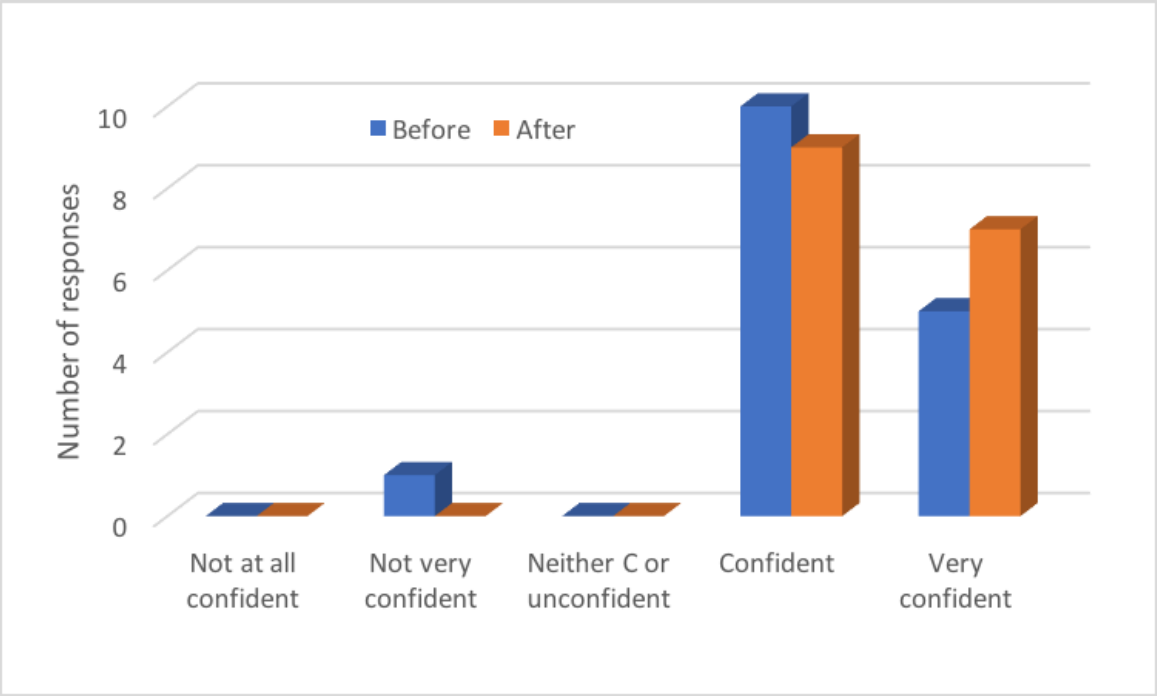


Figure 10. Number of participants rating themselves on confidence about talking to others about forest-water interactions, on a scale of 1 to 5.

5. Thinking about the selection of a new site for forest restoration, tell us what you think makes a good site for forest restoration?

At the beginning of the workshop:

- ***Community participation; where community leaders can be part of it***
- ***Close to spring or water flow (most frequent)***
- ***Nearby village so that people can monitor and see progress***
- ***Waste land area***
- ***Areas where more trees can be planted***
- ***Suitable for tree growth***
- ***A site that lacks trees***
-

Responses offered at the end of the workshop:

- ***Sites should not be completely degraded, should still have remnants; 300-600 trees/ha***
- ***Free from negative human interference***
- ***Select sites where enrichment planting can do to make the forest easier to grow***
- ***Adequate/enough soil for infiltration***
- ***Already forest nearby***
- ***Villages aware of ANR; easy to cooperate with people***
- ***Community land***

AFTER INTERVENTION:

As the workshop ends, we would like you to provide some final thoughts. Please answer these questions honestly. There is no right or wrong, and we will not share your answers with anyone.

Name:

Did you attend the full workshop (every day)?

Have your views changed during this week? In what way?

Yes =84%

Understood the importance of water in the forest; contribution of water in the forest through the hydrological cycle; need to measure soil infiltration; confident, participation; I learned from presentation and discussion and in the field visit I got experience; learned how to promote the hydrological phenomena; need to fully understand the context, need training before implementing; learned a lot through discussion

No =16%

More info; My views have not changed but has strengthen about plant and water relationships

Questions about forest and water:

1. What are the 3 most important problems that you think relate to forest and/or water in your area/village? Please cite in order of importance.

    1. The most important problem is …….

    2. The second most important problem is ……..

    3. The third most important problem is ……

2. Do you think trees are relevant for water?

3. In what way are trees associated with water? Name any tree-water connections you can think of

4. How confident are you talking to others about forest-water interactions? Tick where appropriate.

1 =not at all confident, 2=not very confident, 3=neither confident nor unconfident, 4=confident, 5=very confident

5. Thinking about the selection of a new site for forest restoration, tell us what you think makes a good site for forest restoration?

6. How can we make sure that we select a good restoration site if we want to increase water availability?

7. What have you learned durng this workshop?

8. How pleased are you with the workshop in general?

    1 =not at all pleased, 2=not very pleased, 3=neither dissatisfied nor pleased, 4=pleased, 5=very pleased

Why?

KHASI HILLS FOREST-WATER CAPACITY BUILDING 5-DAY WORKSHOP

WORKSHOP REPORT

WeForest
Making Earth Cooler

Food and Agriculture Organization of the United Nations