A SPRINGS MAPPING EXERCISE IN MEGHALAYA

Rose Christine M. Kharsyntiew

The state of Meghalaya, in north east India, suffers from water shortages due to its hilly topography and the inability to store rain water. The Institute of Natural Resources in Shillong, under the Meghalaya Basin Development Authority, is carrying out springs mapping and springshed development initiatives to enhance the availability of water from the local springs, all of which are improving the situation for the local population.

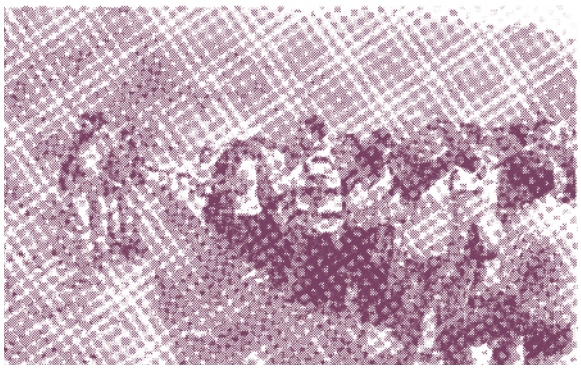
Cover Carefully documenting the state of all springs in the state

Meghalaya has a population of approximately 30 million inhabitants, and is predominantly an agrarian state with about two thirds of its population depending on agriculture for their livelihood. It ranks amongst the wettest regions in the world, with an overall annual average rainfall of 280 cm. According to the estimates, the state has over 50,000 springs, and 78% of the total number of villages (approx. 6,800) depend on springs as their main source of water for household, drinking and irrigation purposes. A sample survey of the springs by the Institute of Natural Resources (INR) in 2015 revealed that over 54% of the springs had either dried up or their water content had significantly reduced in the past few years. Impaired springs have caused widespread water stress in the rural landscape. So despite heavy rainfall, the state suffers from water shortages. This is mainly due to its inability to store and capture the rain water because of its location in the hilly areas, which leads to increased surface water runoff.

Another major cause of water stress in the state is its high vulnerability to climate change. The preliminary studies and hazard analyses carried out in Meghalaya by the INR to assess climate change vulnerability indicated that:

- runoff is as high as 50% in exposed areas due to the loss of vegetation and a decrease in ground water recharge, even during monsoons;
- ground water recharge decreases during winters, and frequent terminal droughts cause complete drying of over 50% of the springs (where 'terminal drought' refers to the early cessation of rainfall);
- early season droughts occur frequently with late or normal monsoon onset, followed by 15-20 days of dry spells;
- there are few but highly intense rainy days with a long mid-season dry spell;
- evapotranspiration rates and water stress is high in forests and agricultural crops, with increased dependence on springs; or that
- crop management (mainly vegetable) is difficult due to flash flood-like situations during intense rains, particularly in the Garo hills.

Many areas are water stressed due to the growing gap between the demand and the supply of water, leading to the population depending more upon – and exploiting – ground water. Change of land use, deforestation, quarrying, mining, soil erosion, *jhum* cultivation (the local term for slash and burn agriculture practiced by the tribal groups in the northeastern states), draughts and floods are perceived to be the main causes for the deterioration of springs and ground water regimes, which in turn, adversely affect agriculture, livestock and other allied livelihood activities. Therefore, springshed development



Left Master trainers were selected from the soil and water conservation department, the water resources department, the community and rural development department

initiatives are a priority in Meghalaya, and spring mapping – as the initial stage – is equally important. The initiative will create a positive impact by improving, rejuvenating and reviving the springs.

Springs mapping

The limited availability of quality data on water resources, hydrology and climate, especially at the local level, is posing challenges to make informed and economically, environmentally and socially appropriate decisions and plans for resource utilisation, and investment and management arrangements in the water sector. Therefore, the process of springs mapping is very important as it serves as a database for decision-making on initiatives related to the development of a springshed, as the area within the ground or surface water basin that contributes to spring flow.

Springs mapping was started in 2015 by INR Meghalaya, which is one of the institutes established under the overall umbrella of the Meghalaya Basin Development Authority (MBDA). This started as part of the project called *"Rejuvenation and Climate Proofing of Springshed for Livelihood, Water and Food Security in Meghalaya"*, under the National Adaptation Fund for Climate Change (NAFCC). Springs mapping exercises take place in all the 11 districts of Meghalaya: in 46 community and rural development blocks that cover around 6,800 villages.

The main objective of springs mapping in Meghalaya are:

- To create an inventory of the springs in the state;
- To develop a Meghalaya spring atlas by sending data to the GIS lab;
- To determine the vulnerability of the springs;
- To rejuvenate and revive the critical springs and springsheds;
- To ensure water security by integrating traditional and scientific approaches to sustainable spring protection;
- To create para-hydrologist and master trainers for springs mapping and springshed rejuvenation through training and capacity building activities (as trainers who then train other members of their village or block);
- To develop resource materials and tools for monitoring the springs.

The information being collected during the springs mapping exercise includes the spring's name, latitude, longitude, elevation, village, district and spring dimension (their general identification details); the physical description – information on rainfall, sanitation and infrastructure; the necessary monitoring parameters, such as the level of spring discharge; and also some basic geological information, such as rock type, structural features, soil, spring type, strike dip and dip direction. The first 2 years of springs mapping was carried out in direct partnership with Arghyam, an organisation based in Pune, and with the National Springs Initiative, drawing experience and support from the initiative's diverse network.

Intensive training was conducted for a set of master trainers drawn from the soil and water conservation department, the water resources department, the community and rural development department. It also considered registered volunteers with MBDA, as well as other agencies. The master trainers then conducted extensive training at the district level, focusing on decision-makers and departmental field staff, local leadership from village *durbars* (local self-governments) and selected members of the community who would become para-hydro-geologists. To date, 262 master trainers have been trained on springs mapping. The master trainers, along with the support from INR and the Basin Development Units (BDUs) located in the 11 districts of Meghlaya, are also conducting springs mapping exercises in different villages of Meghalaya. A total of 1,388 springs were mapped between April 2015 and June 2017,

INR Meghalaya, along with the knowledge management team from MBDA, has also developed information series, booklets and newsletters related to

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springshed development in order to raise awareness. They were published on the INR and MBDA websites (www.inrmshillong.org and www.mbda.gov.in, respectively). The institute also shares information with the line departments in Meghalaya and other institutes under MBDA and the BDUs in order to avoid overlapping or duplicating the work.

The process, however, faced a few challenges. Private individuals own 90% of the land in Meghalaya, so the government has very little leverage to mandate or regulate the use of resources directly. Considerable knowledge sharing with the community must be done to raise awareness and convince landowners of the value of springs management. A proper guideline and policy is not available to master trainers, which also hinders the smooth functioning of springs mapping.

Another major challenge faced by the springs mapping team was the lack of available instruments, such as GPS and tracers – a device used to measure water quality parameters. One GPS and one tracer were required per block (of which there are 46) for the smooth running of the project, but INR currently only owns six GPS devices and ten tracers. Clinometer compasses used for measuring the dip and strike direction, and abney levels used for measuring slopes, are also not available.

There is no baseline data on the location of the springs, the number of springs or the topography of the area in Meghalaya. It is also difficult to find the recharge location of the spring in the main city due to increased population and housing. All the work started from scratch and was thus time consuming and demanding on human resources.

A positive impact

A sample survey of the springs mapped revealed that over 54% of the springs have either dried or been impaired. Through springs mapping, the team was able to understand the water discharge, water quality, scarcity of water and the necessary initiatives to be taken up. Knowledge about each village was also developed, i.e. whether water is in surplus or deficit supply. People were sensitised on water management to harness maximum water during the peak season. Through springs mapping, it was also observed that most of the springshed conserving villages are not users of the spring water. Therefore, villages on higher reaches were encouraged to protect the catchment and were made aware that they would be compensated for their environmental services by villages using the spring water.

In addition, the team has seen:

- **the creation of a local cadre to map the springs.** By the end of 2017, 262 master trainers were trained all over Meghalaya, and sensitisation on the springshed initiative was conducted in all 11 districts of the state;
- **the development of springs atlas.** The coordinates of the springs mapped was provided to the GIS team of MBDA and the first edition of the spring atlas has been developed. It is a humungous task to map all the springs in Meghalaya but this will help to constitute scaled baseline data for the springshed initiative programme;
- **participation and ownership.** When the nearby communities or villages heard about springs mapping, some villages came forward to request for springs mapping in their village too. This shows that

Left A total of 262 master trainers are now training others

the villagers have gained knowledge about the importance of spring mapping. The participating communities were keen to rejuvenate the springs because they are their main water supply;

- **the protection and rejuvenation of vulnerable springsheds.** Umtyngar is one of the villages located in the East Khasi Hills district of Meghalaya. The Umtyngar river has been highly affected by sand mining and stone quarrying, meaning the springs discharge around Umtyngar has drastically decreased. In order to solve the problem, in April 2017, INR Meghalaya dug contour trenches around the recharge area of the springs. The springs discharge has since increased compared to the discharge before the initiative and at present, the water discharge is around 490 l per minute. As a step forward, the tree species present in Umtyngar will also be mapped in order to identify and understand the local species for plantation in the area

Next steps

In Meghalaya, 78% of the villages are highly dependent on springs for drinking water and irrigation, but the state still has no records, data or information related to springs. The extensive springs mapping and survey is expected to provide precise knowledge and understanding of the basic characteristics of these springs and their present condition.

In the next years, a total of 306 springsheds in 11 districts of Meghalaya will be covered under the NAFCC as per the project, which is expected to end in March 2020. With these springshed initiatives, the water availability, water discharge and water use efficiency is expected to improve. At the same time, the adverse impacts of climate change affecting water security and agriculture is expected to reduce. Increased ecosystem resilience to climate change and community empowerment may reduce climate risk at the local level.

With around 50,000 springs in Meghalaya, the team will be able to conduct the springs mapping exercise successfully and effectively if the necessary amount of instruments is supplied and circulated. Proper guidelines and policies for springs mapping also need to be developed and disseminated to all the blocks and master trainers so they are all working along the same lines and towards a common goal.

So far, the process has been limited to mapping. Springshed development initiatives and interventions should next be spread widely across the state in order to protect and rejuvenate the springs. Springs mapping will provide the data and information required for decision-making and will help in analysing the vulnerability of the springs, while springshed development will contribute to the protection and rejuvenation of the springs.

The institute must capitalise on the experience of the project in order to grow and understand the successes and failures of the interventions. The data collected will also be helpful for other organisations who want to initiate similar activities, and will enable them to avoid repeating similar mistakes.

Rose Christine M. Kharsyntiew works as Assistant Manager, Meghalaya Basin Development Authority.
E-mail: christine.rose19@gmail.com

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