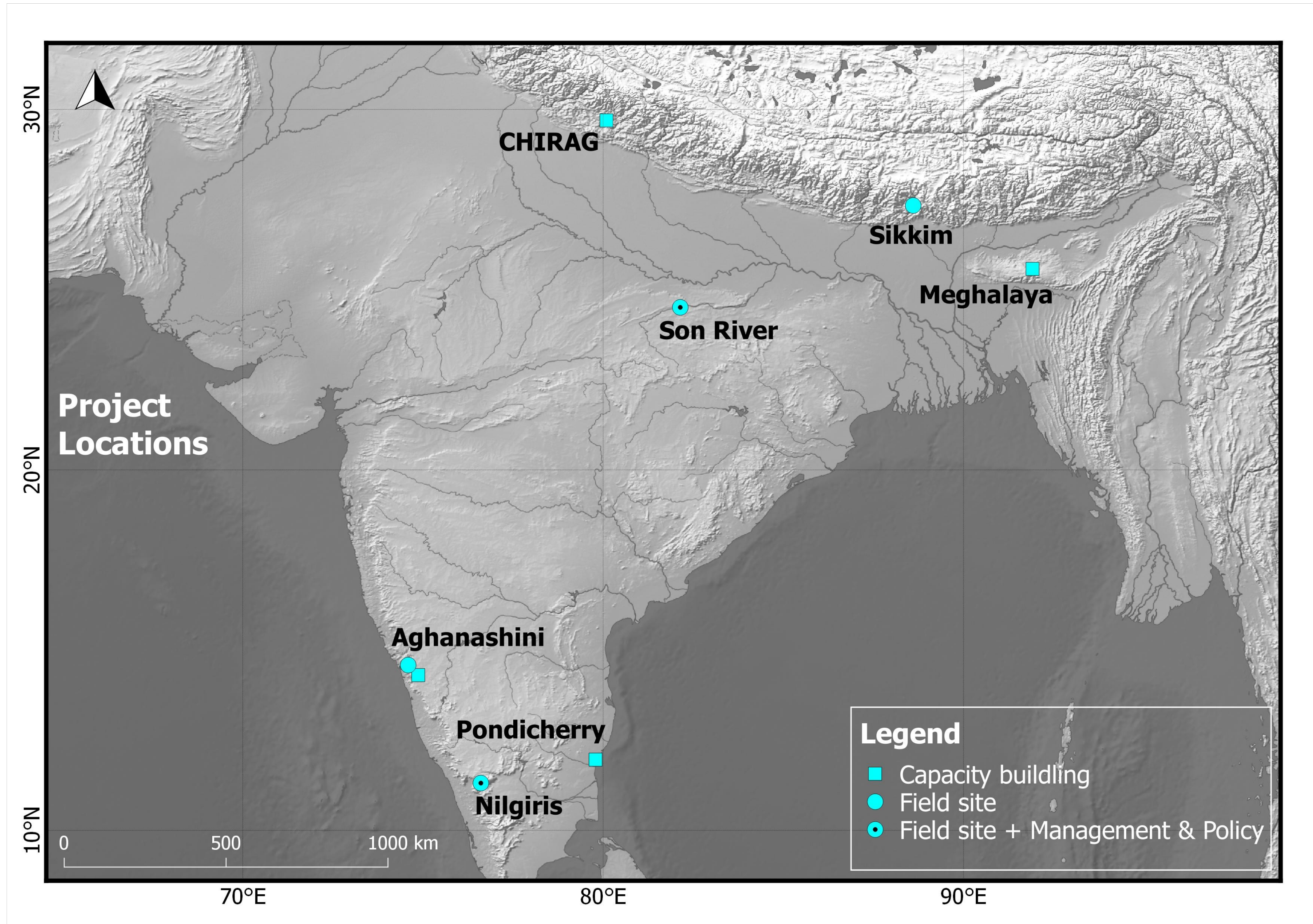


The Changing Water Cycle (CWC) programme was set up in 2010 and was the first joint collaborative research programme between the Natural Environment Research Council (NERC, UK) and Ministry of Earth Sciences (MoES, India) and ran from 2010–2016. One of the projects funded under this programme was *Hydrologic and Carbon Services in the Western Ghats: Response of Forests and Agro-ecosystems to Extreme Rainfall Events*. The ongoing *Adaptation at Scale in Semi-Arid Areas* (ASSAR) project funded by IDRC, Canada and DFID, UK is a collaborative effort across India and Africa.

These projects aimed to:

- (1) develop a quantitative understanding of the changes taking place in the regional water cycle and climates;
- (2) understand how local and regional scale hydrological, biogeochemical and ecosystem processes respond to changing climate and land use;
- (3) understand the consequences of the changing water cycle for water-related natural hazards including floods and droughts, as well improving prediction and mitigation of these hazards and; where appropriate
- (4) develop scalable adaptation strategies for communities.



River flood events have devastating consequences for health, livelihoods & economic development in India. The CWC research project focused on the role of extreme rainfall events in the generation of floods in a region of India that has some of the largest short-term rainfall intensities. The methods used were capable of identifying changing dynamics directly from meteorological and hydrological time-series from both existing government stations and new experimental systems. Both field and numerical techniques were used so that change could be observed to reduce uncertainties. The underpinning mantra being that change is rarely easy to see in observations of environmental systems. Robust experimental designs and sophisticated sensors and numerical tools are needed to identify these changes.

We also used the field experience from experimental catchments in the Western Ghats established during this project to train a diverse set of trainees from diverse academic, government and civil society backgrounds in field hydrology and hydro-climatic data processing.

The poster describes the methods and approaches we used (field training, web-based approaches and workshops) to develop the capacity of civil society to generate primary hydro-climatic data and use secondary data to measure and monitor changes in water resources from local to regional scales.

Project outcomes: Over 100 students, independent researchers, and those from NGOs, government agencies and various academic institutes have been trained during the course of this project. We also illustrate the impact of these approaches in enhancing civil society contribution to science and evidence-based policy and management issues related to sustainable management of rivers and streams.

- 9 PhD students, 14 MSc students and more than 50 other students and professionals have benefitted from the capacity building and training exercise.



Photos (L to R): a) Nachiket Kelkar (PhD student, ATREE) taking depth profile in the Ganges, Bihar; b) Shishir Rao (MSc student, NCBS) sampling in the Yettinahole basin, Karnataka; and installation of c) Stream-gauge, and d) v-notch weir by participants of the first field hydrology workshop in Pondicherry.

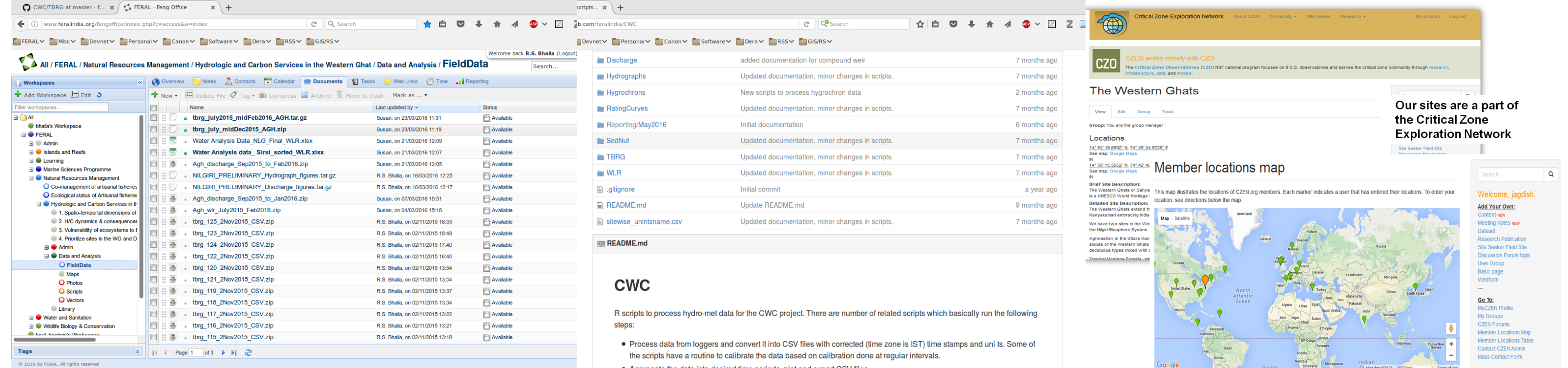
* With inputs from Shrinivas Badiger, Srinivas Vaidyanathan, Nick Chappell, Nachiket Kelkar.

- Government agencies like the Water Resources Dept. (Meghalaya), Forest Dept. (Tamil Nadu & Karnataka) and the Electricity Board (Tamil Nadu) have also undergone capacity building exercises.



Photos (L to R): a) Field exercise demonstrating area- velocity method for discharge measurement; b) Stream profiling and area-velocity calculation; and c) Field Hydrology workshop participants in Meghalaya.

- Engaging with end users in India & abroad to share new knowledge of field and modelling techniques, and tropical hydrological science throughout the project.



Photos (L to R): Online repositories for a) project data on Feng Office, b) R scripts on GitHub; and c) participation in the Critical Zone Exploration Network.

- Partnering with NGO-led action research, natural resources management and community-based water management across the country (SACON, ACWADAM, FES, LIFE, KEYSTONE, Arulagam, CHIRAG & Samprag).



Photos (L to R): a) CHIRAG spring recharge team installing an automated flume in a Himalayan spring; b) Revathi (ASSAR field coordinator) at a stakeholder workshop in the southern Moyar region; c) Tarun Nair (FES) stream-gauging in the Son River, Madhya Pradesh.

- Collaborations with research institutes in India and abroad for both research and teaching exchange.
- A new community of networked freshwater ecologists and conservationists with a good appreciation of hydrology and hydro-climatology.



Photos (L to R): a) Ravi Bhalla at collaborator's field site in United Kingdom, b) MSc Wildlife students (NCBS) at Sirsi project site attending course in Freshwater Ecology & Conservation; c) students from King's College London visiting Nilgiris project site; d) Jagdish Krishnaswamy training students on hydrology and impacts on land use - land cover change at College of Forestry, Sirsi.

- Communication, outreach and policy interventions.



Photos (L to R): TOP: a) Blog post on current and future concerns for semi-arid ecosystems in India; b) Multi-lingual joint-statement on 'alternative vision and approach for sharing of the Cauvery River water'; c) Popular article on saving India's rivers; d) Book chapter 'Restoring the Ganga for its fauna and fisheries'.

BOTTOM: a) Participation in television discussion on effects of El-Nino and climate change on human health; b) ASSAR animated climate messages for India.