A Universal Language for Community-driven Water Management

Going Digital in Support of SGD 6

WaterUp

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Context

Water scarcity currently affects over 40% of the global population and this problem is projected to worsen as climate change results in increasingly erratic and extreme weather combined with rising global temperatures (UNDP, 2018). The link between poverty and water scarcity, as well as exploitation of water resources, has been well documented (Matshe et al.2013). The vast majority of the affected population will be located in semi-arid regions within Asia and sub-Saharan Africa, which also contain the greatest number of rural poor and the highest incidence of rural poverty (IFAD, 2011). An increasing number of those living in poverty have identified access or control of water resources as more critical than access to food, primary healthcare and education (Barker et al., 2000). In many instances, poverty and elevated water stress has been caused by anthropogenic interference with the hydrological regime, such as over-extraction for agricultural irrigation which triggers and perpetuates processes of environmental degradation (Agarwal and Narain, 1999). Based on the 'natural flow paradigm', any alteration to the natural flow condition will alter the river ecosystem (Mittal et al., 2016) and thus, the environmental quality of the river basin.

Improved holistic river basin management (human and physical processes) can regenerate local water resource availability, restore natural capital and contribute to the alleviation of rural poverty in addition to the sustainable provision of water and sanitation (Merrey et al., 2005). The successful management of local hydrological systems and resources in remote arid areas invariably requires a decentralised, cooperative and community-based approach (Barker et al., 2000). Local community-driven approaches have successfully supplied reliable, sustainable water to local populations and returned perennial flow to previously ephemeral rivers across north-western India using indigenous surface rainwater collection and storage techniques. This includes the work of the community-based NGO Tarun Bharat Sangh (TBS) in restoring landscapes across Alwar, Rajasthan. The basic and passive nature of these techniques makes them applicable to communities and river basins around the world, which will further contribute to ensuring available and sustainable management of water and sanitation for all – Sustainable Development Goal (SDG) six. Arup and The Flow Partnership recognised that community driven (bottom-up) water management is one of the most effective and robust ways to decrease global water woes, and founded the WaterUp project to address this.

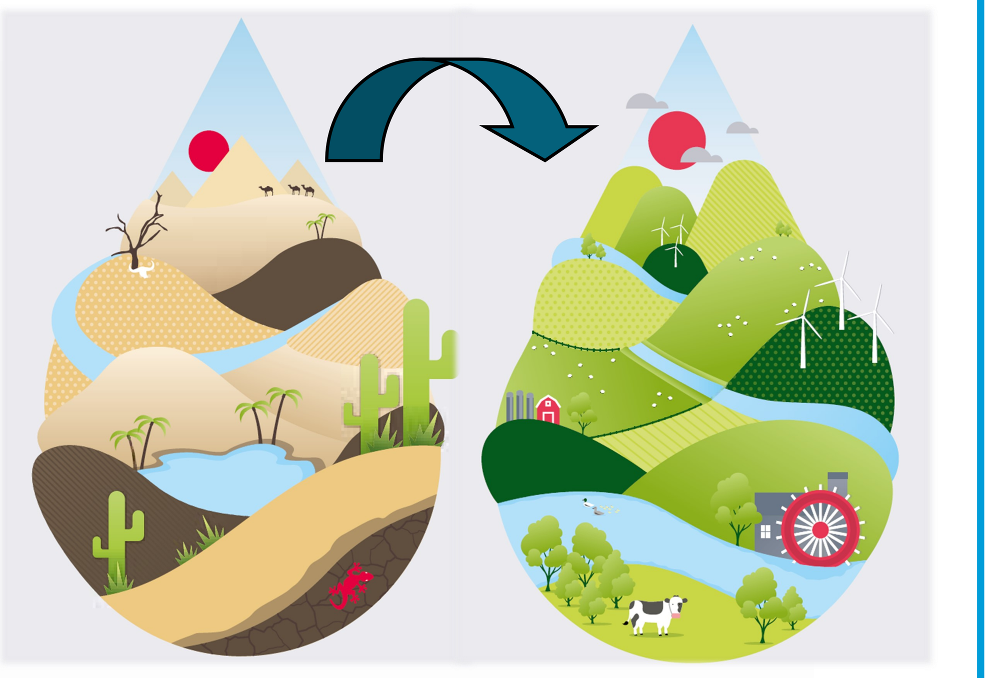
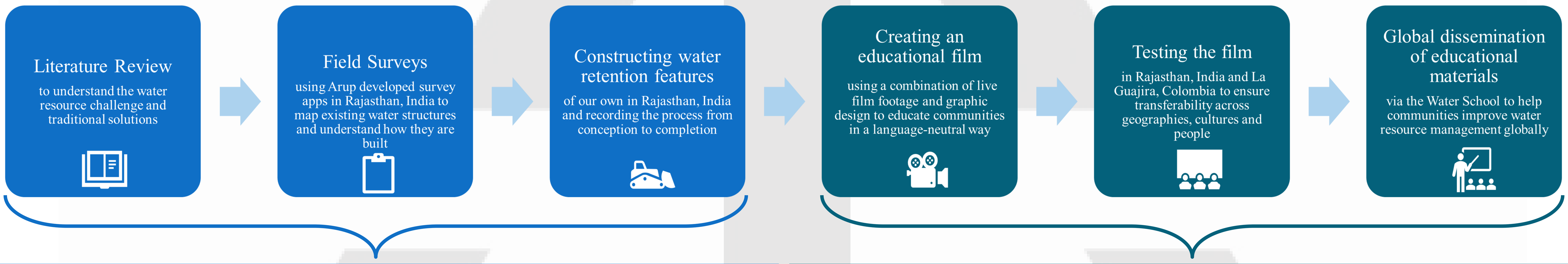


Figure 1 The impact of sustainable water management practices on landscape restoration (image: Arup)

WaterUp—aims and objectives

The overall aim of WaterUp is to produce a language—neutral, digitally enabled educational film on sustainable methods of managing water resources in semi-arid climates and ensuring it is globally and freely available to communities to make a meaningful contribution to achievement of the SDG6. This was achieved through the process shown in Figure 2 which is replicable to produce further educational materials in the future:

Figure 2 The process WaterUp undertook to produce the language-neutral educational film, utilising digital tools including survey apps along the way



Catchment Data

The literature review revealed a series of traditional engineered water resource management systems exist across India, summarised in Table 1. WaterUp focuses on the use of johads in the Sarsa catchment, Alwar, Rajasthan.

Measure	Region of Origin	Description
	Northern India	
Kuls or Kuhls	Himachal Pradesh Also found in Jammu and Kashmir	Long channels extending a glacier to a local tank. Water used for irrigation as required.
Araghatta	Kashmir	Wooden water wheels also known as the Persian wheel. Used to lift water out of the River Jhelum into the canal irrigation system which serves rice fields.
Johads	Rajasthan and Haryana	Earthen check dams that hold rainwater, aid groundwater recharge and slow percolation to underground aquifers.
	Southern India	
Kovil Kulam	Andhra Pradesh, Karnataka, Tamilnadu and Kerala	Tanks of varying size and shape, surrounded by corridors and long flights of stairs. Inlet channels bring water from local streams or rivers and outlets remove excess water.
Surangams	Western Ghats	Vertical tunnel-like structures which extract groundwater using gravitational force which is then stored in a tank and used for irrigation.
Eri	Tamilnadu	Interconnected feed through channels that divert river or rain water, that can balance water levels in times of excess or drought. One of India's oldest water conservation systems.
	Eastern India	
Ahar Pynes	South Bihar	A river basin (ahar) fed by a canal (pynes) stemming from a river.
	Western India	
Virdas	Banni grassland, Great Rann of Kutch, Gujarat	Shallow wells dug into depressions to collect rainwater. This separates freshwater from the mostly saline groundwater. Originally built by the nomadic Maldhari people.

Table 1 Summary of traditional water resource management techniques across India

In the Sarsa, TBS have implemented approximately 300 johads in strategic positions across the $360km^2$ catchment. The location of a proportion of these johads was mapped and their composition, dimensions and storage capacity recorded to enable us to better understand the scale of the work. The field data were collected using an Arup developed app based on Arc Collector that allows river basin information to be mapped and detailed using tablet devices and uploaded to the cloud in real time.

Data collected in the field was combined with remote sensing data (Landsat imagery and topographic digital elevation data) to analyse the impact of the johads compared to a similar catchment without johads using multivariate clustering and through change over time in satellite imagery. The mean normalised difference vegetation index (NDVI) for each grid square was analysed annually between 1981 (following implementation of the johads) and 2018, as shown in Figure 3, indicating increases in vegetation of up to 15% as a result of the implementation of the johads.

The field survey also identified an ideal location for a new johad to be constructed and an existing structure to be repaired to support local communities in need in Saseri and Maharajpura, Alwar, respectively. TBS facilitated in arranging community members to help with the construction process. This was essential to ensure longevity of the structures as the local population have to the knowledge and means to maintain the johads in the future and have a sense of ownership over their future.

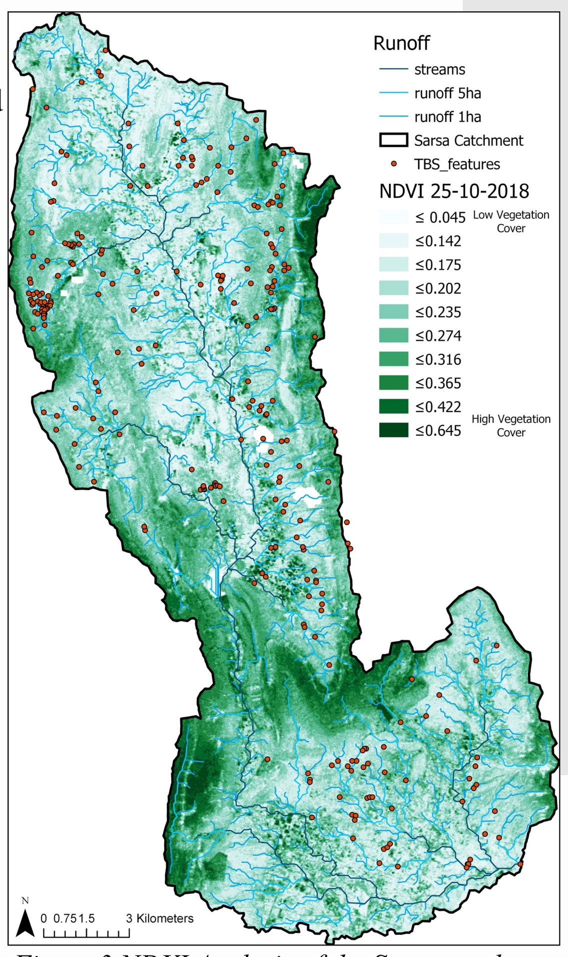


Figure 3 NDVI Analysis of the Sarsa catchment and the spread of Johad features

Figure 4 The new johad built by WaterUp in Saseri, Alwar following the first monsoon rainfall after completion

Knowledge Sharing

The construction process of the new and maintained johad structures were recorded from start to finish by a local videographer and the footage utilised within the educational film. Arup graphic designers and storytellers used a combination of live footage and animation to relay the process of constructing a johad from site selection through to the completed johads filling with surface water runoff. By appraising the natural environment, topography and vegetation, the character of the water landscape and underground aquifer can be deduced to inform the best, most effective location to install a johad. The film then demonstrates the principles of design and physical process of building a johad along with guidance on the use of the rainwater harvesting features. Figure 5 below depicts an extract from the educational film in animation compared to the live footage captured on site.

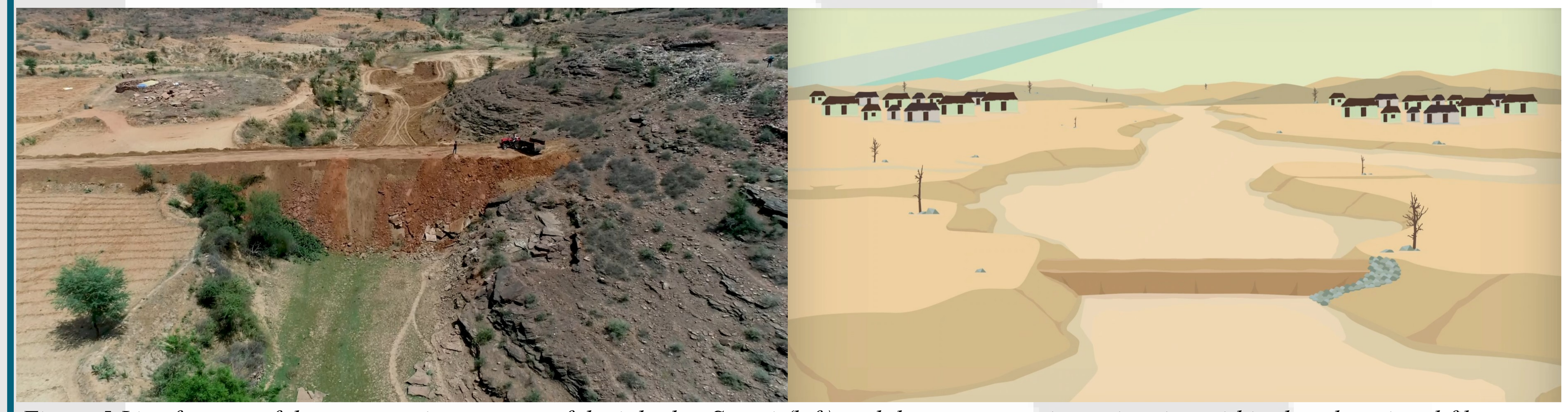


Figure 5 Live footage of the construction process of the johad at Saseri (left) and the accompanying animation within the educational film (right) which is used to exemplify the process and principles of water management without the use of spoken word or text

Testing of the film was undertaken in a neighbouring community in Rajasthan and in La Guajira, Colombia to ensure all the necessary information was captured and to ensure compatible with communities in different geographies around the world. The language-neutral nature of the film ensures that it is accessible regardless of literacy level or language and it is believed to be the first tool of its kind, particularly in the water resource sector, to educate communities in an entirely free and easily accessible manner. The film will be made globally available on the Flow Partnership's flagship Water School and shared with NGOs and academic institutions alike for use on the ground. The Water School hosts a variety of educational tools and sustainable water management techniques for communities around the world, and will be updated as new educational materials are produced in the future.

Figure 6 Members of the Wayuu community reviewing the educational film in La Guajira, Colombia

In this digital age, 85% of the population has access to a mobile phone but almost one third still lack access to safe drinking water – this is a unique opportunity to use these technologies to improve all aspects of water resources. Therefore, WaterUp has the potential to benefit the 3.2 billion people who currently live with high to very high water shortages or scarcity in rural areas every single day (FAO, 2020). By empowering communities through upskilling and shared knowledge with the aim of catalysing landscape restoration and livelihood improvement around the world, we can contribute towards achievement of the SDGs, particularly SDG 6.

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