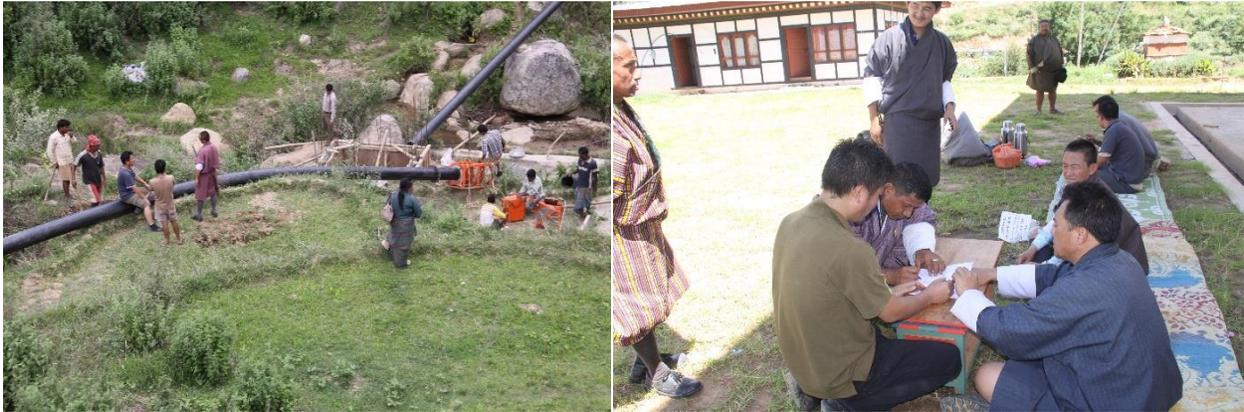


Provision of Access to Siphon Irrigation for Farmer Communities in Lingmutey-Chu Basin in Bhutan (#496)



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The views expressed in this case study do not necessarily represent the official views of GWP.

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About Global Water Partnership

The Global Water Partnership's vision is for a water secure world. Our mission is to advance governance and management of water resources for sustainable and equitable development.

GWP is an international network that was created in 1996 to foster the implementation of integrated water resources management: the coordinated development and management of water, land, and related resources in order to maximize economic and social welfare without compromising the sustainability of ecosystems and the environment.

The GWP Network is open to all organizations that recognize the principles of integrated water resources management endorsed by the Network. It includes states, government institutions (national, regional, and local), intergovernmental organizations, international and national non-governmental organizations, academic and research institutions, private sector companies, and service providers in the public sector.

The Network has 13 Regional Water Partnerships, 85 Country Water Partnerships, and more than 3,000 Partners located in 182 countries.

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1. Background

In South Asia Global Water Partnership (GWP) has been tackling the mounting challenges of climate change through the Water and Climate Resilience Program (WACREP) since 2013. WACREP includes a portfolio of programs and projects aiming to build climate resilience through implementation of Integrated Water Resource Management (IWRM). GWP's Country Water Partnerships (CWPs) develop these programs and projects in collaboration with respective governments/agencies, international and regional economic development communities, and citizens.

2. Introduction

As a country that espouses and pioneered the philosophy of Gross National Happiness (GNH) as a measure of well-being of its population of some 800,000 citizens, Bhutan has a coveted position in South Asia. It ranks first in economic freedom, ease of doing business, and peace, second in per capita income, and is the least corrupt country as of 2016. Despite these achievements, Bhutan continues to be a least-developed country. Its location in the Eastern Himalayas grants it ample freshwater resources and as a result, Bhutan has one of the highest per capita water availability in the world. This resource has been harnessed for the generation of hydropower, which acts as a major source of the country's income.

Despite water resources being abundant in the region, uneven spatial and temporal distribution of water bodies makes them hard to access. The majority of Bhutan's water resources flow through small streams and rivers located at the bottom of gorges and ravines while human settlements and farmlands occupy upper slopes and hilltops (Asian Development Bank, 2016).

Water is needed for drinking and irrigation purposes and paradoxically, water shortages occur despite the access of sufficient resources. As the population grows in both urban and rural areas and the country seeks to modernize, these challenges are forecasted to get more critical with rising pressure on available water resources. The increased pressure is due to intensifications in agricultural practices, animal husbandry, and industrial and domestic uses. However, climate change brought on by global warming will most likely be the biggest threat in the coming decades.

Farming is the primary occupation of the Bhutanese people with over 60% of the population engaged in subsistence farming and animal husbandry. Despite this, the irrigated area constitutes only 25 percent of the total arable land due to a lack of irrigation water and supporting infrastructure. Paddy is the dominant crop currently under irrigation and is cultivated on terraced land on the hill slopes and valley bottoms. However, a significant proportion of the paddy land relies on rainfall for crop production. The rice yields are comparatively low (1 MT/acre), but there is a sustained move to increase rice cultivation across Bhutan.

The primary goals of agriculture in Bhutan are to raise the per capita income of the people living in rural areas, to enhance self-sufficiency in staple crops, and to increase the productivity per unit of farm labour and agricultural land. Agriculture is hampered by lack of irrigation, rough terrain, poor soil quality, and limited number of arable lands.

3. Description of the Problem

3.1 Traditional Water Sharing System in Bhutan

One of the most widespread uses of water in Bhutan is farming. Most of the water for irrigation is drawn from small streams and spring water, unlike other countries where groundwater is extracted for irrigation purposes. Due to abundant surface water sources, traditional water sharing systems have worked well historically. Due to a range of factors; recent population rise, shift in the nature of farming from self-sufficiency to commercialization and compounding climate change related challenges, long and protracted legal disputes over water sharing between upstream and downstream farmers are known to occur annually across the Bhutanese landscape.

The traditional water sharing system is ruled by two principles (Bhujel, 2006):

One: First come, first served.

Two: Communities located near the source have full rights over water use based on settlement dates, ancestral rights, and village location.

The first principle gives upstream users more water rights than downstream users. The second principle implies that downstream communities have the right to seepage (escape/leakage of water) from the upstream canals. This system is enforced based on ancestral rights and traditional understandings (Bhujel, 2006). These practices are unique to Lingmutey-chu and are not the norm across the entirety of Bhutan.

3.2 Challenges in the Lingmutey-chu Watershed

The Lingmutey-chu watershed is a small agriculture area (~34 km²) in Thedtso Block within the Wangdue Phodrang district. It is an important source of water for seven villages (Limbukha, Dompola, Matalumchu, Omteykha, Nabjee, Wangjokha, and Thangu). This watershed is located at the junction of Thimphu, Punakha and Wangdue Phodrang *dzongkhags* - an administrative and judicial district of Bhutan.

The total population of the watershed is 1261 spanning 166 households (Bhujel, 2006). The majority of the inhabitants support themselves through farming activities. By local standards, the area has a high proportion of paddy land, and this is a source of pride for the local farmers. The Lingmutey-chu stream is the main source of irrigation for paddies and provides drinking water for

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Image 1: Lingmutey-chu Watershed (International Development Research Centre)

the region. Bhujel states that Lingmutey-chu is a seasonal stream that depends on rainwater and is the only source of water at 2500 meters above sea level, which feeds 16 irrigation canals in the watershed. Under normal circumstances, the stream does not have sufficient flow to irrigate the whole agriculture land within its catchment. Local farmers experience severe water shortage during the dry season for paddy cultivation. The demand for water in the area has increased over time while the sources have been in decline. This miss-match leads to water crises in the area.

Conflicts come into picture principally because of the traditional water sharing system, wherein upstream farmers take the full right to divert the flow in the canal without due regard to the needs of downstream farmers. Since downstream farmers benefit from the seepage of canal, they prevent the canal from being restored (Tobgay, 2015). This existing traditional sharing system is the main cause of inequity and conflict among the farmers because the system does not support the actual water requirements by the different villages (Bhujel, 2006). It further detracts from taking measures to protect the degrading watershed.

Rice growers in Lingmutey-chu have shared a limited amount of water to irrigate their highland terraces at 1200- 2200 m above mean sea level for many years. At this altitude, the period propitious to rice transplanting is very short and stirs disputes for timely access to water among village communities. Customary rules cannot solve these disputes since cropping practices change with the adoption of commercial crops. Despite centuries of communal water sharing and collective management practices, water is proving to be a source of conflict for the villagers in Lingmutey-chu watershed.

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In a climate change regime, increased variability in water supply and seasonal shortages stand to affect Bhutan's access to irrigation water that is necessary to maintain food security (Asian Development Bank, 2016). The inability to predict these variations precisely in advance aggravates the competition to gain access to water and necessitates a fair and equitable water sharing method so that all farmers have access to water and can be self-sufficient when it comes to production of food.

Small and fragmented landholdings that carry out subsistence farming prove to be labour intensive and has limited capacity for economies of scale. A priority for the Royal Government is food-sufficiency, but the promotion of agriculture through extension services and various subsidies has failed to attract the younger generation, who are uninterested in working in this sector. Migration from rural to urban areas has shaped the social settings of farming communities with older generations taking on the responsibility of farming.

These constraints are well-recognized by the government, demonstrated by the budgetary outlay for agricultural development in the 11th 5-Year Plan being significantly increased over past allocations. A National Irrigation Master Plan (NIMP) has now been developed, which sets out a strategy for increasing agricultural production for food self-sufficiency. With continued seasonal variations in rainfall under a changing climate, innovative and cost efficient technologies, infrastructure, and management interventions are key for increasing access to the abundant water resources available primarily in valley bottoms and deep gorges (Asian Development Bank, 2016).

4. Decisions and Actions Taken

4.1 Integrated Water Resource Management in Bhutan

The emergence of IWRM in Bhutan can be traced to the work of the Bhutan Water Partnership (BhWP) in the early 2000s. At that time BhWP began to advocate alongside the Royal Government for the establishment of necessary mechanisms to safeguard Bhutan's water resources. This was adequately expressed in the Bhutan Water Vision and the Policy document of 2008, which envisions that water is the most important natural, economic, and life-sustaining resource and that it must be conserved. The document recognized that water can cause severe damage to life and property and it was acknowledged that in the Bhutanese scenario, water is available in abundance to meet the increasing demands of stakeholders, provided proper management of water resources is carried out. Further, it was expected that as a by-product of IWRM implementation in Bhutan, present and future generations would have assured access to adequate, safe, and affordable water to enhance and maintain the quality of their lives and the integrity of natural ecosystems. (National Environment Commission, 2008; Royal Government of Bhutan, 2007)

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4.2. Bajo Siphon Irrigation Project

In order to provide irrigation water to farmers living in upper slopes and hilltops in Lingmutey-chu who faced issues in accessing water in 2014, a siphon project was initiated by Bhutan Water Partnership/Royal Society for Protection of Nature in collaboration with the Ministry of Agriculture and Forest in Bhutan. Primarily the Engineering Division of the Department of Agriculture under the Ministry of Agriculture and Forests, Bhutan carried out the designing and on-ground implementation of the project along with providing in-kind contributions. BhWP, who also carried out monitoring and evaluation and mobilised local community members for provision of labour financially, backed this project.



Image 2: Construction of the Siphon



Image 3: Completed Intake Structure

Siphon irrigation provides a cost-effective solution that can help augment irrigation facilitation available to farmers to grow paddy and rice. Hydraulic Siphon Technique (HST) is best suited for the harsh Himalayan conditions in addition to being affordable. HST can be adapted to the specific conditions of the Himalayas and can lower lake water levels by a magnitude of 5 m by taking advantage of the difference in hydraulic potential between the inlet and the outlet with a water-filled pipe in a deeper lying outlet (Royal Government of Bhutan, 2011). Siphon irrigation provides a cost-effective solution that can help enhance irrigation facilitation available to farmers to make use of their farmland and enhance their livelihoods.



Image 4: Laying of the Pipeline



Image 5: Handing Over to the Community

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The main objectives of the project were:

- To increase rice yield from 1.2 MT/acre to 1.6 MT/acre
- To resolve existing conflicts with upstream users of Lingmutey-chu stream

The project financed the purchase and laying of 606 m of HDPE pipe that was connected to the existing Bajo Yuwa irrigation canal. Since the Bajo Yuwa canal has sufficient flow and has the capacity to support additional discharge, it was selected as a reliable source of water. Using the force of gravity, water is lifted to the upper slopes and hilltops not fed by Bajo Irrigation Canal. The water is collected in a small reservoir and further distributed to various sites using traditional canals. The civil works were outsourced to a local contractor and beneficiaries contributed through physical labour work for the trenching of the pipeline as part of their contribution to the project.

Planning for the project started in February 2014 with the surveying, designing, and cost estimation being carried out by the implementing agencies. A Memorandum of Understanding (MoU) was signed between the collaborating partners on 6 March 2014. Until mid-March 2014, quotation calls for civil works was done, and the contract was awarded to a local contractor. From March onwards the new pipeline was laid, and concrete work was carried out. Over the course of 6 months, the project was carried out and was finally handed to the communities of 31 households of Wangjokha and Thanggo villages under Thedtso gewog (Block) on 14 September 2014.



Image 6: Graphical Representation of the Siphon Pipeline (Google Earth)

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5. Outcomes

About 50 hectares of fertile land, belonging to 31 households of the Wangjokha and Thanggo districts within the Thedtso Block, located at the tail end of Lingmutey-chu stream, which would have otherwise remained fallow due to a shortage of water, became productive. Now farmers can cultivate rice during summer season and winter crops such as wheat, vegetables and cereals. As such, farmers are now able to increase their food productivity thereby ensuring self-sufficiency. This has also enabled farmers to generate income from the sale of farm products.

6. Lessons Learned

Recognizing that the water system is the inevitable entry point for addressing climate change, IWRM serves as a foundation upon which the planning and implementation of climate resilience is being pursued in Bhutan. The goal is to achieve sustainable water security for the benefit of all stakeholders.

In the face of climate change, identifying and using an appropriate technology to overcome the issues influencing human livelihoods has become of the utmost importance. The Siphon project at Bajo proved to be the right choice to address the issue of water scarcity in the area, having benefited the farmer community in a remarkable way. With similar landscape and terrain, alike projects can be replicated in other parts of the country, considering the success of this initiative. BhWP conducted the outcome monitoring after the project, while the Department of Agriculture did the output monitoring to find the system functioning as intended.

Recommendations:

- Rain fed lowland rice systems (under wet subtropical zone) account for majority of the rice growing area, but contribute the least in terms of total rice production. Improvement in productivity of rice in this zone will increase rice production at the national level and enhance the income at the household level, and thereby contribute to improving food security (Karma & Ghimiray, 2003).
- Lack of financial resources and capital investments has been the major constraint in creating adequate and efficient irrigation facilities in the country. There is a huge potential to increase domestic agriculture production and ensure food self-sufficiency by making major investments in development of irrigation infrastructures.

7. Conclusion

Bajo Siphon project is one project that best demonstrates a successful low-investment climate adaptation initiative. The success of Bajo project have improved livelihoods of the farmers through a simple application of technology. This project also demonstrated the successful collaborative efforts between the community, government agencies, and an NGO.

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GWP's IWRM ToolBox identifies the various tools that can be used to carry out successful IWRM in the field. In Bhutan's Lingmutey-Chu basin, conflict management (C5.03) to pacify various stakeholders was a key part of cultivating access to siphon irrigation for farmer communities. By improving access of affected parties to irrigation water, mutually beneficial arrangements were set up. Public authority had a key role to play in this process of providing water supply and sanitation services (B1) while it was the onus of the community members to maintain and reap its benefits.

Reflections on the Siphon Irrigation Project at Wangdue Phodrang

“Bringing water where it is most needed through the use of simple technology is an essential application of water management. The Siphon Irrigation Project in Bhutan is a good model where the Government, Country Water Partnership and local communities worked together to make water available for farmers. The farmers of Wangjokha and Thango villages are now harvesting the benefits of the project, which contributes to their well-being. They remain grateful to Global Water Partnership – South Asia for the funding support.”

Ugyen Lhendup
Regional Council Member-Bhutan

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2. The Engineering Division, Department of Agriculture, Ministry of Agriculture and Forests, Bhutan, karmatshether@yahoo.com
3. Beneficiary Community: The Gup, Thedtso Gewog, Wangduephodrang District, Bhutan

10. Supporting References

The final project report can be accessed here:

http://www.gwp.org/globalassets/global/gwp-sas_files/wacrep/bhwp-project-report-1.pdf