RANGUN KHOLA WATERSHED PROFILE

STATUS, CHALLANGES AND OPPORTUNITIES FOR IMPROVED WATERSHED MANAGEMENT

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Cover photo: Women participate in a focus group discussion (FGD) in Rangun Khola. In addition to FGDs, Paani conducts multi-stakeholder consultation (MSC) workshops, key informant interviews, household surveys and participatory rural appraisal to ensure communities' perspectives are incorporated throughout the entire watershed profiling process.

Photo credit: USAID Paani Program

RANGUN KHOLA WATERSHED PROFILE:

STATUS, CHALLENGES AND OPPORTUNITIES FOR IMPROVED WATER RESOURCE MANAGEMENT

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ABBREVIATIONS

BZFC	Buffer Zone Community Forest
BZMC	Buffer Zone Management Committee
CAPA	Community Adaptation Plan of Action
CBAPU	Community-based Anti-poaching Unit
CBS	Central Bureau of Statistics
CBOs	Community-based Organizations
CFUGs	Community Forest User Groups
CIP	Community Irrigation Project
CSOs	Community Service Organizations
DADO	District Agriculture Development Office
DCC	District Coordination Committee
DDC	District Development Committee
DDRC	District Disaster Risk Reduction Committee
DEECC	District Environment and Energy Coordination Committee
DFO	District Forest Office/Officer
DFRS	Department of Forest Research and Survey
DSCO	District Soil Conservation Office/Officer
DSCWM	Department of Soil Conservation and Watershed Management
EAP	Emergency Action Plan
EIA	Environmental Impact Assessment
FEDWASUN	Federation of Drinking Water and Sanitation Users Nepal
FGD	Focus Group Discussion
GON	Government of Nepal
GP	*Gaun palika* or rural municipality (new federal administrative unit; formerly Village Development Committee)
IEE	Initial Environmental Examination

IRBM	Integrated River Basin Management
IUCN	International Union for Conservation of Nature
KII	Key Informant Interview
LAPA	Local Adaptation Plan of Action
LSGA	Local Self-Governance Act
MOE	Ministry of Energy
MOFSC	Ministry of Forest and Soil Conservation
MOAD	Ministry of Agriculture Development
MOE	Ministry of Environment
MOFALD	Ministry of Federal Affairs and Local Development,
MOI	Ministry of Irrigation
MOPPT	Ministry of Physical Planning and Transportation
MOFALD	Ministry of Federal Affairs and Local Development
MSC	Multi-stakeholder Consultation
NEFIN	Nepal Federation of Indigenous Nationalities
NFIWUAN	National Federation of Irrigation and Water Users' Association
NP	*Nagar palika* (new federal administrative unit; district level)
NPC	National Planning Commission
NRM	Natural resource management
PAANI	USAID Paani Program
USAID	United States Agency for International Development
VDC	Village Development Committee
WECS	Water and Energy Commission Secretariat
WWF	World Wildlife Fund

ACKNOWLEDGEMENTS

Water is the single most important natural resource underpinning Nepal's economy and livelihoods. Inclusive, sustainable management of water resources depends on strengthening community resilience and protecting healthy, biodiverse ecosystems in the face of both development and climate change.

This discussion draft watershed profile is the result of many people working together. Most significant were the generous contributions of time, thoughtful attention, and ideas of members of many community forest user groups (CFUGs), cooperatives, water user groups, and, especially, the communities dependent on aquatic biodiversity and local water management. Leaders of Jorayal, Chure, Badikedar, and Mohanyal rural municipalities and the newly elected local government bodies engaged deeply in the assessment and prioritization and committed themselves to collaborate and integrate the priority agenda into local planning processes.

The USAID Paani Program—युएसएड पानी परियोजना—is grateful for the privilege of having been invited to support the above efforts. The Paani Program (Paani) is a consortium of DAI, WWF, SILT, and NESS that works closely with Nepal's Water and Energy Commission Secretariat (WECS) and draws on the support of the WECS' member agencies. Paani enriched the watershed profile by compiling and reviewing secondary data and carrying out surveys to assess community perceptions and biophysical conditions. Thanks are also due for several other collaborating government agencies, civil society organizations, and federations for their consistent cooperation and contributions to prepare this watershed profile. These groups include NFIWUAN, FEDWASUN, NEFIN, MOE, MOFSC, MOAD, MOFALD, MOI, and MOPPT, who gave their full cooperation and support at the national, district and local levels. Any errors in this discussion document are those of the Paani team.

EXECUTIVE SUMMARY

This profile assesses the status, major challenges and opportunities for the management of multiple users and uses of water resources within the Rangun Khola watershed in Province No. 7 in far western Nepal.

The USAID Paani Program — also known as *Paani*, युएसएड पानी परियोजना— facilitated the preparation of this profile, in close coordination with the Government of Nepal (GON) and local stakeholders and with support from the United States Agency for International Development (USAID). Paani aims to increase the knowledge, engagement and benefits of local water users in target river basins to build local water resource management capacity.

This watershed profile provides critical baseline information for local governments, communities, civil society, and private sector stakeholders within the Rangun Khola watershed to strengthen water resource management in a way that benefits human development and protects the natural resource base upon which well-being depends. This profile also helps local stakeholders to design and test interventions to strengthen community resilience and conserve freshwater biodiversity, for which additional resources are available through the Paani local grants program.[1]

Rangun Khola is one of seven watersheds within the Mahakali River Basin (Figure 1). The watershed ranges in elevation from 2,500 m in the north, near the Mahabharat range, to 300 m along its southern reaches where the watershed flows into the Makakali River at Parshuramdham. The Rangun Khola watershed stretches across parts of Doti and Dadeldhura districts in far western Nepal, in Province No. 7, under Nepal's newly established federal structure.

[1] It should be noted here that the research for this watershed profile, and the other profiles under the Paani initiative, was conducted before and after the country elected to move to a federal system of government. This change means that former governmental units, such as village development committees (VDCs), will be gradually superseded by new units such as the municipality (*nagar palika)*, rural municipality (*gaun palika*) and province.

Watersheds as a unit of analysis do not align with past or current administrative units; however, as our research began and ended after this change, you will note references to both the new and old forms – VDC, gaun palika (GP) and nagar palika (NP). When we refer to liaising with or providing support to local governments, we are making reference to the units as assigned by the new federal system.

Watersheds occasionally sit within a single province, but more commonly extend across two provinces, which presents a particular incongruence when offering recommendations for action. However, for biological and socio-economic research, a watershed is optimal because it provides a discrete area in which to examine the effects of climate change and human-environmental interactions. As all rain water and snow melt drain toward a primary river in watershed, so does this area provide a unique record of environmental and socio-economic change.

Subsistence agriculture and small-scale livestock are the more common livelihood options in Rangun Khola, but declining production and limited opportunity for off-farm income activities have contributed to rising food insecurity in many households.

Major climate-induced hazards in the watershed include extreme rainfall events, which often precipitate flooding, river cutting, sand, and gravel deposition. Collectively, these events are affecting the availability of water, the quantity of water and water quality, all of which impact natural habitats for aquatic and terrestrial species.

Monsoon floods have exacted large economic losses in parts of Aalital, Shirsha, and Jodbudha rural municipalities. GON and donor agencies have implemented some river control practices in parts of Katal, Parigaun, Simalkhet, and Laldhunga; however, deforestation, soil erosion and river cutting continue to pose substantial threats to communities downstream. The District Soil Conservation Office (DSCO) has supported the Rangun Khola Control Master Plan since 2010.

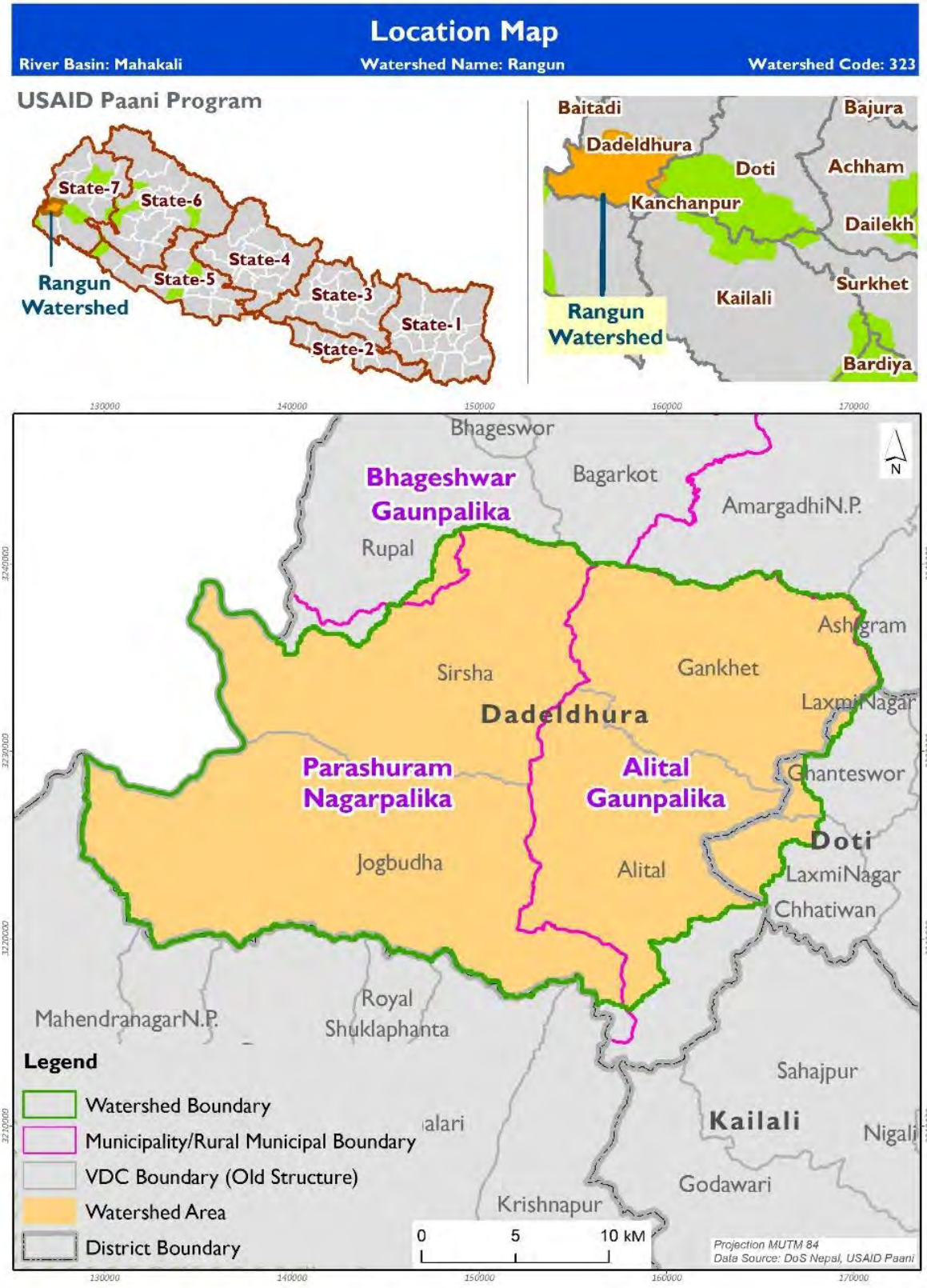

Figure 1: Map of the Rangun Khola watershed

As climate change impacts on water resource management are not yet perfectly understood, attempts are being made to analyze the links between fish population persistence and the livelihoods of fishing communities. In this report, we explore some of those links and identify specific threats to climate change adaptation and freshwater biodiversity in the Rangun Khola watershed.

Priority Issues and Challenges for the Rangun Khola Watershed

The following priority challenges in the Rangun Khola watershed were identified through a series of data collection methods, including a multi-stakeholder consultation (MSC) workshop, household surveys and field observations. The challenges are summarized in Table 1 and described below with recommendations for addressing each challenge.

Table 1: Priority issues for watershed health in the Rangun Khola watershed

SN	Priority Issue	Impacts
I	Flooding, landslides, soil erosion and river cutting	Loss or degradation of natural habitats reduces the amount of natural resources available for local populations, such as fish and water. Landslides and flooding exact loss of property, infrastructure and human life.
II	Drying water sources and water conflicts over drinking water and sanitation	As water sources dry up, there is less water available for drinking, sanitation, and agriculture. As a result, aquatic habitats are degraded. Additional investments are needed to improve water distribution and encourage adoption of modern technologies to improve efficiency of water use.
III	Declining fish stocks	In this watershed, capture fishery has not been reported an important issue; however, destructive fishing practices are reportedly depleting available fish stocks. Climate change and human-induced pressures are impacting aquatic conditions necessary for successful fish reproduction. Traditional fishing communities are particularly affected by these trends.
IV	Forest degradation, deforestation and illegal logging	Overharvesting of timber and non-timber forest products is negatively affecting livelihoods and food security. The loss of forest cover intensifies soil erosion, as root systems are needed to hold water and stabilize slopes in the rugged terrain of the watershed. Loss of forest also increases the likelihood of wildfires.

1. Flooding, landslides, soil erosion, and river cutting

Increasingly intense rainfall and increased soil erosion due to deforestation, agricultural production and infrastructure construction combine to intensify the conditions that lead to flooding and river cutting. These factors are disturbing natural habitats for aquatic animals and exact high costs from households

through property and asset (e.g., livestock) destruction (Figure 2). In this context, households in the Rangun Khola watershed are finding it more challenging to adapt to climate-resilient methods and technologies to improve their livelihoods.

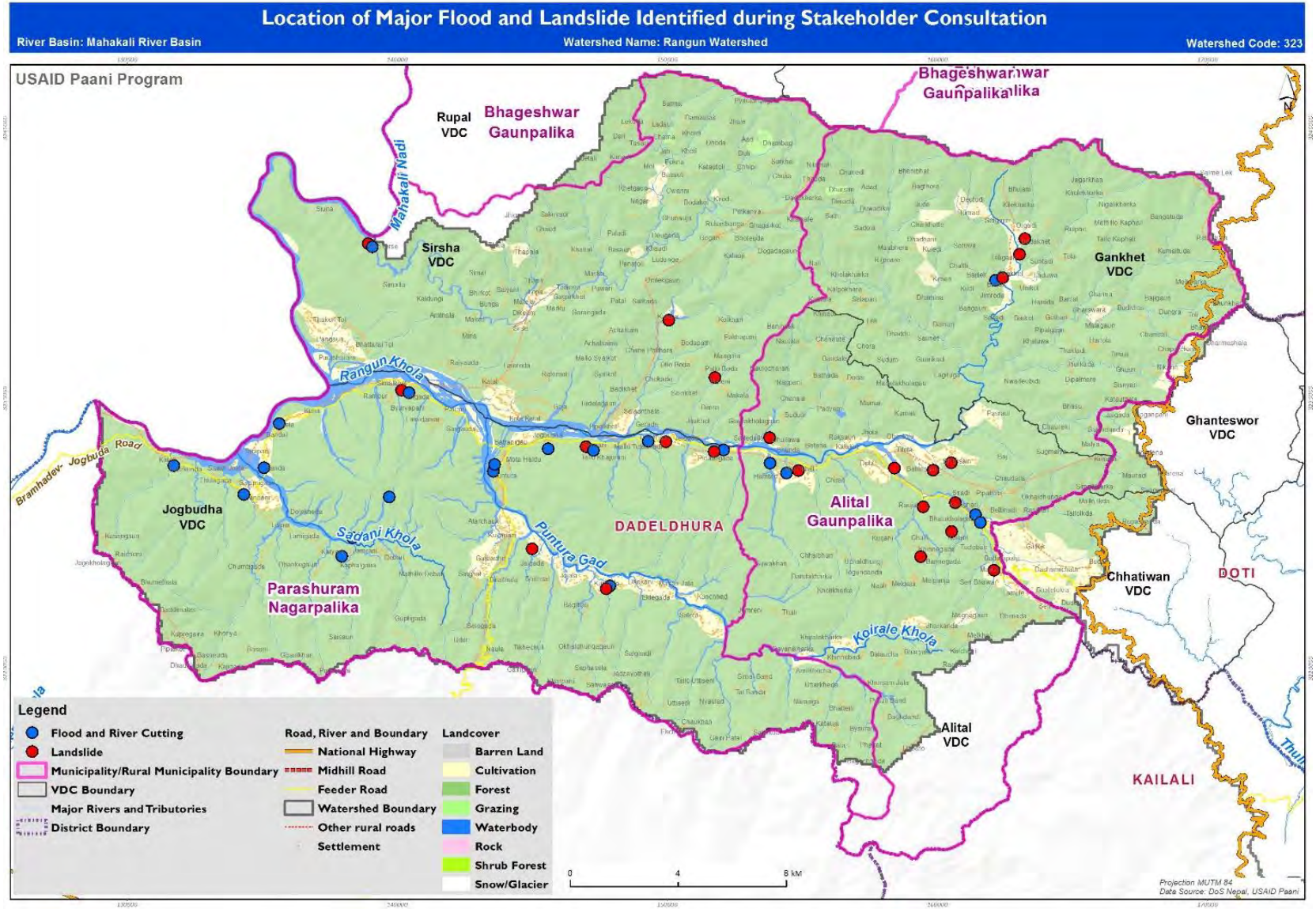

Figure 2: Map of major flood and landslide risk areas in Rangun Khola watershed

Recommendations

- Raise awareness among communities about the need for re-plantation and other sustainable forest management practices;
- Strengthen existing early warning systems, and install EWS where not yet available;
- Provide training and support for low-cost slope and riverbank stabilization techniques, such as check dams, embankments, spurs, bunds, eye-brow trenches, conservation ponds, and slope terracing; and
- Construct check dams, embankments, spurs, and bunds along major rivers and tributaries.

II. Drying water sources and water conflicts over drinking water and sanitation

Changing climatic trends are reducing spring water sources, diminishing the available water for drinking, irrigation and livestock. This reduction has inspired conflicts in some communities as households compete to acquire necessary water for daily needs. The lack of water also contributes to rising concerns about human health as related to sanitation.

Recommendations

- Preserve, protect and clean water sources; and
- Raise awareness about ensuring equitable access to water for all.

III. Declining fish stocks

Fish stocks are declining in the Rangun Khola watershed due to climate and human-related factors. On the climate side, changing temperatures are altering the river conditions necessary for aquatic life and reproduction. Human impacts on fish stocks include destructive fishing practices (e.g., gill nets) and improperly constructed roads and infrastructure that instigate landslides and intensify sedimentation, which eliminate fish holds and egg sanctuaries (Paani Focus Group Discussion Note, 2017).

Recommendations:

- Conduct a survey to develop a capture fishery database; and
- Encourage fishing groups to form and unify to discourage illegal fishing practices and raise awareness about destructive fishing practices.

IV. Forest degradation, deforestation, and illegal logging

Forests play a crucial role for storing and draining freshwater within a watershed. To adapt to the impacts of climate change, forests offer communities a strong resource for enhancing the health and vibrancy of their ecosystem by sequestering carbon in the soil, filtering water for consumption, and slowing water run-off to local rivers to support fish habitats. Within the Rangun Khola watershed, forest degradation, deforestation and illegal timber harvesting are threatening the effectiveness of these important forest ecosystem services.

Recommendations:

- Strengthen the capacity of local government agencies to implement and enforce existing forest-related policies and legislation;
- Raise awareness about the benefits of sustainable forest management practices; and
- Strengthen capacity of forest user committees to implement and monitor forest management plans.

IV. Declining fish stocks

In recent years, fish stocks are reportedly declining in the Rangun Khola watershed due to climate and human-related factors. On the climate side, changing temperatures are altering the river conditions necessary for aquatic life and reproduction. Human impacts on fish stocks include destructive fishing practices (e.g., gill nets) and improperly constructed roads and infrastructure that instigate landslides and intensify sedimentation, which eliminate fish holds and egg sanctuaries (Paani Focus Group Discussion Note, 2017).

Recommendations:

- Conduct a survey to develop a capture fishery database including fish habitat locations; and
- Encourage fishing groups to form and unify to discourage illegal fishing practices and raise awareness about destructive fishing practices.

Watershed Health Report

These priority issues are discussed more in this profile and outlined in the associated Rangun Khola watershed health report (link to be provided). The watershed health report portrays the current condition of the natural resources and the quality of ecosystem services available for community use. It identifies the drivers that pose threats to peoples' livelihoods, fresh water biodiversity and natural habitats. The health report provides relevant information to strengthen informed decisions, take action to protect and restore the watershed, and to reduce risks and create sustainable economic opportunities. The report also provides opportunities to identify the drivers of watershed health degradation and explore the options to mitigate, correct and prevent them timely for sustainable watershed management. The health report thus serves as a planning tool.

The Rangun Khola watershed health report was developed drawing on information gathered during the watershed profiling process. It was prepared based on secondary literature and information related to biophysical conditions, socio-economic characteristics, infrastructure, vulnerability and disaster risk, and freshwater biodiversity of the watershed and multi-stakeholder consultations (MSCs) in the watershed. During the MSCs, participants discussed and agreed upon indicators, groups impacted by issues, and locations of issues within the watershed. The watershed health report contains a scoresheet with each issue ranked according to threat level (e.g., high, medium and low). Draft health reports have been shared with key stakeholders, including government line agencies, civil society organizations (CSOs) and local governments for their feedback before finalization.

A more detailed description of the report and its methodology can be found in Annex 1: Methodology.

1. RANGUN KHOLA WATERSHED: NATURE, WEALTH AND POWER

The Rangun Khola watershed profile is organized around three interrelated themes that influence the management and overall health of the watershed: nature (environment and natural resources), wealth (socioeconomics and infrastructure—the many ways that people **use** nature), and power (governance and institutions—the ways that the different people and groups **make decisions** together about the watershed and its uses)[2]. The analysis draws on multiple data sets associated with these themes to identify critical issues and opportunities for this watershed. We introduce this watershed in terms of its local natural and social dimensions. Then we examine how climate change and other drivers threaten and impact local livelihoods and biodiversity.

In 2016-17, the Paani program conducted a series of literature reviews, household surveys, focus group discussions (FGDs), and key informant interviews to characterize the watersheds, including the identification of priority threats and opportunities. Through exit workshops the Paani team shared preliminary results with multiple stakeholders, based on which priority issues and environmental assets were identified by location and impact groups. During the exit workshop, the Paani team also identified champions among stakeholders and local government agencies for leveraging funds and expertise to support water resources management initiatives.

Paani took the critical feedback and suggestions to identify priority issues and actions (Section 8), and with the participants, developed a 20-year vison for improving watershed management. The representatives of newly-elected local bodies also expressed eagerness to allocate their resources in support of activities in all aspects of watershed conservation.

Related annexes
Annex 1: Methodology

[2] The full text from which this report's structure was taken (NATURE, WEALTH, & POWER 2.0: Leveraging Natural and Social Capital for Resilient Development) is available here: https://rmportal.net/library/content/nwp-2.0

2. NATURE

In this section, we review the status of the environment and natural resources in the Rangun Khola watershed, paying special note to trends and changes that may threaten the health and sustainability of these assets.

2.1 RANGUN KHOLA WATERSHED

The Rangun Khola watershed is one of seven in the Mahakali River Basin and stretches across parts of Doti and Dadeldhura districts in far western Nepal in Province No. 7 under Nepal's newly established federal structure (Figure 3). The watershed ranges in elevation from 2,500 m in the north, near the Mahabharat range, to 300 m along its southern reaches, where the watershed flows into the Makakali River at Parshuramdham.

The watershed is 687 km^2 and ranges from a tropical climate in the south to temperate in the north. The geology of the watershed is characterized by mountain ridges comprised of Precambrian augend and banded gneiss and various mixtures of mica-schist and phyllite. The higher peaks of the watershed belong to the Mahabharat Range. An active fault passes close to the main boundary thrust and runs through Budar, Alital and Kalena.

The Rangun Khola watershed is fed by many tributaries that empty into the Rangun Khola, which is the main drainage channel for the watershed. The Rangun Khola joins the Puntura Khola before draining into the Mahakali River downstream, which ultimately joins the Karnali River in India. Extensive distribution of river gravel deposition is one of the characteristic features of the watershed.

The watershed includes all of Parshuram *Nagar Palika* and Alital rural municipality in Dadeldhura district, and Jorayal rural municipality in Doti district.[3] To the west, the watershed borders Uttarakhand in India, and Kanchanpur district in Nepal to the south.

Despite numerous rivers and streams in the watershed, water distribution is uneven and several places are considered water scarce, including Bantal, Gothana, Baseli and Gallek. Forests, water and agricultural land are considered the major resources of the watershed. The modalities of forest include community forest, national forest, leasehold, and religious. The agricultural land supports seasonal and off-season fruits and vegetables.

The watershed is populated predominately by Chhetris (66%), followed by Brahmins (10%), Janajatis (9%) and Dalits (15%). Janajati groups are primarily Magar, Tharu and Gurung. Agriculture is the dominant form of livelihood, although migration abroad and within Nepal for employment is becoming more common.

[3] Parshuram NP was formerly Jodbudha and Sirsha VDCs, prior to the federal system, and Alital rural municipality was formerly Alital and Gankhet VDCs. Jorayal rural municipality was formerly Chhatiwan and Ghanteshwar VDCs in Doti.

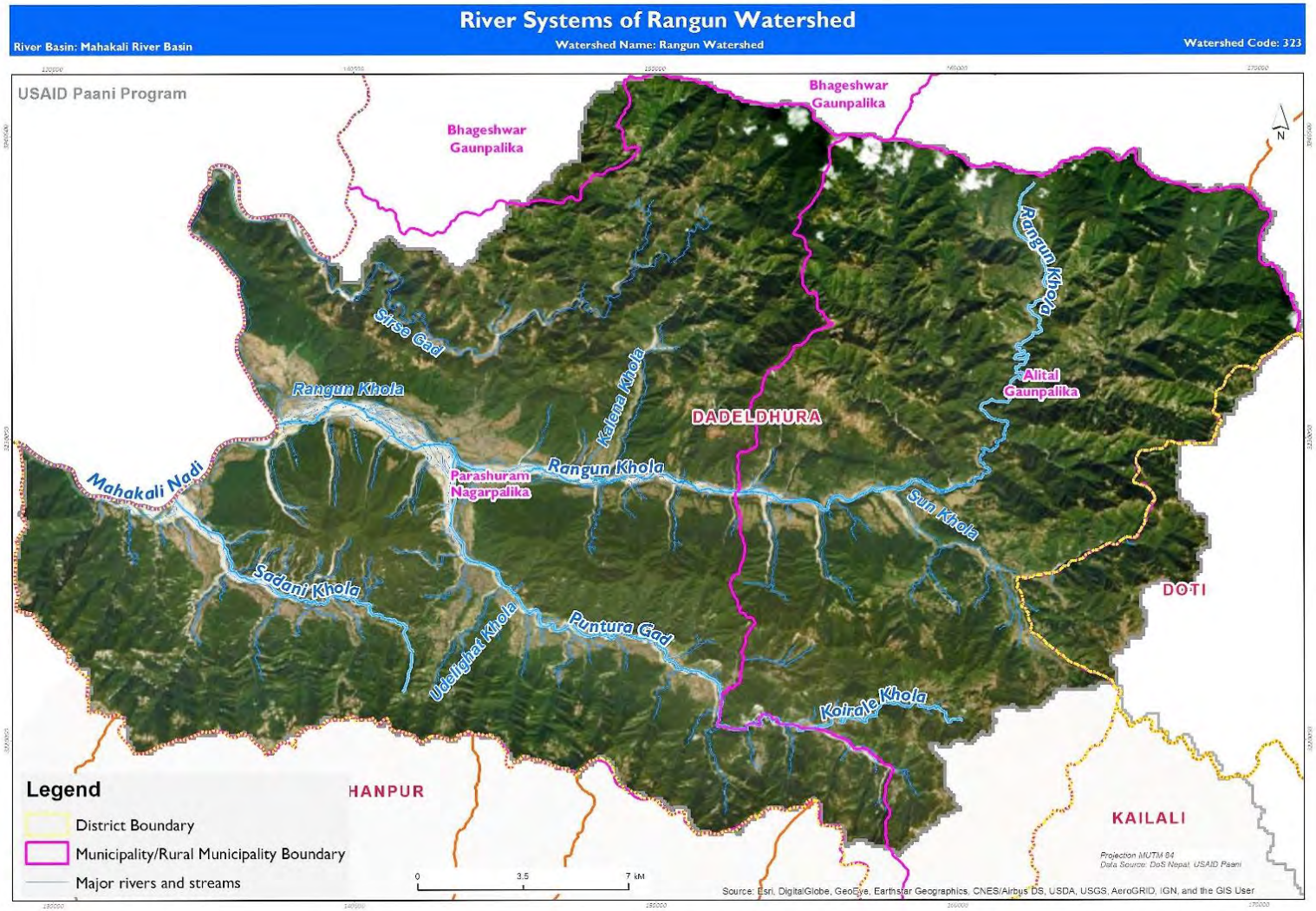

Figure 3: Map of Rangun Khola watershed featuring its major rivers

Related annexes

Annex 2: Land use and land cover

Annex 3: Population

2.2 WATER AVAILABILITY AND QUALITY

The Rangun Khola watershed is a complex network of rivers and streams – a total of five river systems (Annex 5) that include 135 streams. The total area under river and stream is 23.7 km^2 while lakes and ponds cover 0.07 km^2. The total drainage density of the network is 1,433 km^3.

To access water, most households have piped water (76%), followed by surface water collection (20%), dug wells (3%) and tube-well boring (1%). Uses of water are primarily domestic and agricultural, while a smaller portion is reserved for livestock and construction purposes. Despite the numerous rivers and streams in the watershed, surveys found that 23% of households required more than 30 minutes per day to collect sufficient water for daily needs. Of this 23%, 67% are Brahmin/Chhetri/Thakuri, 22% are Janajati and 6% Dalit.

Eighty-six percent of respondents reported having equal access to water, while more than 80% said they were facing difficulty in accessing water due to drying water sources. Only six percent of households reported the local drinking water quality as "good." Biophysical test results reveal that water quality of the Rangun Khola and its tributaries is suitable for irrigation and domestic use.

As in many parts of the Nepal, water, lakes and rivers hold a sacred significance in the communities of the Rangun Khola watershed. The Parshuramdham Temple at the confluence of the Rangun Khola and Mahakali Rivers draws large numbers of pilgrims each year for Maghe Sankranti festival. Many surveyed households described the value of fish and water in their daily rituals.

Focus group discussions (FGDs) revealed that women bear most of the burden for collecting daily water, a task that over time can accelerate physical ailments, particularly in the back and abdomen.

Water discharge in five tributaries in Rangun Khola watershed was estimated using the floating method and area velocity during a biophysical survey on the availability of water from April to May 2017 (Table 2).

Table 2: River and stream discharge rates in the Rangun Khola watershed

Name of Rivers / Streams	Latitude	Longitude	Elevation (m)	Date of measurement	Estimated Discharge (L/S)
Sandani Khola	29.1126	80.2486	268.83	11-Apr-2017	194
Puntura Khola	29.1269	80.3330	337.95	12-Apr-2017	700
Rangun Khola (1ST Part)	-	-	-	11-Apr-2017	1,195
Rangun Khola (2nd Part)	29.1478	80.2780	263.24	11-Apr-2017	1,090
Bantal Khola	29.1745	80.5538	935.24	10-Apr-2017	338

Water quality in the watershed was determined by testing a range of parameters, including pH, nitrate nitrogen, ammonium and phosphate. All were found to be in the normal range for drinking, domestic use and irrigation. Ammonium and phosphate levels were found to be slightly elevated in the Puntura and Bantal Kholas. The water was sampled at several locations in the watershed using an Akvo Caddisfly kit.

Related annexes

Annex 5: Lakes, streams, rivers, and sub-watersheds
Annex 12: Micro hydropower – potential rivers and streams
Annex 13: Irrigation projects
Annex 14: Water quality

2.3 LAND USE AND LAND COVER

Forest covers 91% of the total area in the Rangun Khola watershed followed by 6% for agriculture, 2% for grazing, and the remaining 1% covered by water bodies. The forest is the major natural resource of the watershed comprised primarily of Chir pine and Quercus trees in the northern parts and Sal and mixed hardwoods in the south (Figure 4). The forest is located in the Churia region of Nepal, a geological formation known for its fragility and tendency for floods and landslides. For this reason, conservation of forests, Churia and aquatic biodiversity are closely linked.

Despite the significant forest coverage in the watershed, loss and gain data from Global Forest Watch (Figure 5) from 2000-2016 shows that forest cover has decreased 546 hectares (ha) in some areas (1%) while 121 ha (0.2%) have been added in other parts. Looking more closely at Figure 5, we can see that large patches of forest loss have been reported along the peripheries of the Rangun Khola, Sandani Khola, and Puntaragaad.

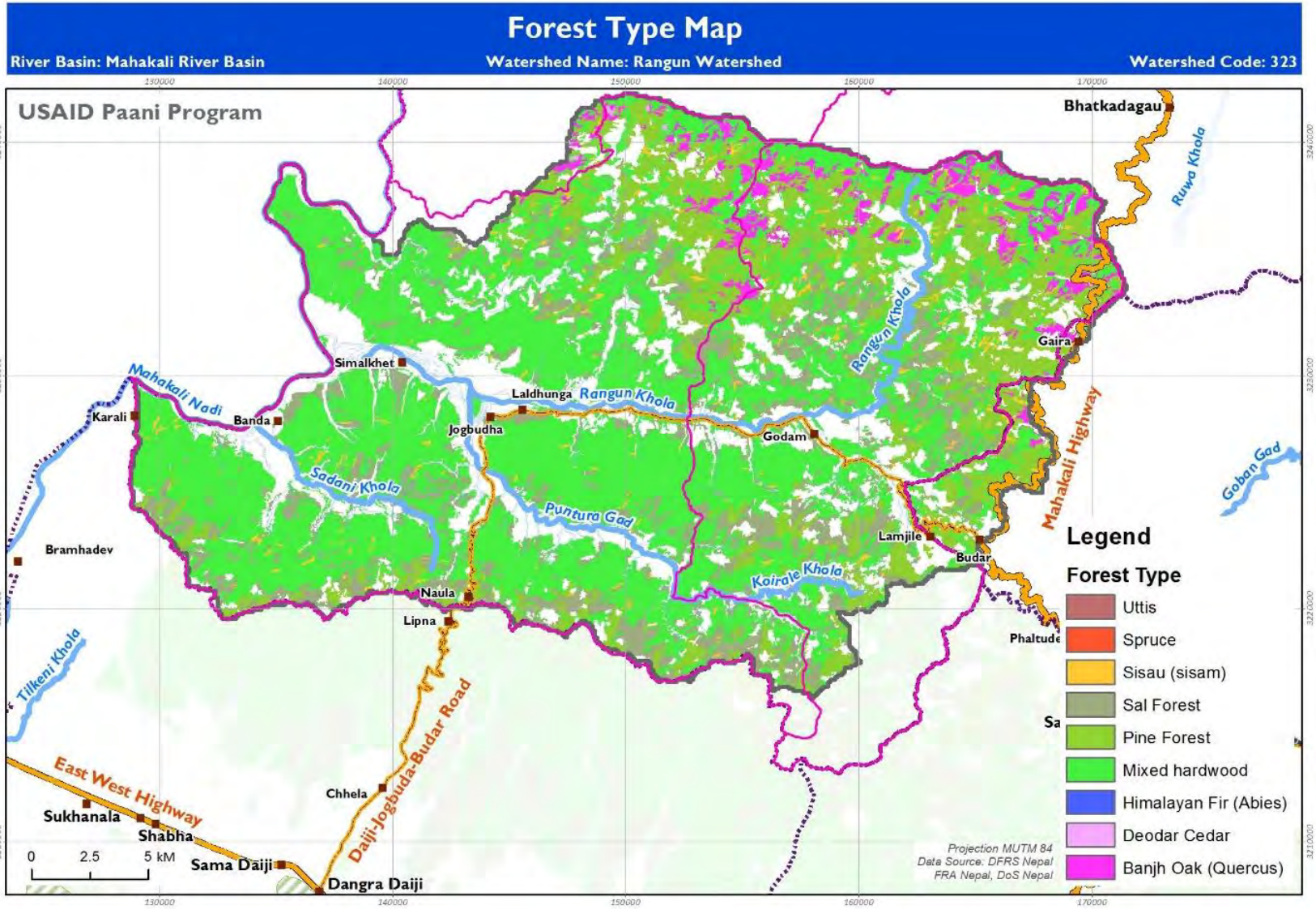

Figure 4: Forest cover and type in the Rangun Khola watershed

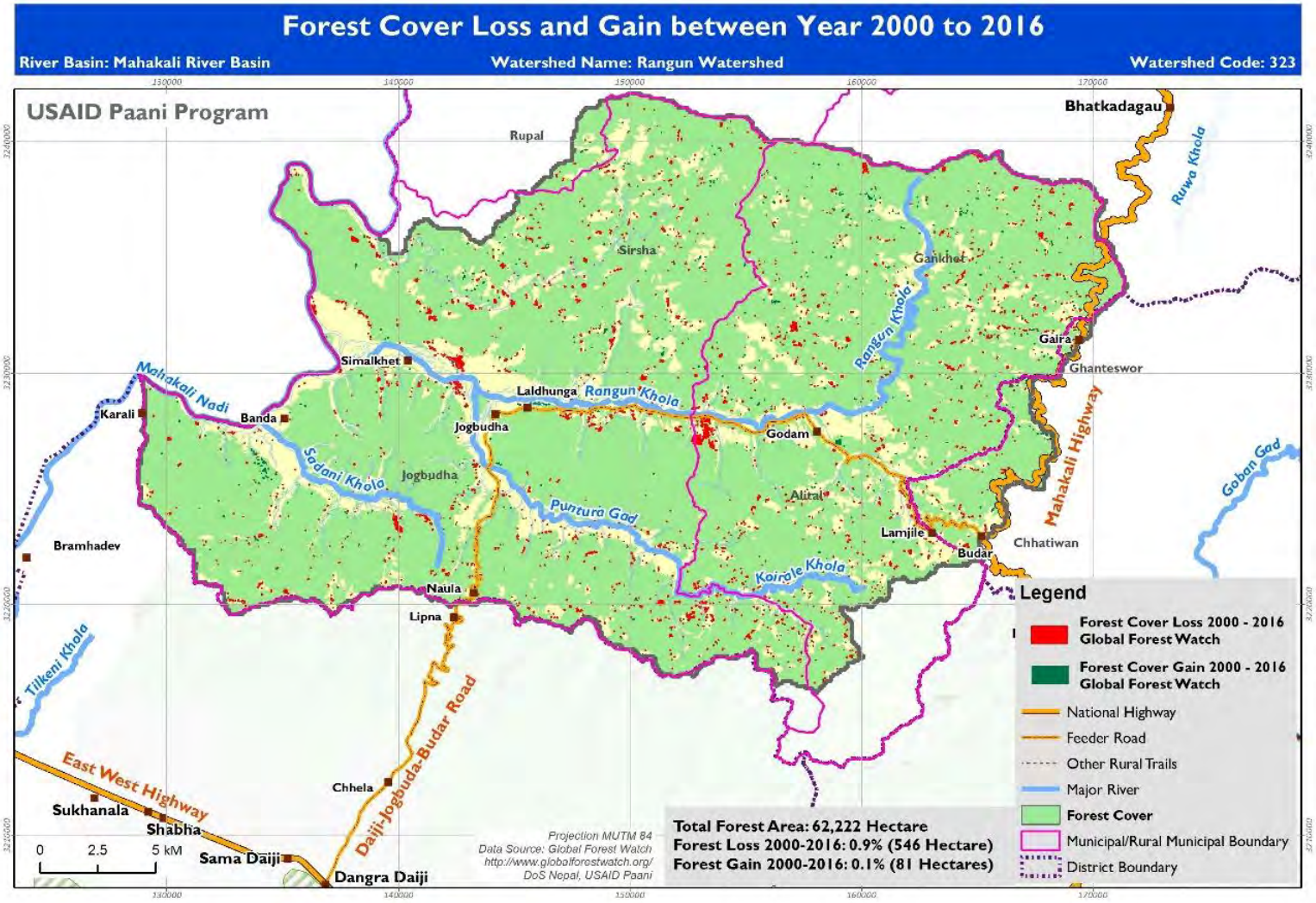

Figure 5: Forest loss and gain in the Rangun Khola watershed

Related annexes

Annex 6: Forest types and composition

2.4 BIODIVERSITY AND INVASIVE SPECIES

The Rangun Khola watershed contains numerous and diverse habitats for terrestrial species among its numerous forests, rangelands and wetlands. The forests are dominated by pine (*pinus roxburgii*) and mixed broad-leaved trees including sal (*shorea robusta*) in lower altitudes and quercus at higher elevations.

The biodiversity of the watershed is supported by not only forests but also some rangelands and wetlands. Numerous species of mammals, birds, reptiles and amphibians can be found across the region. Thirteen species of fish were reported including snow trout (*schizothorax spp*), *katle* (*acrossocheilus spp)*, *sahar* (*tor tor*), etc.

The lakes and wetlands in Rangun Khola host a variety of aquatic plant species – some floating (e.g., *pistia stratiotes, nelumbo nucifera, nymphoides indica, nymphoides hydrophyllum*, *chara*) and others waterside species (e.g., *equisetum diffusum, dryopteris cochleata* and *phragmites karka*).

Invasive species in the watershed at present is a lesser concern among residents. Only 7% reported having seen new plant species in the watershed, and only 1% reported non-native fish.

Related annexes

Annex 7: Fish and aquatic life
Annex 8: Mammals and population trend
Annex 9: Reptiles and population trend
Annex 10: Birds and population trend

2.5 CLIMATE AND PHYSIOGRAPHY

There are four prominent climatic seasons in Nepal: winter (December-February), spring/pre-monsoon (March-May), summer/monsoon (June-September) and autumn/post-monsoon (October-November). Temperature and rainfall variations persist not only by season but also by altitudinal gradients.

2.5.1 RAINFALL

Rainfall stations are sparse in the Rangun Khola watershed; therefore, we combine historical data with the nearest available stations to arrive at figures and estimates. We compared observed rainfall at Jodbudha (located in Rangun Khola) against data from rainfall stations at Dadeldhura, Kola Gaun, and Mahendranagar (slightly outside the watershed; see Annex 15 for details). Figure 6 shows the estimated monthly rainfall (the solid blue line) using these sources.

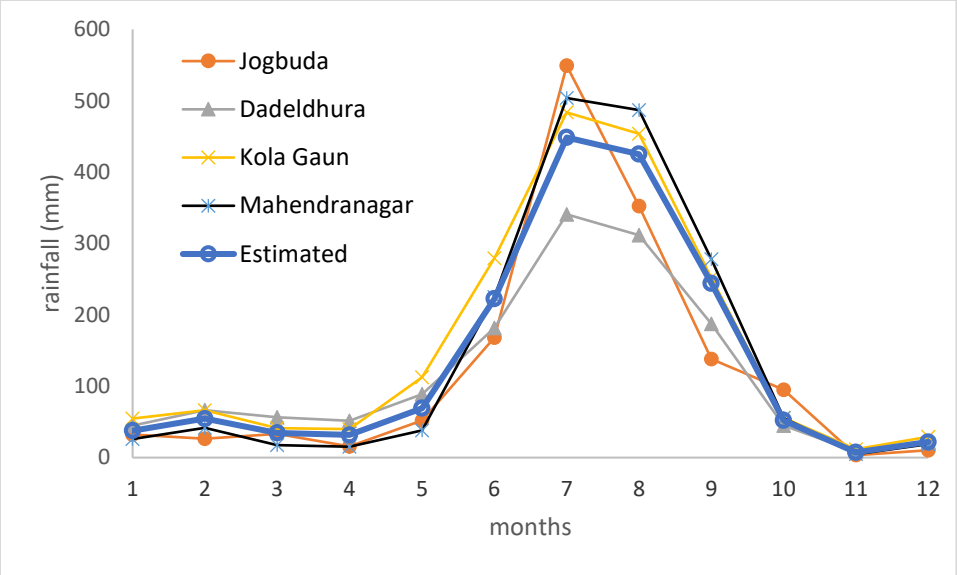

Figure 6: Long-term average monthly rainfall (in mm) estimated in Rangun Khola watershed

The annual average rainfall in the watershed is 1,346.6 mm, with the highest amount falling in the month of July (448.4 mm) and the lowest in November (7.3 mm).

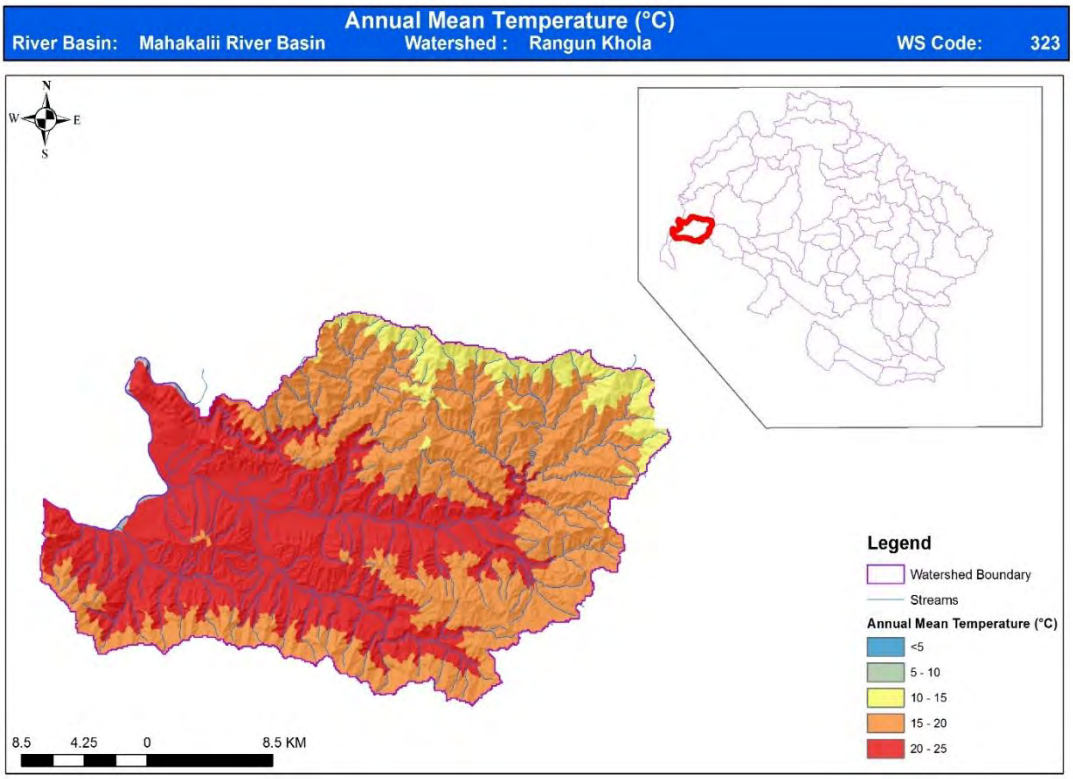

Figure 7: Mean annual temperature (°C) distribution in the Rangun Khola watershed

2.5.2 TEMPERATURE

Air temperature varies by altitudinal gradients. The average annual high temperature for the watershed is 25ºC, while the low average annual temperature is 10ºC. For mean annual temperature distribution in Rangun Khola, see Figure 7.

As with rainfall data, temperature stations are scarce in Rangun Khola; thus, figures and estimates are derived through information at the nearest available stations in Dadeldhura, Mahendranagar, and the Dhangadi Airport. In addition to the seasonal temperature variation, which is expected, differences in topography also induce spatial variations of temperature. In Figure 5, the annual mean temperatures reflect the sharp topography of the watershed from north to south within the temperature zone (10-15ºC) swiftly shifting to a sub-tropical climate (20-25ºC) in the south where the watershed meets the Mahakali River.

2.6 CLIMATE RESILIENCE AND DISASTER RISK REDUCTION

Increased human activity combined with climate change impacts is escalating environmental degradation in many parts of the Rangun Khola watershed, and, in some cases, increasing the likelihood and intensifying the effects of natural hazards such as floods and landslides (Table 4). In this context, watershed residents are beginning to realize the importance of climate resilient activities to fortify their livelihoods in the short- and long-terms. Twenty-five percent of households said they had adopted practices to adapt to changes brought by climate variability, including tree planting, water source protection, sprinkler irrigation, solar pump irrigation, and rainwater harvesting, among others.

The District Disaster Preparedness and Response Plan from Dadeldhura (2017) cites Parshuram and Alital VDCs as high risk, while Gankhet VDC was rated medium risk for a range of hazards, including floods, drought, landslides, and forest fires (Figure 8).

Early warnings systems (EWS) to inform households of impending disasters are uncommon. Only one EWS has been established in Rangun Khola along the Mahakali River at Parigaon and Shirshagad, and this system informs only part of the watershed. The District Administrative Office (DAO) alerts communities of landslides and potential flood conditions through SMS, radio, mobile phones and newspapers. These alerts typically run for 24 hours during which the DAO mobilizes security personal for potential rescue and response efforts, and to help households relocate to high ground.

Only 14% of households in Rangun Khola said they had access to EWS information. Of that 14%, 92% reported they had equal access to that information as compared to other social groups.

Table 3: Vulnerability ratings for selected GPs, NPs or previous VDCs

Climatic hazards	Vulnerability	Locations	
		Dadeldhura	Doti
Climate and water induced hazards (flooding, soil erosion, river cutting and landslides)	Very high	Kurmulle, Kauchhadi, Dhakani, Kainpani, Motahaldu, Tulabhadi, Chandani, Sisamjhala, Karali, Tatapani, Saleta, Jogbudha, Puntura, Katauthala, Sela, Lekgaon, Kaptola, Baseli, Parigaon,	Gallek
Forest fires	High	Hagulte, Katal, Shirsha, Kolkhan, Bodapathi, Saleta, Kurmulle	Dharapani
Invasive species in lakes and natural ponds	Low	Alital-3, Gharelu, Godam, Kunda, Simalkhet, Dangsera	Buder, Dharapani
Drying water sources	High	Sandani-7, Jamreni-8, Gaibandhe-9, Kunda-6, Majhpani-12, Damar-6, Rampur-6, Bandachhela-6, Khajurani-12, Malash-11, Saisan-11, Simalbanda-11, Patali-11, Naula-7, Bannegada-7, Jamarkhali, Patal-7, Kataunja, Uttarkheda, Rajyauda, Malash, Baddimalash	Buder, Gallek

Gender and Social Inclusion (GESI) issues: In the Rangun Khola watershed, women bear primary responsibility for water collection. Due to the very physical nature of this work, many women complain about associated physical complications such as back and abdominal pain, and prolapsed uteri.

Differential access to water further complicates this situation, as women from marginalized groups are most profoundly affected. Ten percent of Janajati, 13% of Brahmin/Chhetri/Thakuri, and 22% of Dalits reported unequal access to water in their communities. When asked about barriers to access, 68% of respondents cited long distances to water as the primary barrier, while 64% said caste-based discrimination was also a significant obstacle.

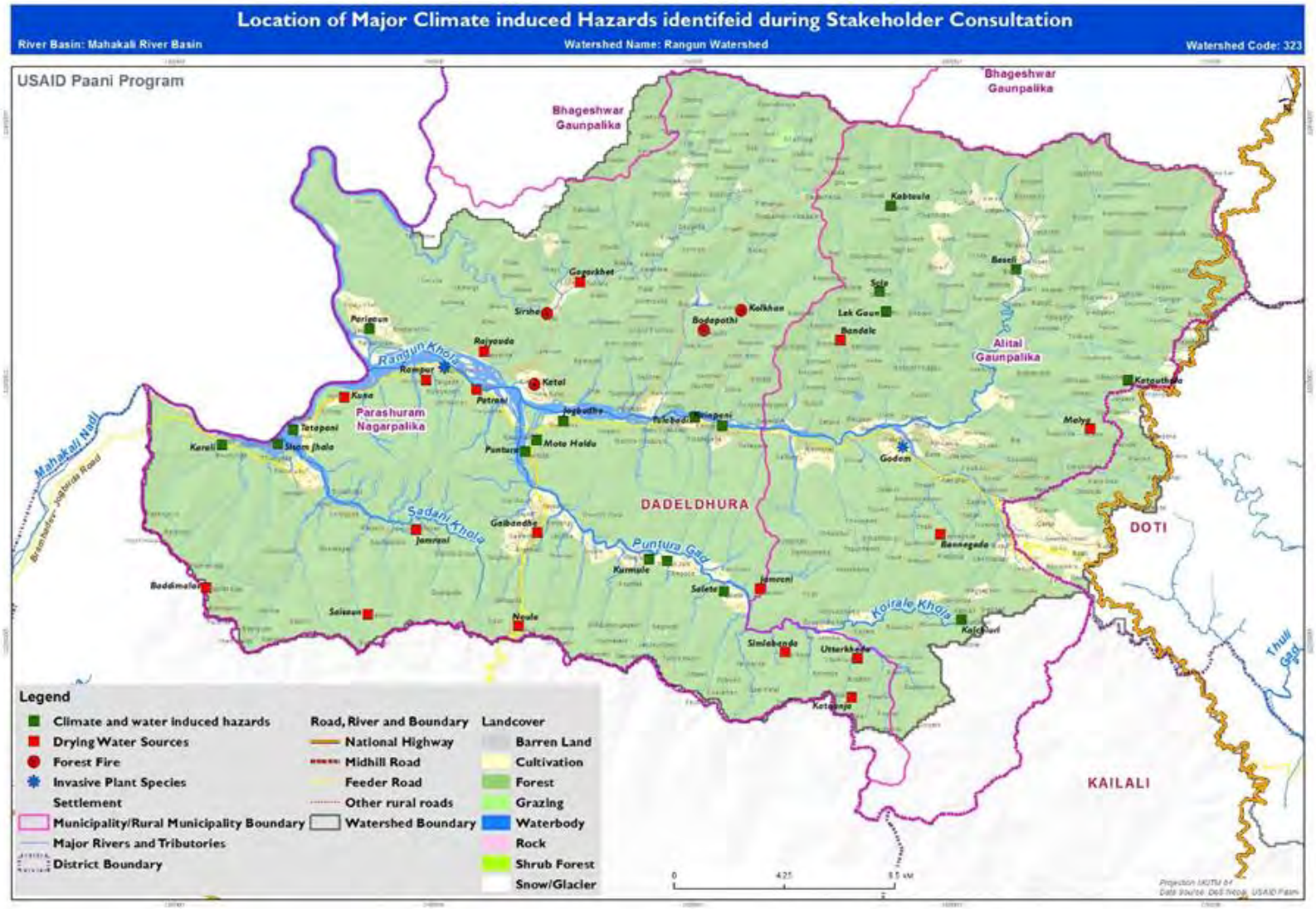

Figure 8: Locations of major natural hazards in the Rangun Khola watershed

3. WEALTH

The population of the Rangun Khola watershed is 53,109 (CBS, 2015), of which 52% are female and 48% are male. The population density is 77 people per km^2 and concentrated in small urban settlements such as Jogbudha, Katal, Parigaon, Godam, Gharelu, Buder and Gaira. Seventy percent of the population identifies as high-caste; i.e., Brahmin, Chhetri or Thakuri. Fifteen percent identify as Dalit and 10% as Janajati. The major Janajati groups in the watershed include Magar, Thuru and Gurung, all of whom are heavily engaged in fishing. The population of the watershed is growing due to in-migration of hill tribes from the uphill areas.

Agriculture is the primary source of livelihood in Rangun Khola. Soil is fertile throughout the watershed and suitable for cereal crops of many variations. Many households necessarily diversify their income sources to protect against shocks and setbacks by raising livestock, poultry, and migrating for labor (seasonally and abroad). Fishing is the most common secondary income source for Janajati households.

GESI issues: Government authorities are working to create better opportunities for women to earn more income through craft production and selling value-added agricultural products. While women have access to these resources, they continue to be excluded from money management decisions in the household.

Road construction in the watershed would provide an opportunity for additional income, but the reliance on heavy equipment as opposed to manual labor prevents local residents from acquiring these jobs. For the jobs available in road construction, Dalit persons claim they are often discriminated against in hiring processes.

The Raute, a nomadic group in western Nepal, have traditionally relied on woodworking as a livelihood, but declines in demand for these products have made them increasingly vulnerable. New livelihood options for Raute include gravel mining and timber cutting, but this work is neither reliable nor consistent. As a nomadic group, most Raute are landless and the government developed a program to distribute 1.5 bigha of land to each Raute family. But few Raute households accepted the offer.

Per a NFIWUAN survey in 2017, only 41% of households held a bank account in a recognized financial institution. In the watershed, there are only eight banking centers located in Godam and Jogbudha. Of those families holding a bank account, 66% are Brahmin/Chhetri/Thakuri, 18% are Janajati, and 15% are Dalit.

To bolster livelihood security, we observed several climate-smart technologies in use in the Rangun Khola watershed. These technologies include water harvesting ponds, multi-use water systems, solar and/or gravity water pumps, check dams, and Napier grass cultivation for the dry season.

3.1 FISHING PRACTICES

Fishing in the watershed is characterized by traditional and non-traditional practices. Commonly used traditional methods include net casting, gill nets, fishing hooks, draining water, and trapping fish in rice paddies. In recent years, however, harmful non-traditional methods (e.g., poison and explosives) are becoming more popular and causing fish populations to decline.

Nearly 4% of the population in Rangun Khola hails from traditional fishing communities, such as Badi and Tharu. Forty-one percent of these fishing communities are located in Alital GP and 12% in Parshuram NP, with the rest scattered around the southern portion of the watershed. None of these fishing groups is formally registered with local government offices.

This lack of official organization bodes poorly for fish conservation, as formal fishing groups could be encouraged to monitor and regulate aquatic habitats to improve long-term sustainability of fish stocks.

Community interest in fishing as a livelihood has declined as traditional fishing households carry 50 kgs and less per year. Women from fishing communities do participate but only alongside the men.

Fifty-three percent of households reported declining fish numbers in nearby rivers over the past decade. They attributed the decline to the decrease in forest cover, which has increased the number of landslides in the area. The landslides often destroy fish holes in rivers and lakes necessary for reproduction. The snow trout and *sandani* species of fish were cited as particularly affected by the drying of water sources in the hills at the river headwaters.

Fish are harvested primarily for household consumption, and surplus catch (rare) is sold locally. Dried fish is sold in area markets during higher than average harvest seasons.

3.2 AGRICULTURE PRODUCTIVITY

Agriculture is the primary livelihood in the Rangun Khola watershed, and the warm climate and fertile soil make this region one of the most productive in western Nepal. Six percent of the land in Rangun Khola is under cultivation.

Major crops include rice, wheat, maize, millet, barley, buckwheat, mustard, potato, tobacco, lentils and soybeans. Almost 83% of households reported declines in agricultural production resulting from climate change and human-induced pressures on the environment. These declines have made food security an increasingly precarious challenge (Table 4).

Table 4: Food security levels by household

Food sufficiency level	Households	Percentage
Less than 3 months	93	35.09
3 to less than 6 months	83	31.32
6 to less than 9 months	43	21.37
9 to less than 12 months	45	16.98
12 months or more	-	-
Total	**306**	**100**

Source: Paani Household Survey 2017

Irrigation at present plays only a minor role in agricultural productive and tends to be a seasonal option in most cases. Only 17.6% of households said they relied on irrigation year-round. For technical assistance, farmers can appeal to several local line agencies such as the Agriculture Services Center (ASC) and Livestock Service Center (LSC) located in Jogbudha and Godam, respectively.

Surplus production for market sale is taken to a collection center in either Godam, Gaira, Gharelu or Jogbudha, from where it is transported to larger outlets in Dhangadhi, Mahendrangar and parts of India.

Several community-managed seed banks (in Gaira, Buder, Godam and Jogbudha) sell high-quality seed to local farmers.

3.2.1 SOIL MANAGEMENT AND FERTILITY

A large majority of households expressed concern about soil fertility in the Rangun Khola watershed: 83% say climate change has led to decreased soil fertility over the past decade. Other households are concerned that traditional links between forest, livestock and cropping systems are breaking down due to climate change impacts. To cope with these changes, many famers have begun opting for chemical fertilizers instead of traditional manures, while other farms use both.

Deforestation, habitat degradation, over grazing, non-point source pollution and agricultural runoff were listed as additional threats to soil fertility. Agricultural runoff, in particular, was cited as problematic due to increasing soil erosion combined with the steep topography of the watershed. Many households said improved access to agricultural inputs and modern farming technologies could help restore soil fertility, as it is more difficult to secure reliable farm labor due to migration.

Agricultural run-off is a serious concern in the watershed. The steep hillsides can precipitate flash flooding during the monsoon and periods of erratic rainfall, which increases soil erosion and lower soil fertility.

According to the Soil and Water Conservation Act (1982), the government holds authority to declare watershed areas as "protected" and to implement conservation measures in these areas through participatory action. The Act recommends that local governments plan and implement poverty alleviation programs to discourage unsustainable production on available lands. Though the objectives of

the Act promote long-term holistic planning to improve soil and water, implementation of the legislation has lagged behind intention.

3.3 INFRASTRUCTURE

The design and construction of infrastructure, such as roads and hydropower plants, has an impact on the health of the watershed. For example, poorly designed rural roads on steep slopes can greatly increase soil erosion and landslides. Similarly, hydropower plants that divert or impound water will restrict the amount of water available for aquatic life that people depend on for their livelihoods. Irrigation canals, while bringing benefits to one group of farmers, can also reduce the amount of water available to other farmer populations. As demonstrated by these examples, it is important that the design, construction and operation of infrastructure projects account for the full range of social, economic, and environmental factors within the watershed. Sustainable infrastructure should provide equitable distribution of benefits with minimal long-term, environmental impacts.

3.3.1 HYDROPOWER

No large hydropower projects operate nor are planned for the watershed, but five micro-hydro plants are operational (Gairagaon, Makail, Sirshagad, Ashurani, and Dahagad) and two others are nearing construction completion (Sankhola and Selakhola). Initial assessments show that some level of interaction exists between micro-hydro power plants and proximate aquatic biodiversity, but further studies are required to understand this problem more clearly.

Related annexes

Annex 12: Micro hydro – potential rivers and streams

3.3.2 GRAVEL MINING AND CONSTRUCTION MATERIALS

Gravel mining is not a serious issue in the Rangun Khola watershed at present, but currently in practice on the Puntura, Sunkhola, and Sandani rivers. Material from these locations are taken to Jogbudha, Parigaon, Katal, Gharelu, Godam and Buder for construction of roads, houses and irrigation canals.

However, gravel mining should be monitored to maintain sustainable levels – for example, by removing excess stones and boulders each year to lower the river water levels and minimize other disaster risk impacts, but not so much that aquatic life is affected by removal.

3.3.3 ROADS

The Rangun Khola watershed contains 167 km of earthen and gravel roads (Annex 11); none of it is black topped. Seventy-nine kilometers of that road was constructed under the Village Road Core Network and the remainder constructed under the District Road Core Network.

Household surveys and observation revealed that most roads had been constructed without proper environmental assessment prior to building. This type of road construction causes severe environmental degradation by intensifying the conditions prone to landslides and/or flooding. Heavy load excavators are increasing the amount of sedimentation that reaches the rivers.

The Office of Water Induced Disaster Prevention in Dhangadhi is currently working to encourage building bunds, spurs and embankments along the Rangun Khola and Puntura rivers to minimize the effects of road construction along these waterways.

While roads undoubtedly serve to spur economic development, poor road construction can negate those gains by increasing the environmental costs to acquire that development.

GESI issues: Rural road construction is pervasive throughout the watershed, and heavy equipment is being used to accelerate construction. The reliance on machinery for road construction means local persons are deprived of a potential employment opportunity. When local persons are hired for road construction projects, Dalits, Janajati, and women are often excluded in the hiring processes.

Related annexes
Annex 11: Road networks in the Rangun Khola watershed

3.3.4 IRRIGATION

While irrigation is necessary to improve livelihoods and economic development in the watershed, the amount of water diverted directly affects aquatic life. Keeping minimum flows intact is crucial to maintain watershed health. GON requires environmental assessments for medium and large projects (>300 ha) but not for smaller schemes.

There are 14 irrigation projects within the Rangun Khola watershed, but these are highly affected at present by the availability of water around the year. Two projects (Upper Parigaon and Sandani) are currently inoperative due to insufficient water.

Irrigation schemes and user groups appear to be inclusive in Rangun Khola, as women, Dalit and persons from other marginalized groups were observed to be present and participating. However, their level of authority and role in decision-making regarding irrigation matters is less known.

In spite of irrigation available in many parts of the watershed, many Dalits and Janajati cannot benefit from these schemes as they are landless. Furthermore, few Janajati and Dalits were employed to help construct these projects.

Related annexes
Annex 13: Irrigation projects

3.4 SOLID WASTE AND MANAGEMENT

Solid waste (e.g., garbage, plastics) in the watershed emanates from a number of sources, and the lack of personal and village-wide sanitation systems threatens water quality and aquatic life. In Rangun Khola, rural markets and settlements at Parigoan, Katal, Jogbudha, Ampani, Kainpani, Godam, Gharelu, Buder, and Gaira are becoming increasingly polluted due to unregulated sewage disposal from households and local businesses. Open defecation near streams and cemeteries (at Parigaon, especially) are a reported problem.

However, household toilet sanitation is effective in Rangun Khola, as 97% of homes use a toilet for defection. However, unregulated disposal of trash was observed throughout the watershed, not only in the urban areas.

Non-point source pollution includes chemical fertilizers, urban wastewater, and runoff from forests, barren land, and mining sites. Individual communities each face their own specific challenges (Annex 16) in terms of common cemeteries and concentrated areas of household waste and sewage.

Related annexes

Annex 15: Major pollution points

4. POWER

In this section of the report, we detail and analyze the social, institutional and regulatory structures through which water resources management, aquatic biodiversity management, and adaptation to climate change are planned and operationalized within the Rangun Khola watershed. Analysis indicates there is a need to better understand how the current institutional arrangements are related to fisheries and gravel mining and whether they improve resource sustainability and benefit sharing with local populations, or not.

Prior to the government's constitutionally-mandated switch to a federal structure, the District Coordination Committee (DCC) oversaw leasing of ponds, lakes, and river stretches to private contractors for fishing and gravel mining. Today, that authority will rest with the local government.

Licensing promotes economic development but often impedes indigenous communities who pursue traditional occupations (e.g., fishing). Accordingly, this section explores issues of access, inclusion, and compliance with laws as they relate to natural resource management.

4.1 ACCESS AND INCLUSION

In this section, we review issues of access and inclusion in regard to natural resource use and management in the Rangun Khola watershed.

4.1.1 ACCESS TO WATER FOR DOMESTIC AND AGRICULTURAL USE

Drying water sources are a major cause for concern in the Rangun Khola watershed. While the issue of drying springs is still not perfectly understood, many water sources have been swept away by soil erosion, landslides, forest fires and improperly constructed roads.

Water accessibility indicates the degree of ease for users to obtain water. Obstacles to water accessibility can be physical (e.g., distance to water points) or cultural (e.g., water sources available only to certain castes), or both. Again, due to drying water sources, many communities reported varying degrees of access to springs and community spouts. In the Rangun Khola watershed, 10% of Janajati, 13% of Brahmin/Chhetri/Thakuri (BCT), and 22% of Dalits said they did not have equal access to available water.

Access to water issues also creates conflict, particularly in regard to caste-based discrimination, which forbids lower castes from taking water from taps and sources used by higher caste families. These differences in access violate article (24) (1) of the Constitution of Nepal, which states that no person shall be subjected to discrimination based on his or her origin, caste, tribe, community, profession, occupation or physical condition.

The Constitution of Nepal stipulates that the federal, state, and local levels of government exercise the power of the State of Nepal pursuant to article 56(2). Certain legislative and executive powers have been vested in local level government (*nagar palika* [NP] and *gaun palika* [GP]), such as environmental conservation and biodiversity, local roads, agriculture, irrigation, drinking water supply, small hydropower, disaster risk reduction, and conservation of watersheds and wildlife (Schedule 8). At the same time, the federal, state, and local levels of government hold concurrent power on a range of other issues, including

forest and jungle management, water use, ecology and biodiversity (Schedule 9). The willingness and ability of government entities to exercise these powers within the cooperative model of federalism has significant implications for the conversation of freshwater biodiversity and community resilience.

These new governance responsibilities suggest the time is appropriate to work closely with local authorities to develop plans to promote improved watershed health. The following 17 agencies are the main agencies responsible in the Rangun Khola watershed for water resource management:

- Two District Coordination Committees (Dadeldhura and Doti)
- Two Rural Municipalities and One Municipality (Alital Rural Municipality and Parshuram Municipality in Dadeldhura, and Jorayal Rural Municipality in Doti)
- Two Irrigation Development Divisions (Dadeldhura and Doti)
- Two Water Supply and Sanitation Division Offices (Dadeldhura and Doti)
- Two District Soil Conservation Offices (Dadeldhura and Doti)
- Two District Forest Offices (Dadeldhura and Doti)
- Two District Agriculture Development Offices (Dadeldhura and Doti)
- Two District Administration Offices (Dadeldhura and Doti)

Related annexes
Annex 18: Water and sanitation user groups

4.1.2 ACCESS TO EARLY WARNING SYSTEMS (EWS) AND DISASTER RISK REDUCTION

Only one EWS has been established in the Rangun Khola watershed: along the Mahakali River at Parigaon and Shirsagaad. When flood conditions arise, the DAO alerts communities through SMS, radio, and newspapers. These alerts run for 24 hours. After an alert is sounded, the DAO mobilizes local security forces for potential rescue and response efforts and to help households relocated to higher group.

EWS can be a crucial defense to lessen the effects of flooding in Rangun Khola by giving household additional time to collect family and important personal belongings. Only 14% of households in Rangun Khola said they had access to EWS information. Of that 14%, 92% said they felt they had equal access to that information.

4.1.3 ACCESS AND INCLUSION IN LOCAL NRM PLANNING

The land, water, flora and gravel of the Rangun Khola watershed comprise the major natural resources of the area. In addition, each of these faces numerous threats from deforestation, habitat degradation, unsustainable agricultural practices, and non-point source pollution, among others. These challenges are exacerbated by the watershed's steep topography and a general lack of suitable land for crops.

In the Rangun Khola watershed, stakeholders have identified these agencies (Table 5) as critical to addressing natural resource issues:

Table 5: Key offices in Rangun Khola for addressing natural resource issues

Office	Location	Remarks
Governmental		
District Agriculture Development Office (DADO)	Dadeldhura and Doti	Starting work with capture fishery groups to discuss sustainable harvest practices
District Coordination Committee (DCC)	Parshuram, Alital and Jorayal	Works with local mayors and village heads to coordinate natural resource sharing in Rangun Khola
District Forest Office	Dadeldhura and Doti	Liaising with CFUGs to ensure clear understanding and proper enforcement of use and conservation guidelines
District Soil Conservation Office	Dadeldhura and Doti	Turning focus to the effects of development activities on soil erosion and soil fertility
Non-governmental		
Community forest user groups (CFUG)	188 formed; numerous locations	Share responsibility for sustainable use and management of community forests
Alliance for Agriculture	Dadeldhura	Sponsoring coordination meetings between farmers and agriculture-related government offices
Rural Access Program	Numerous locations	Endorsing environment-friendly road construction practices in the watershed

Many environment and agriculture focused groups (e.g., farmers, drinking water and sanitation, water consumer, community forestry and DRR groups) are active in the Rangun Khola Watershed. However, involvement in these groups is minimal. Only half of the households sampled were aware of the local NRM committees in their community, whereas less than 24% of households claim membership in an NRM group. Of that 24%, 78% are affiliated with a community forest user group followed by 16% with an irrigation group, 15% with drinking water and 14% with a farmers group. In terms of caste and ethnicity distribution, 15% of Janajati, 25% of Brahmin/Chhetri/Thakuri/Sanyasi, and 28% of Dalit claimed affiliation with a local representative NRM body.

National guidelines states that women should comprise 33% of the seats in a CFUG. While nearly all groups meet those standards in Rangun Khola, FGDs revealed that women's participation appear to be limited, particularly in decision-making and leadership responsibilities. Surveying all NRM groups in

Rangun Khola, only 3% of leadership positions were held by women and/or persons from a marginalized group.

Local governments are tasked with using a participatory approach to local NRM planning; however, in our survey, only 8.2% of residents said they were aware of such planning such as Local Adaptation Plans of Action (LAPA) and Community Adaptation Plans of Action (CAPA).

4.1.4 ACCESS TO BENEFIT SHARING IN THE WATERSHED

User groups for water and forests are entities that employ participatory practices to ensure equitable distribution of benefits derived from natural resources.

As more than 70% of Nepali households depend on agriculture, community management of water and forests has been a critically important, and largely successful, intervention in terms of management of water for irrigation and forest restoration and developing broad strategies for livelihood improvement and poverty reduction.

Irrigation in Rangun Khola is one potential area for development. Only 18% of households have access to irrigation for water year round, while 82% depend on seasonal sources.

Related annexes

Annex 16: Community user forest groups
Annex 18: Water and sanitation user groups

4.2 COMMUNITY ACTION AND RESPONSE

This section provides detail on community planning and response to climate change and disaster risk, how communities collaborate for improved natural resource management, and the status of local compliance with existing environmental policies and regulations. Taken together, these aspects of community action reveal significant information about a watershed population's ability to adapt to future challenges.

4.2.1 CLIMATE CHANGE ADAPTATION AND DISASTER RISK REDUCTION

As a majority of the population in Rangun Khola is dependent on climate-sensitive agriculture, variations in temperature and precipitation are causing serious livelihood distress to communities in the watershed. To adapt to these changes, many farmers have adopted climate-smart technologies to strengthen their crops and livestock and to promote resilient food systems. Some of these technologies include water harvesting ponds, multi-use water systems, solar and/or gravity water pumps, check dams, and Napier grass cultivation for the dry season.

At the policy level, GON has developed a National Adaptation Plan of Action (NAPA), while delegating authority to the NPs and rural municipalities to develop LAPAs and CAPAs. Nepal's current NAPA promotes climate-smart technologies as described above and advocates for building capacity in rural districts to diversify livelihoods and income sources as another source of buffer against future shocks.

Preparation and implementation of LAPAs and CAPAs in Rangun Khola has been slow. There are currently only three LAPAs operating in the watershed, in the former VDCs of Alital, Gankhet, and Parshuram. The activities included are related to disaster risk reduction and preparedness.

Local Disaster Risk Management Planning (LDRMP) has been more successful in Rangun Khola. Five plans have been implemented, while the DSCO has identified 79 sub-watersheds that it plans to engage

for disaster risk planning in the near future. LDRMPs use a point system to establish risk ratings for various locations for an area according to the potential for flood, drought, landslides or forest fire. Safe locations are also assessed for households to use as a temporary alternate shelter if necessary.

4.2.2 NATURAL RESOURCE MANAGEMENT (NRM) GROUPS AND ACTIVITIES

As water resources are a shared resource, the formation of user groups to collectively manage these resources has become common in Rangun Khola. These user groups serve under various government authorities (e.g., DDC, DFO, DADO) and seek to improve forest and water use and management.

Numerous irrigation, water, and sanitation user groups function in the Rangun Khola watershed. Fifteen irrigation user groups cover 1,273 hectares in the watershed and affiliate with the district chapter of the Nepal Federation of Irrigation Water Users' Associations (NFIWUAN). Eleven water and sanitation user groups cover 231 hectares and work closely with the district office of the Federation of Drinking Water and Sanitation Users Nepal (FEDWASUN). The Nepal Federation of Indigenous Nationalities (NEFIN) works closely with both forms of user groups to ensure that rights-based issues on natural resource access are addressed.

Community forest user groups (CFUGs) are extremely active in the Rangun Khola watershed: 188 groups representing 12,348 households manage more than 25,930 hectares of forest. In addition to these CFUGs, there are 42 (32 in Parshuram NP; 10 in Alital rural municipality) leasehold forest user groups, which specifically target poor families living adjacent to degraded forest that cannot secure enough food for their families.

The Rangun Khola watershed has also been included in the Churia conservation river system network plan, a comprehensive assessment of the aquatic and terrestrial health for the Chure Madhes and Tarai. The plan seeks to improve communication between affected populations in the region to share concerns and ideas for improving livelihoods and conservation.

These groups face numerous challenges for improving their effectiveness. Some of these challenges include limited resources and knowledge, remote locations that inhibit idea-sharing with other user groups, changing environmental policies at the government level, and areas of forest that are too large to manage.

Women's and marginalized people's participation is improving but few hold leadership positions. Furthermore, when women do occupy a leadership role, FGDs revealed that many felt women yield to men's opinions too easily in decision-making and that groups remain male-dominated despite efforts to create a more inclusive environment.

Related annexes
Annex 16: Community user forest groups
Annex 18: Water and sanitation user groups

4.2.3 COMPLIANCE WITH LAWS AND POLICY PROVISIONS

Surveys and FGDs revealed a generally low knowledge of existing environmental policies and provisions, and an equally low compliance with these regulations where they were known. The primary reason for this is the remote location of many communities in the Rangun Khola watershed, where they have

limited interaction with government officials and representatives. As a result, creating a culture of environmental conservation and a shared interest in promoting watershed health will require significant outreach to equip citizens with relevant information.

For example, despite the existence of the Aquatic Animals Protection Act 1961, the use of harmful, non-traditional methods of fishing (e.g., gill nets, poison, electric currents) continues to rise and decimate local fish populations. Weak enforcement of this legislation allows these practices to continue unchecked.

The Solid Waste Management Act 2011 contains strict language forbidding the unregulated disposal of household and industrial waste. More than 80% of households are burning their solid waste, while 31% use some of this waste for compost, and 15% dump solid waste into the nearby river[4].

Compliance with provisions of the Solid Waste Management Act 2011 in Rangun Khola watershed has been limited; however, 86% are utilizing waste water in kitchen garden, 41% disposing in the sewage system while 16% were found mixing it directly to the river system.

4.3 GOVERNANCE

Governance and its responsiveness to community needs and aspirations provides a key focal point for managing natural resources sustainably, strengthening community resilience, and conserving freshwater biodiversity.

Through FGDs and KIIs, respondents expressed their growing awareness of the need to develop stronger relations between upstream and downstream communities. In spite of the many regulations providing vision on issues related to watershed health, there was a general consensus that the lack of implementation would lead to conflict between communities on issues of fish, forests, and water. Moreover, the growing amount of infrastructure development in the form of roads and micro hydro has raised general concern about e-flows and maintaining sustainable agricultural production.

Survey responses indicate that coordination between VDCs, municipalities, districts and provinces is quite low. For this reason, formal and informal institutions and organization in Rangun Khola need to increase the representation of women and marginalized persons in the watershed. Similarly, village and municipality level governments need to make their planning and budgeting processes (e.g., LAPA, CAPA, WUMP) transparent and participatory. Building consensus and ownership between government and citizens will improve the potential to create conditions favorable to conserving aquatic biodiversity and promoting community resilience.

Related annexes

Annex 19: Existing policy provisions and status of enforcement
Annex 20: Key stakeholders – organizations and offices

[4] These percentages add to more than 100 because some households utilize more than one method for solid waste disposal.

5. MAJOR ISSUES AND CHALLENGES

Stakeholders in the Rangun Khola watershed were asked to list their environmental concerns, particularly in relation to sustainability and livelihoods.

Table 6 presents issues identified by 62 participants in a community survey, whose responses were later validated during the multi-stakeholder consultation (MSC) exit workshop. The participants were selected from a wide range of backgrounds representing local residents, civil society groups, and government agencies.

After creating a full list of environmental challenges, including issues related to scope, severity and local interest, participants were asked to vote for issues based on their perceptions of urgency in the need to address. Each participant was allowed to vote for up to three issues, although many chose to cast only two or one votes. Men and women were asked to vote separately to avoid the potential for vote influence across gender.

Table 6: Environmental issues by priority

SN	Issue	Female	Male	Total	Ranking
1	Encroachment, forest fire and forest degradation	37	7	44	Very high
2	Landslides and river cutting	34	1	35	Very high
3	Haphazard rural road construction	16	1	17	High
4	Decrease in population and species of fishes	16	1	17	High
5	Flooding and sedimentation	7	6	13	High
6	Limited coordination among upstream and downstream communities	9	2	11	High
7	Drought	6	4	10	High
8	Use of destructive fishing methods	7	0	7	Medium
9	Loss of live and property from landslide	3	4	7	Medium
10	Drying of water sources	4	0	4	Medium
11	Conflict for water use and water source	3	1	4	Medium
12	Deficit in drinking water and sanitation	3	0	3	Low
13	Open grazing	2	0	2	Low
14	Collection of gravel, sand, boulders, mining	1	0	1	Low
15	Decrease in water table	1	0	1	Low

6. PRIORITIZATION OF MAJOR THREATS AND OPPORTUNITIES

During the MSC exit workshop, participants also listed the major threats, challenges, and opportunities for watershed health in Rangun Khola. Their comments are summarized in Table 7.

Table 7: Threats, challenges and opportunities for improved watershed health

Threats and challenges	Opportunities
• Lack of systematic settlements, forest area encroachment • Fragile structure of land • Poverty, illiteracy, unemployment in the population • Lack of trained/skilled human resources • Complex policy and legislation regarding natural resources and environment regulations • Region is prone to natural hazards • Human-induced pressures on landscape such as deforestation, forest fires, unplanned settlements • Reluctance to implement plans • Poor implementation of policy • Community feels low ownership of NRM issues • Food insecurity • Climate change impacts • Poor monitoring and enforcement of existing policy • Low protection of public lakes, ponds and wetlands • Freshwater biodiversity conservation is low priority for government	• Create local level employment opportunities • Endorse micro hydro with proper environmental guidelines • Endorse multiple uses of water • Decentralize environmental activities to promote participation • Collaborate with water governance projects at OXFAM • Expand road networks within proper environmental guidelines • Develop communications between level of government and upstream/downstream communities • Prepare draft policy for watershed conservation and fisheries development in collaboration with MoFALD

7. VISION AND MISSION OF RANGUN KHOLA WATERSHED

This Rangun Khola watershed profile has been prepared through various consultative processes, actively engaging with stakeholders from media, civil society organizations, government agencies, government offices, and environmental research institutions (e.g., universities).

7.1 VISION OF RANGUN KHOLA WATERSHED

A two-day vision-building session was organized in Dadeldhura in August 9-10. 2017. The participants were divided into five groups to draft their own watershed vision statement. The groups were asked to draft the statements based on what they hoped to see in the watershed 20 years from now. The five drafts were shared with the entire group and they collectively created the following vision statement:

"To promote social, economic and environmental prosperity in the Rangun Khola watershed through conservation, sustainable use, and equal distribution of benefits."

7.2 COMMITMENT TO CONSERVE THE RANGUN KHOLA WATERSHED

Using the threats, challenges, and opportunities for watershed health (Table 7), participants at the exit workshop described what they intended to do within their capacity to act (i.e., as residents, government officials or NGO representatives) and the outcomes expected from this activity. These ideas have been organized by watershed health theme in Table 8.

Table 8: Action commitments and expected outcomes by theme

SN	Theme	Major Activities	Expected Outcomes
1	Climate change and aquatic biodiversity conservation	• Coordinate discussions with communities to strengthen upstream-downstream relations • Use bioengineered, low-cost technologies where available and appropriate • Replant barren lands • Exercise tighter control on open grazing	• Improved sustainable use of natural resources • Improved regeneration of forests and biodiversity • Improved fish populations and fish diversity • Improved resilience to climate change impacts • Improved waste management and sanitation

		• Explore artificial breeding potential for rare species of fish • Conserve aquatic habitats and fish species • Promote implementation of laws such as Aquatic Animals Protection Act 1961	• Comply with constitutional provisions and laws
2	Physical infrastructure and disaster management	• Prepare and implement IEE or EIA for road construction • Prepare master plan for road network development • Use available technology to reduce environmental hazards during road construction, such as embankments and Gabion walls	• Improved preparation for and formulation of policy and strategy for infrastructure development • Diminished negative physical impact of road building on watershed health • Reduction in human and property loss due to mitigated flood and landslide effects
3	Water availability and water quality	• Control illegal harvesting of natural resources • Promote awareness about water quality issues • Conserve natural ponds and lakes • Construct water harvesting ponds to protect against drought and make multiple water use possible • Employ more solar pumps • Promote defecation free zones • Strengthen waste and sludge disposal, and forest management • Promote multiple water use, such as kitchen water reuse	• Diminished negative impacts of mining • Improved control over landslides, floods and river cutting • Improved forest conservation • Additional economic opportunity made available • Increased access to water and more sustainable use of water • Fewer water conflicts between and within communities • Fewer water-borne diseases • Increased ground water availability • Improved food production and food security

4	Livelihoods	• Prepare LDRMP for all areas of the watershed • Replant in catchment areas • Prepare disaster maps • Demarcate flood prone areas • Use available conservation techniques in the watershed • Promote awareness of flood and landslide risks • Provide training for composting manure • Conserve traditional skills and livelihood options • Look for commercial potential of traditional skills to increase market place viability	• Reduced effects of floods and river cutting • Improved conservation of forests • Enhanced agricultural productivity • Reduction in destructive fishing methods • Decreased use of pesticides • Increased employment opportunities
5	Governance, policy, and GESI	• Prepare and implement sustainable natural resource policies • Reduce use of machine during construction • Use evidence-based studies to support policy formulation • Promote sustainable fishing practices • Form a joint committee of the watershed's three municipalities/rural municipalities to discuss watershed health-related issues	• Greater implementation of policy and guidelines • More evidenced-based studies to inform policy-making • Formal policy to create joint watershed team formalized • A common understanding of conservation issues and watershed health developed

8. RECOMMENDATIONS

This Rangun Khola watershed profile assesses the status, major challenges and opportunities facing water resources management for the multiple users located within the region. Based on discussions at the various workshops, these recommendations were conceived and compiled based on input from all the participants, seeking to improve climate change adaptation and freshwater biodiversity in the watershed:

- Assess areas of known knowledge gaps to develop fish inventory guidelines for regulated harvesting, legal protections and appropriate capacity building measures.
- Facilitate engagement of local government in developing and integrating plans related to water governance and aquatic biodiversity management.
- Mainstream conservation initiatives into local planning and advocate for budget allocation for subsequent implementation.
- Support sustainable management of aquatic biodiversity through effective implementation of policy provisions, appreciating local norms and standards, and devising strong monitoring mechanisms.
- Support local initiatives to improve livelihoods of rural and marginalized people who depend on traditional practices (e.g., capture fisheries) or labor-intensive livelihoods (e.g., river bed mining).
- Raise awareness on ways to improve forest fire prevention and reduce open grazing through trainings to community forest user groups and resin collection groups that can directly contribute to maintaining or improving watershed health.
- Produce and disseminate behavior change communication materials (e.g., radio programs) for publicizing watershed management friendly practices, such as solar water lifting pumps, drip irrigation, and disaster risk reduction ideas.
- Implement low-cost stabilization techniques for slopes and river banks, such as layered plantation.
- Develop georeferenced information on aquatic biodiversity and fishery hotspots to guide management of river and fishery resources.
- Encourage research, conservation and governance initiatives to integrate gender and social inclusion into all programs.
- Develop and support implementation of green infrastructure guidelines with reference for the proper construction of rural roads, hydropower, and water management.

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ANNEXES

Annex 1: Profile methodology

The overall objective of the watershed profiling process is to develop and enrich a shared understanding among key stakeholders about the major issues that affect local watershed health and water resource management. This watershed profile reflects the collective understanding and aspirations of people in the Rangun Khola watershed and concerned institutions so they can provide baseline information to help identify priorities for project design and implementation. Moreover, the profile can support the development of tools for watershed planning and approaches for collaborative management moving forward. The profile serves as a foundation for:

- Building consensus and common understanding among the Rangun Khola watershed's stakeholders on the current situation and future;
- Establishing a benchmark for activities targeting human and ecological communities in the watershed by describing the existing interaction between people and nature;
- Identifying potential priority areas for stakeholders to plan and work together on local-level activities to improve watershed management of the Rangun Khola area where Paani and other projects can provide support; and
- Providing a platform for consultation and advocacy for Rangun Khola watershed stakeholders through which they can participate in decision-making at the river basin and policy levels.

The watershed area was delineated using GIS tools during the watershed prioritization stage. This profile was prepared by drawing on a range of data sources including,

1. Secondary literature and information related to biophysical conditions, socio-economic characteristics, infrastructure, vulnerability and disaster risk, and freshwater biodiversity of the watershed;

2. An entry multi-stakeholders consultation (MSC) conducted to:

    a) Share preliminary results of watershed conditions,

    b) Identify priority threats, vulnerabilities and biodiversity values by location and impact groups, and

    c) Prepare detailed plans for the key informant interviews (KII), focus group discussions (FGD), and water quality and water discharge measurements;

3. Household (HH) surveys to assess the differential impacts of various environmental issues;

4. FGDs to assess the severity of environmental threats and significant value associated with Paani focal interests; and

5. KIIs to explore the causes and intensity of the particular environmental issues in the watershed. Different guiding checklists designed around Paani focal interest areas and cross cutting areas were used while conducting surveys including governance, gender and social inclusion and policy (Figure 9, below).

The consolidated data collected through these methods were presented to group leaders at the exit MSC workshop to provide the participants with a shared foundation for identifying and prioritizing watershed health issues in Rangun Khola. We also used this information to identify possible solutions and champions for leveraging knowledge and support through partnerships with local agencies and organizations.

The HH survey data (Table 9) was organized into four broad categories: a) climate change and biodiversity; b) livelihoods and well-being; c) water sources; and d) water quality. The surveys were conducted in locations that were selected during the entry MSC, as participants indicated specific issues and challenges appropriate to their respective areas.

Table 9: Household (HH) surveys by topic and number conducted

Subject of HH survey	Number conducted
Biodiversity and climate change	180
Livelihoods and well-being	295
Water sources	231
Water quality	217
Total	**923**

To complement the surveys, we conducted 13 FGDs and 8 KIIs to investigate the key issues identified by households. Water quality and discharge were measured by Paani staff using the Akvo Flow Mobile App.[5]

To prioritize the collected issues, we held an exit MSC in which we presented preliminary findings and asked the participants to rank these issues in order of importance as well as potential actions and outcomes for addressing these issues. The participants were divided into groups to generate potential mission statements for the watershed. We brought the various statements together and synthesized the ideas into the mission statement located at the front of this profile:

Mission statement: *"Model prosperous Rangun Khola watershed: Social, economic and environmental prosperity through biodiversity conservation, sustainable utilization and equal distribution of benefits."*

[5] Akvo Foundation: https://akvo.org/products/akvoflow/#overview

Figure 8: Methodological approach illustrated

Heath report development process

The watershed health report portrays the current condition of the natural resources and the quality of ecosystem services available for community use. The health report identifies the drivers that pose threats to peoples' livelihoods, fresh water biodiversity and natural habitats. The health report provides relevant information to strengthen informed decisions, take action to protect and restore the watershed, and to reduce risks and create sustainable economic opportunities. The report also provides opportunities to identify the drivers of watershed health degradation and explore the options to mitigate, correct and prevent them timely for sustainable watershed management. The health report thus serves as a planning tool.

The watershed health report was developed drawing on information gathered during the watershed profiling process. The health report was prepared by drawing on a range of data sources including;

1. Secondary literature and information related to biophysical conditions, socio-economic characteristics, infrastructure, vulnerability and disaster risk, and freshwater biodiversity of the watershed;

2. Multi-stakeholder consultation (MSC) conducted to

- Draft health report with provisional indicators consolidated from the review of literature and data analyzed from secondary sources. MSC participants are invited to assess the condition of watershed health. Key indicators are arranged under three broad themes – nature, wealth and power.
- Identify priority threats, vulnerabilities and biodiversity values in the watershed area
- Share and discuss the consolidated analytic results of community surveys, including water quality tests and discharge measurements of major streams and rivers
- Identified and agree on the proposed provisional indicators and evaluation methods

3. After sharing the priority health indicators, MSC participant discuss and agree on the indicators, along with associated impacted groups and locations of issues within the watershed. The workshop participants review indicators and assess their condition. They then rank each indicator according to threat levels, which are designated a color, e.g. high (red), medium (yellow) and green (low)..

4. The draft health report is then widely shared with key stakeholders, including government line departments, CSOs and local governments for their feedback before producing a final version.

Annex 2: Land use and land cover

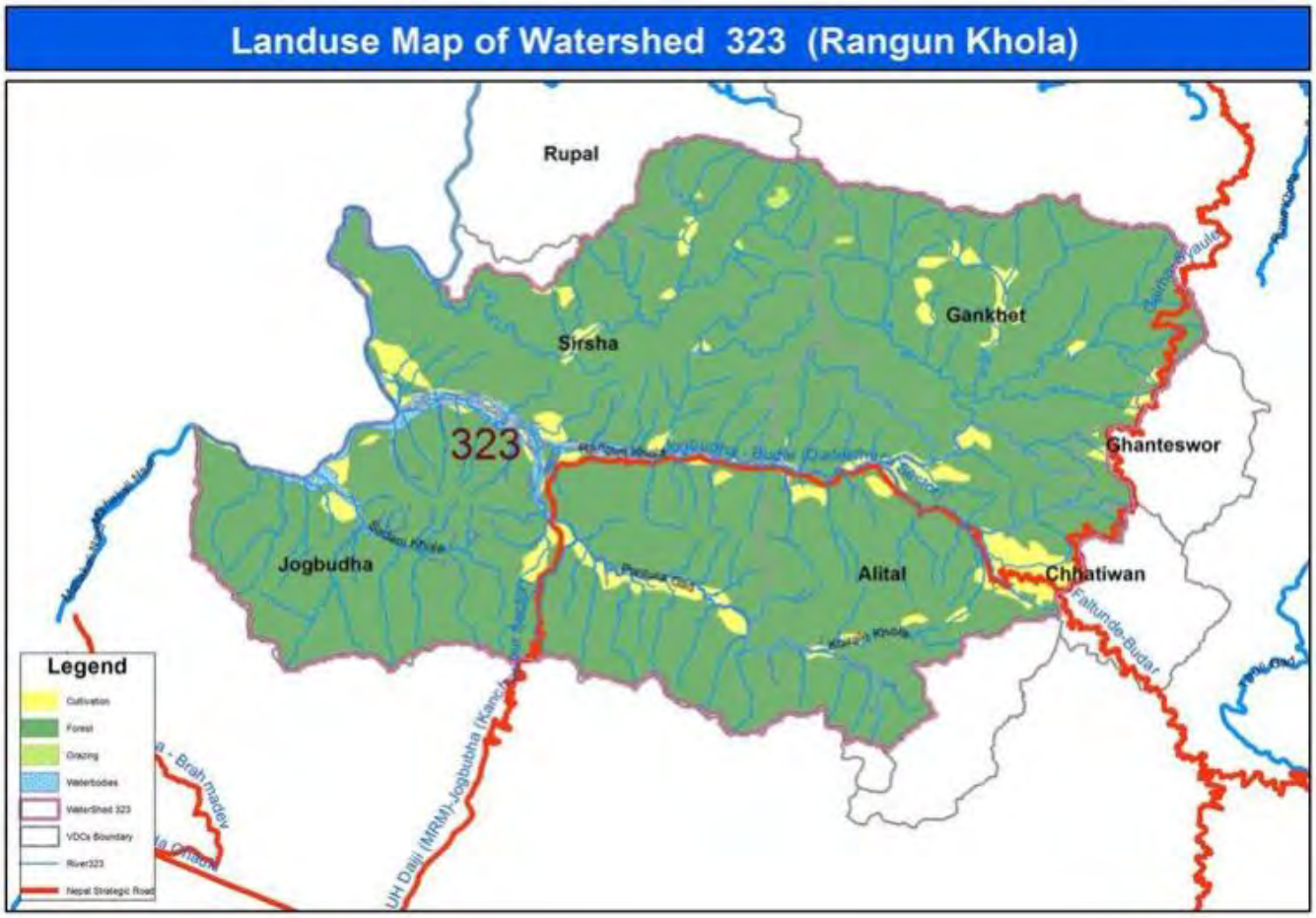

Figure 9: Map of land use and land cover in the Rangun Khola watershed

Annex 3: Population

Table 10: Population by municipality, VDC, sex, and caste/ethnicity

Municipality	VDC	Total population						
		Sex dist.			Population by caste/ethnicity			
		M	F	Tot	BCT	Dalit	Janajati	Other
Parshuram	Jodbudha	10,358	11,274	21,632	16,537	2,942	1,574	579
Parshuram	Shirsha	6,436	6,915	13,351	9,534	1,929	815	1,073
Alital	Alital	5,301	5,788	11,089	7,188	1,613	1,717	495
Alital	Gankhet	2,500	2,570	5,070	3,279	695	1,066	30
Jorayal	Parts of Chhatiwan	595	653	1,248	423	648	177	0
Jorayal	Parts of Ghanteshwar	357	362	719	363	256	100	0
	Total	25,547	27,562	53,109	37,324	8,083	5,449	2,177

Annex 4: Temperature and precipitation

In addition to the seasonal temperature variation, differences in topography also induce spatial variation of temperature in the watershed. Long-term temperature data recorded in the Rapti, Karnali and the Mahakali River basin were used to determine the temperature change rate with respect to the elevation change. Temperature was observed to decrease at an average rate of 4.4 °C, 4.6 °C, 4.6 °C and 4.8 °C per 1 km rise in altitude in winter, pre-monsoon, monsoon and the post-monsoon seasons respectively. Similarly, the annual average temperature is observed to decrease at the rate of 4.9 °C per 1 km rise in altitude.

The average monthly temperature of the watershed varies from 8 °C, in winter to about 18 °C in summer. Similarly the maximum and minimum monthly temperature varies from 4 °C and 12 °C respectively in winter to 11 °C and 25 °C respectively in summer. Maximum temperature in Rangun Khola watershed is observed in June, and the minimum temperature is observed in January.

The long-term average annual temperature variation in Rangun Khola watershed is shown in Figure 3. The average annual temperature varies from 11°C, in the north, to 23 °C in the west.

From a historical perspective, an analysis of temperature and precipitation recorded at all stations in Nepal between 1976-2005 by Marahatta et al. (2009) shows an overall increasing trend of temperature and precipitation in the country. However, the changes vary spatially and seasonally. In Rangun Khola watershed, temperature observed change across all seasons. The summer/monsoon and autumn temperature increased at a rate of 0.02 - 0.04 °C/year. Winter temperature and spring temperature are observed to increase at the rate of 0.02 - 0.06 °C/year and 0.04 - 0.06 °C/year, respectively. The mean

annual temperature is observed to increase at a rate of 0.02 – 0.06 ◦C/year. The rate of increase in temperature is observed to be higher in the western part than the eastern part of the watershed.

Spatial as well as seasonal variation in rainfall has been observed. Rainfall decreased in pre-monsoon (Mar – May), monsoon (Jun – Sept) and post-monsoon (Oct –Nov) seasons at the rate of 2 -3 mm/year, 0 – 10 mm/year and 0 - 1 mm/year, respectively. In winter (Dec – Feb), rainfall increased at the rate of 0.8 – 1 mm/year. Annual rainfall decreased at the rate up to 10 mm/year.

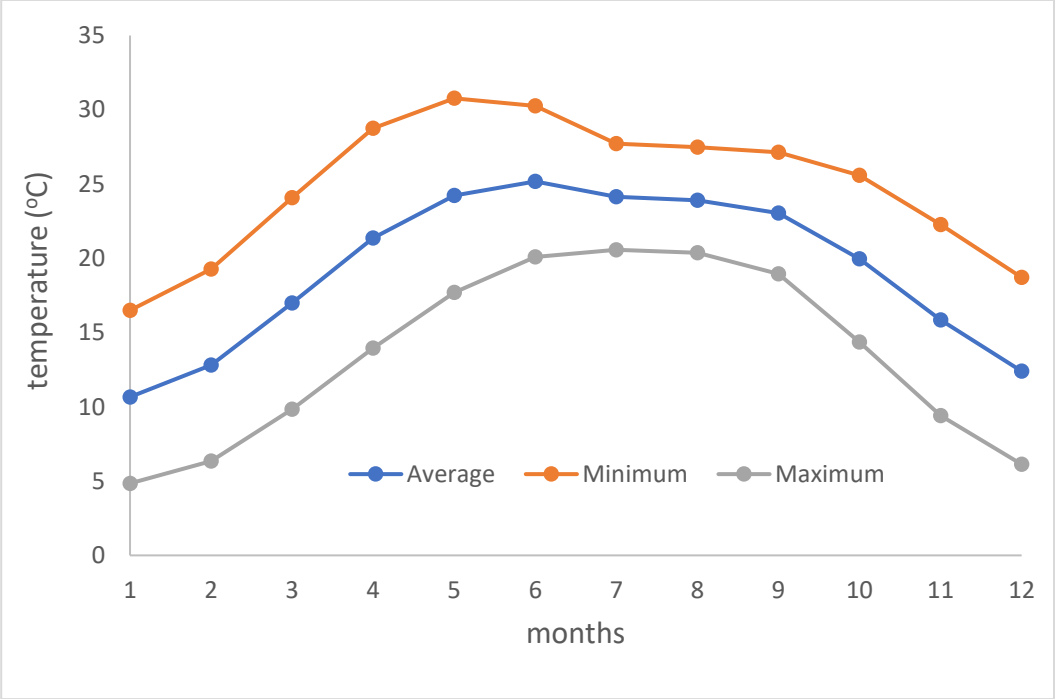

Figure 10: Monthly average temperatures in the Rangun Khola watershed

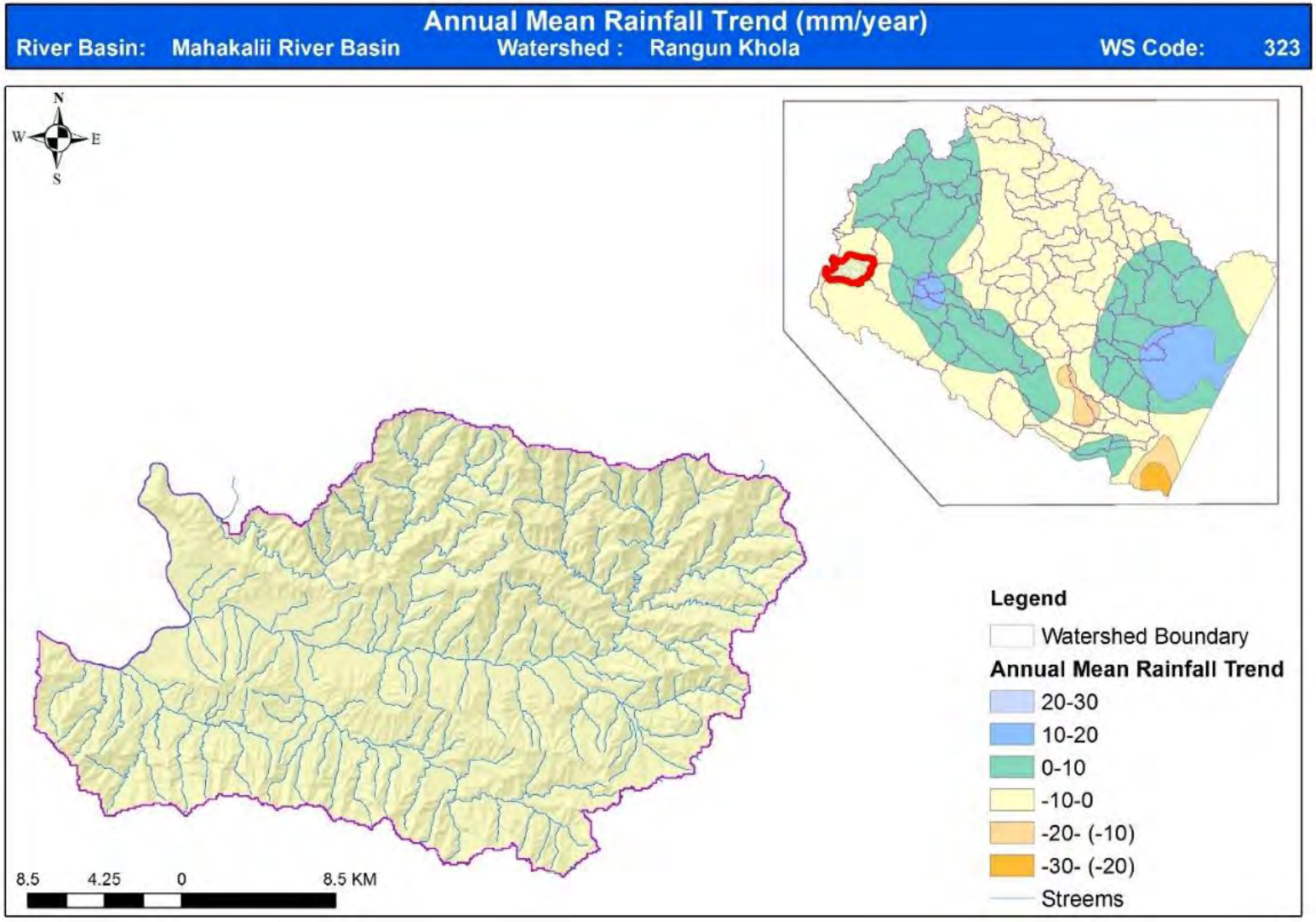

Figure 11: Annual mean rainfall in the Rangun Khola watershed

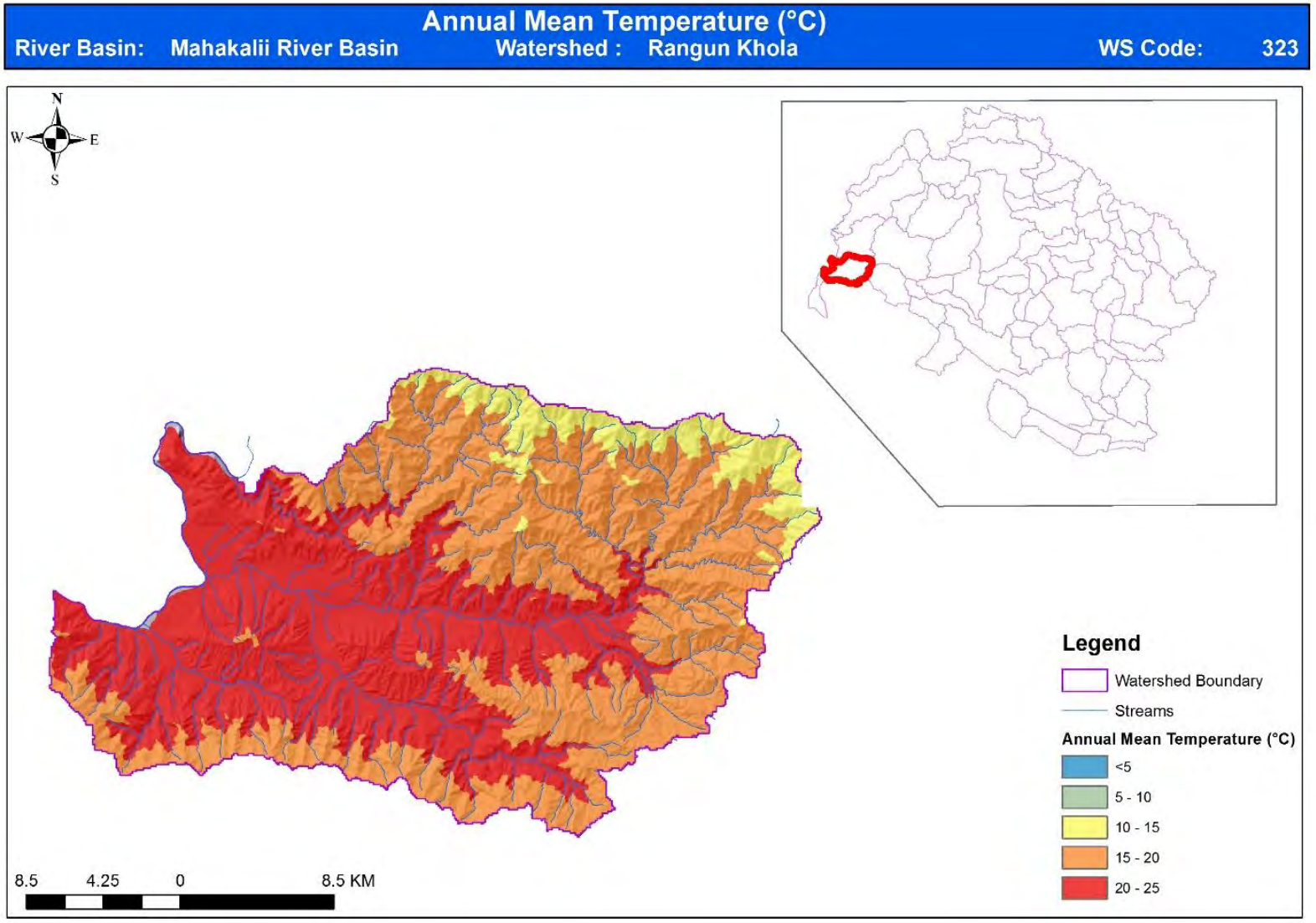

Figure 12: Annual mean temperature change trend in the Rangun Khola watershed

Annex 5: Lakes, streams, rivers, and sub-watersheds

Table 11: River systems in the Rangun Khola watershed

Name of sub-river systems	Origin	Area (m^2)	Tributaries
Sandani Khola	Churia	8,889.4	Sandani Khola, Chhutte Pahiro Khola, Gailo Khola, Ghumti Khola
Puntura Khola	Churia	12,477	Puntura Khola, Jamareni Khola
Rangun Khola Khola (1ST Part)	Mid-hill	12,674.3	Rangun Khola Khola, Kuna Khola, Sunkhola, Bhadreni Khola
Rangun Khola Khola (2nd Part)	Mid-hill	10,656.3	Rangun Khola Khola, Kalena Khola
Sirshagad	Mid-hill	2,820.5	Sirshagad

Table 12: List of identified sub-watersheds in the Rangun Khola watershed

S.N.	Name of sub-watershed	VDC	Area of watershed (m^2)
1.	Madelakhola Sub-watershed	Alital	22.07
2.	Kasanikhola Sub-watershed	Jogbudha	29.86
3.	Gharsula Jamanikhola Sub-watershed	Jogbudha	36.48
4.	Gharsula Jamanikhola Sub-watershed	Alital	9.44
5.	Sirsha Gad Sub-watershed	Sirsha	52.99
6.	Sadanikhola Sub-watershed	Jogbudha	57.50
7.	Satkatakhola Sub-watershed	Gankhet	0.68
8.	Poknagaad Sub-watershed	Sirsha	38.02
9.	Punturagaad Sub-watershed	Jogbudha	54.22
10.	Kalena Khola Sub-watershed	Alital	3.07
11.	Kalena Khola Sub-watershed	Sirsha	51.37
12.	Bhalu Khola Sub-watershed	Jogbudha	9.71
13.	Bhalu Khola Sub-watershed	Alital	44.37
14.	Kheti Khola Sub-watershed	Sirsha	4.85

15.	Kaler Khola Sub-watershed	Gankhet	36.05
16.	Kaler Khola Sub-watershed	Alital	8.51
17.	Gagat Khola Sub-watershed	Gankhet	35.01
18.	Sunkhola Sub-watershed	Alital	53.47
19.	Khaluwa Khola Sub-watershed	Gankhet	57.44
20.	Tallo Rangun Khola Khola Sub-watershed	Sirsha	29.81
21.	Tallo Rangun Khola Khola Sub-watershed	Jogbudha	26.16
22.	Kalakhola Sub-watershed	Alital	4.32
23.	Kalakhola Sub-watershed	Jogbudha	27.99
		Total	**693.39**

Annex 6: Forest types and composition

Table 13: Forest types by area and percentage

Forest Type	Area (sq km)	Percentage
Mixed hardwood	367.2	59%
Sal	98.6	16%
Pine	123.7	20%
Sisau (Sisam)	8.8	1%
Banjh Oak (Quercus)	23.4	4%
Deodar Cedar	0.5	0%
Total Forest Cover	**622.2**	**100%**

Annex 7: Fish and aquatic life

Table 14: Fish issues in the Rangun Khola watershed

Issues	Information/community responses
Fish diversity	*Sahar, bam, kalaunch, gardi, thend,* and *dhami* are presently found in the Mahakali River. *Buduna, sano sahar, chuche bam*, snow trout, *sano asala,* and *fagate* are found in the Sandani, but snow trout and *chuche bam* are almost extinct. Some fish are migratory such as the *gerada* and *kadanga*.
Fish migration	Sahar come from the Mahakali to the Sandani and sometimes migrate to the Ghumtegaad tributary during monsoon, and return at the start of autumn. Generally, *sahar* from Mahakali seasonally travel up to the first tributary Mahakali, but not up to the sub-tributary. Communities believe this could be due to topography and food availability.
Commercial value of fish	With variation by location, the price of per kilo fish is Rs. 300 to 350. Larger fish like snow trout and *sahar* fetch a premium price. At the local level, there are more markets for fresh fish, but dried fish are also sold to distant markets in good harvest seasons.
Threats to fish habitats	*Dhami machha* is at high risk of extinction because landslides are more common in areas where it lives. No single fish species was reported to be extinct, but fish will be conserved when their numbers are greatly minimized. If a fish habitat is lost in the Bantal area, the fish tend to go downstream. Once they reach Rangun Khola, they cannot return because a high cliff prevents them from turning back up river. This is the reason why fish from Rangun Khola do not seasonally migrate upstream to Bantal.
Other aquatic species	Crabs are found in the Sandani and eaten, but their numbers are low, although not decreasing. Turtles are found in the Mahakali, but they have disappeared from the Sandani.

Source: PANI FGD, 2017

Annex 8: Mammals and population trend

Table 15: Types of mammals, location, and population trend

Local Name	Latin Name	Trend	Location
Porcupine	*Hytrix indica*	Decreasing	Gallek, Gharelu
Hare	*Lupus sp.*	Decreasing	Jogbudha, Aampani
Wild boar	*Sus salvanius*	Decreasing	Gharelu, Godam
Common leopard	*Panthera pardus*	Decreasing	Hagulte
Fox	*Vulpes bengalensis*	Decreasing	Rajyauda, Godam
Squirrel	*Funambulus pennanti*	Decreasing	Sandani, Puntura
Nyaurimusa	*Herpestes edwardsi*	Constant	Dharapani, Buder
Malsapro	*Martes flavigulia*	Constant	Buder, Rupaskanda
Ratuwa	*Muntiacus muntjak*	Decreasing	Gankhet, Hagulte

Ghoral	*Noemorhedus goral*	Decreasing	Unikot, Hagulte, Gothana
Monkey	*Macaca spp*	Increasing	Present in almost all areas of the watershed
Langoor	*Semnopithecus entellus*	Decreasing	Gaira, Rupaskanda
Bat	*Pteropsus sp.*	Increasing	Rajyauda, Unikot
Jackal	*Canis spp*	Increasing	Present in almost all areas of the watershed

Annex 9: Reptiles and population trend

Table 16: Reptile species, location and population trend

Name	Type	Trend	Location
Green Snake	Aquatic/Terrestrial	Decreasing	Rangun Khola watershed area
Turtle	Aquatic/Terrestrial	Decreasing	Mahakali River
Tortoise	Aquatic/Terrestrial	Decreasing	Sandani Khola
Boa Snakes	Aquatic/Terrestrial	Decreasing	Rangun Khola watershed Area
Cobra	Aquatic/Terrestrial	Decreasing	Sandani area
Dhaman	Aquatic/Terrestrial	Decreasing	Rangun Khola watershed Area
Krait	Aquatic/Terrestrial	Decreasing	Rangun Khola watershed area
Lizard	Terrestrial	Increasing	Rangun Khola watershed area
Frog	Aquatic/Terrestrial	Increasing	Rangun Khola watershed area

Annex 10: Birds and population trend

Table 17: Bird species, location and population trend

Local Name	Latin Name	Trend	Location
Black Eagle	*Milvus migans*	Decreasing	Gaira, Rupaskanda
White Eagle	*Neophron percnopterus*	Decreasing	Gaira, Gankhet
Kalo Titra	*Francolinus franodinus*	Decreasing	Hagulte, Gaira
Nyauli Chara	*Megalaima virens*	Decreasing	Buder, Dharapani
Spotted Dove	*Streptopelia chinensis*	Decreasing	Alital, Godam

Kuthurke	*Megalaima asiatica*	Constant	Gharelu, Rajyauda
Crow	*Corvus macrohynchos*	Increasing	Almost all over the watershed
Julphe Jureli	*Pycnonotus leucogenys*	Decreasing	Sandani, Gaibandhe
Fisto	*Orthotomus sutorius*	Constant	Aampani, Gallek
Rani Chari	*Pericrocotus flammeus*	Decreasing	Unikot, Gothana
Chichilkote	*Parus major*	Decreasing	Bantal, Gaira
Chyakhura		Decreasing	Katal, Shirsha, Gaira

Annex 11: Road networks

Table 18: Key roads in the watershed

Communities connected	Total (km)
Buder - Jogbudha - Gaibandhe - Lipna	47
Sadani - Gaibandhe - Saleta	20.5
Jogbudha - Shirsa - Rupal	8
Gaira - Gangkhet - Unikot	12
Aita-Niglad-Achaksain-Katal Road	6
Buder - Nile	19
Gaibandhe-Jamrani Brahmadev Rural Road	7
Gharelu - Khinnebhadi - Saleta - Gaibandhe	15
Jogbudha - Shirsa - Parigaun	18
Puntura - Simalkhet - Tatap*aani* - Sandani	13
Sandani-Gairikhan-Chune*Paani* Road	1.5
Total	**167**

Annex 12: Micro hydropower – potential rivers and streams

Table 19: Information on micro hydro plants in the Rangun Khola watershed

Name of hydropower project	Existing or planned?
Gairagaon MHP	Existing
Sankhola MHP	Existing, but not in use
Selakhola MHP	Existing, but not in use
Makail MHP	Existing
Sirshagad MHP	Existing
Ashurani MHP	Existing
Dahagad MHP	Existing

Annex 13: Irrigation projects

Table 20: List of irrigation projects by name, location and area

SN	Project name and location	Area (ha)	Remarks
1	Parigaon Irrigation Project (Sirsha 9)	200	
2	Peti Irrigation Project (Sirsha 8)	20	
3	Melmel Chaud (Sirsha 3)	5	
4	Sirsha Irrigation Project (Sirsha 6-7)	300	
5	Upper Parigaon Irrigation Project (Sirsha 9)	136	Currently without water
6	Puntura Irrigation Project (Jogbudha 1)	200	
7	Kurmulle Irrigation Project (Jogbudha - 8)	35	
8	Sandani Irrigation Project (Jogbudha 4)	115	Currently without water
9	Jajola Irrigation Project (Jogbudha 7)	28	
10	Gothankhet Irrigation Project (Sirsha 9)	55	
11	Kirod Irrigation Project (Sirsha 2)	25	
12	Ghatteplat Irrigation Project (Sirsha 9)	45	
13	Naulakhola Irrigation Project (Jogbudha 4)	45	

14	Bantal Irrigation Project (Gankhet 8)	11	
	Total	**1,220**	

Annex 14: Water quality

Table 21: Water quality by river/stream and tested aspect

	Name of the river/stream					Water quality standards		
	Puntura Khola	**Rangun Khola Khola**	**Bantal Khola**	**Sadani Khola**	**Sunkhola**	*** Drinking**	**** Irrigation**	**** Aquaculture**
Date of test	12-Apr-2017	11-Apr-2017	10-Apr-2017	11-Apr-2017	12-May-17			
Conductivity (µS/cm)	357.2	246.5	NA	321.6	352.2	1,500		
Temp °C	28.5	26.3	NA	29.1	27.0			4 to 30
Iron (mg/L)	0.0	0.0	0.0	0.0	0.0	0.3 (3)	5	0.01
pH	7.6	7.2	6.4	7.5	7.4	6.5-8.5	6.5-8.5	6.5-9.0
Nitrate Nitrogen (mg/L)	0.0	0.0	0.0	0.0	0.0	50		<300
Nitrite Nitrogen (mg/L)	0.0	0.0	0.0	0.0	0.0		<5	
Ammonium (mg/L)	1.0	NA	NA	NA	1.0	1.5		0.025
Phosphate (mg/L)	6.5	1.8	4.4	1.5	1.5	0.4 EEC		

** Nepal's Drinking Water quality standards*

*** Nepal Water Quality Guidelines, Volume 1 (Irrigation) and Volume 2 (Aquaculture), Irrigation, Ground Water Resource Development Board, Ministry of Irrigation*

Annex 15: Major pollution points in the XXX watershed

Table 22: Major pollution points in the watershed

Municipality	Settlement	Northing	Easting	Elevation (m)	Comments
Sirsha	Katal	80°20'26.19" E	29°08'31.23" N	429.15	Draining of sewages and disposal of household wastes
Sirsha	Parigaon	80°16'32.00" E	29°08'58.63" N	321.56	Common cemetery

Jogbudha	Jogbudha Bazaar	80°20'38.66" E	29°07'45.18" N	384.96	Draining of sewages and disposal of household wastes
Jogbudha	Ampani	80°22'44.79" E	29°07'38.72" N	449.27	Draining of sewages and disposal of household wastes
Alital	Gharelu				Draining of sewages and disposal of household wastes
Alital	Godam				Draining of sewages and disposal of household wastes
Jorayal	Buder	80°34'00.27" E	29°05'15.40" N	1411.83	Draining of sewages and disposal of household wastes

Annex 16: Community user forest groups

Table 23: Community user forest groups by location, area, and representation

SN	Name	Location	Area (ha)	Households represented	Population benefited
1.	Bhuvaneshwari CF	Alital-5	294.1	123	768
2.	Alital CF	Alital-4	27	42	264
3.	Rajani CF	Alital-5	150.6	61	173
4.	Dakshinkali CF	Alital-3	51	105	619
5.	Bhairavkali CF	Alital-5	26	20	231
6.	Sadabahar CF	Alital-5	221.55	69	341
7.	Siddha Bhagawati CF	Alital-5	170.14	53	332
8.	Dogati CF	Alital-6	118	32	249
9.	Bhim CF	Alital-3	45.25	52	381
10.	Bhagawati CF	Alital-6	58	58	250
11.	Chyureni CF	Alital-5	335.63	76	538
12.	Narayan CF	Alital-6	53	29	232
13.	Jay Laxmi CF	Alital-7	47.76	88	491
14.	Malika CF	Alital-8	181	96	698

15.	Santoshi CF	Alital-8	259.85	106	630
16.	Shiv Shankar CF	Alital-7	134.92	39	242
17.	Kauleni CF	Alital-2	26.61	39	242
18.	Siddha Bhagawati Women CF	Alital-6	142.19	43	298
19.	Siddha Kedar CF	Alital-8	115.44	62	431
20.	Siddha Chyureni CF	Alital-6	83	30	187
21.	Siddha Bhagawati CF	Alital-7	137.5	63	453
22.	Gauri Shankar CF	Alital-7	30.36	33	237
23.	Parwati CF	Alital-7	54.71	22	127
24.	Siddhanath CF	Alital-6	48.75	38	231
25.	Kalika CF	Alital-4	61	32	260
26.	Bhagawati CF	Alital-4	105.68	80	470
27.	Shantipur CF	Alital-5	135.3	69	412
28.	Khahare CF	Alital-4	112.49	49	284
29.	Radha Krishna CF	Alital-4	84	52	356
30.	Laxmi Narayan CF	Alital-4	32.95	15	119
31.	Gangamala CF	Alital-5	230.12	38	244
32.	Mahalaxmi Bhawani CF	Alital-6	98.38	43	333
33.	Surpal CF	Alital-9	235.36	71	324
34.	Nav Durga CF	Alital-6	35.17	33	216
35.	Khildanda CF	Alital-3	51	39	245
36.	Siddhanath CF	Alital-9	138.8	38	254
37.	Janaki CF	Alital-5	60.7	53	332
38.	Bhimdatta CF	Alital-7	38.25	29	237
39.	Asigram CF	Alital-4	113	29	193
40.	Baijnath CF	Alital-4	132.6	29	189
41.	Chirasaini Women CF	Alital-5	173.62	76	538

42.	Sita Women CF	Alital-8	113	61	477
43.	Rauleshwar CF	Alital-8	60.21	38	170
44.	Basant Hariyali CF	Alital-9	114.8	52	331
45.	Manela Samaijee CF	Alital-2	186.49	97	671
46.	Panchwali CF	Alital-6	204.59	64	416
47.	Saptarangi Pragatisheel CF	Alital-4	80.5	28	193
48.	Bhagawati CF	Alital-2	40.77	64	478
49.	Bhagawati Women CF	Alital-3	36	104	348
50.	Kailashpati CF	Alital-6	64	25	140
51.	Krishna CF	Alital-6	120.96	32	203
52.	Siddha Bhagawati CF	Alital-2	153.28	20	171
53.	Hariyali CF	Alital-4	179.75	24	152
54.	Balwan CF	Alital-3	12.78	57	354
55.	Bhumiraj CF	Alital-4	134	44	203
56.	Pasalinga CF	Alital-4	236	51	325
57.	Siddha Samaijee CF	Alital-6	117.04	32	205
58.	Pragatisheel CF	Alital-6	156	40	270
59.	Bhumiraj CF	Alital-6	84.12	32	216
60.	Kailpal CF	Alital-1	27.93	29	153
61.	Kailpal Women CF	Alital-1	20	40	253
62.	Chitrakut Ghanteshwar CF	Gankhet-8	240.08	82	462
63.	Bhumiraj CF	Gankhet-9	154.21	61	337
64.	Siddhababa CF	Gankhet-9	119.25	82	424
65.	Kailash Samaijeshwar CF	Gankhet-6	148.69	31	188
66.	Radha Krishna CF	Gankhet-4	236	58	305
67.	Chaturmala CF	Gankhet-9	217	53	348

68.	Jay Ambe CF	Gankhet-7	75	51	322
69.	Ban Devi CF	Gankhet-8	119.67	55	318
70.	Bhageshwar CF	Sirsha-7	226.34	126	843
71.	Durga Devi CF	Sirsha-7	295.34	146	981
72.	Jagadamba CF	Sirsha-6	186.84	257	1612
73.	Kalika CF	Sirsha-6	304.6	192	1205
74.	Samaijee CF	Sirsha-8	146.08	37	177
75.	Siddhanath CF	Sirsha-9	494.03	254	1499
76.	Janaki CF	Sirsha-8	112.25	74	480
77.	Aidiwan CF	Sirsha-9	470.91	329	1890
78.	Kalika Women CF	Sirsha-8	65.3	114	720
79.	Asigram CF	Sirsha-1	119.19	35	146
80.	Parshuram Banghat Women CF	Sirsha-9	79.11	179	1168
81.	Bhageshwar CF	Sirsha-1	75	35	203
82.	Kharikhan CF	Sirsha-1	129.08	48	204
83.	Sadabahar CF	Sirsha-8	70	31	215
84.	Samaijee CF	Sirsha-8	190.8	45	205
85.	Pashupati CF	Sirsha-1	71	42	297
86.	Jagadamba CF	Sirsha-8	89.4	27	170
87.	Jhirkot Jimdar Women CF	Sirsha-1	77.4	21	150
88.	Nav Durga CF	Sirsha-5	48.5	27	179
89.	Siddhanath CF	Sirsha-4	74	22	108
90.	Mahakali Women CF	Sirsha-9	172	207	1261
91.	Bhageshwar CF	Sirsha-4	140	30	165
92.	Samaijee CF	Sirsha-5	108.46	67	539
93.	Sigas CF	Sirsha-5	105.4	81	500
94.	Bhagawati Women CF	Sirsha-1, 8	136	81	586

95.	Bhumiraj Khudakot Women CF	Sirsha-9	99	192	1393
96.	Gwasi Samaijee Janakalyan CF	Sirsha-5	182	60	350
97.	Siddhanath CF	Sirsha-8	195.66	42	255
98.	Jay Durga Women CF	Sirsha-5	198.84	22	119
99.	Nagarjun CF	Sirsha-5	192.8	25	118
100.	Samaijee Basghari CF	Sirsha-1	125.8	39	299
101.	Shiv Parbati CF	Sirsha-1	239.2	40	247
102.	Jana Chetana CF	Sirsha-5	188.93	36	243
103.	Latadeo CF	Sirsha-4	181.54	67	504
104.	Samaijee Women CF	Sirsha-8	52	29	168
105.	Baijnath Women CF	Sirsha-2, 8	268.39	41	246
106.	Samaijee CF	Sirsha-3	172.5	45	392
107.	Sunkharka CF	Sirsha-6	88.5	53	392
108.	Rangun Kholabhir CF	Sirsha-7	78.32	23	159
109.	Ranakuchi CF	Sirsha-5	164	33	185
110.	Chhaudideo CF	Sirsha-4	167.78	22	107
111.	Mahakali CF	Sirsha-5	191	35	293
112.	Mayalu CF	Sirsha-8	56.94	40	276
113.	Mahakali CF	Sirsha-5	182.4	24	144
114.	Tharthare Women CF	Sirsha-5	196.5	24	144
115.	Sangam CF	Sirsha-6	97	48	140
116.	Nav Durga CF	Sirsha-2, Gogan	89.9	44	368
117.	Bhagawati CF	Sirsha-1, Kolkhan	47.38	37	245
118.	Sundari CF	Jogbudha-1	291.73	221	1154
119.	Hatwani CF	Jogbudha-6	266.89	260	1585
120.	Mude*Paani* CF	Jogbudha-8	193.41	112	509
121.	Talkhola Chautari CF	Jogbudha-6	289	151	943

122.	Dansera CF	Jogbudha-1	399.23	246	940
123.	Siddhanath CF	Jogbudha-2, 3	120	115	351
124.	Kulebhat CF	Jogbudha-6	229.21	116	637
125.	Siddhanath CF	Jogbudha-1	186.98	159	1022
126.	Ram Janaki CF	Jogbudha-8	177.27	105	605
127.	Dhansara CF	Jogbudha-8	369.44	146	1003
128.	Baijnath CF	Jogbudha-2	240.15	116	787
129.	Siddhanath CF	Jogbudha-2	144	104	660
130.	Siddheshwar CF	Jogbudha-9	102.5	18	109
131.	Naya Mahila CF	Jogbudha-8	198.17	73	317
132.	Baijnath CF	Jogbudha-7	261.78	176	1092
133.	Aamgaudatal CF	Jogbudha-6	144.81	62	358
134.	Airani Rupse CF	Jogbudha-6	154.8	115	681
135.	Shaileshwari CF	Jogbudha-1	111.13	85	423
136.	Purnapur CF	Jogbudha-1	56.16	260	1585
137.	Dhanuke CF	Jogbudha-1	71.68	49	145
138.	Dakshinkali Women CF	Jogbudha-1	122.4	47	226
139.	Santoshi CF	Jogbudha-1	98	42	260
140.	Devidhura Women CF	Jogbudha-2	101.5	143	923
141.	Bhuvaneshwari Women CF	Jogbudha-8, 9	87.5	129	826
142.	Bhageshwar CF	Jogbudha-7	98.5	116	760
143.	Madhuban Women CF	Jogbudha-1	49	85	549
144.	Khajurani CF	Jogbudha-1	200.02	101	608
145.	Siddhanath CF	Jogbudha-7	100.88	29	148
146.	Panchkanya Women CF	Jogbudha-7	80.48	61	361
147.	Durga Bhagawati CF	Jogbudha-9	195	66	464

148.	Baijnath CF	Jogbudha-9	190.76	43	263
149.	Bhagawati CF	Jogbudha-7	162	60	356
150.	Salleri CF	Jogbudha-9	198.86	84	421
151.	Jay Laxmi CF	Jogbudha-9	197.6	80	358
152.	Siddha Bhagawati CF	Jogbudha-9	198.5	107	731
153.	Jarayokhal Sundari Women CF	Jogbudha-2	247.12	121	685
154.	Trishuli Women CF	Jogbudha-2	185	113	777
155.	Rauleshwar CF	Jogbudha-9	196	58	351
156.	Bandal Hariyali CF	Jogbudha-9	174	30	227
157.	Siddha Bhagawati CF	Jogbudha-9	139.5	48	359
158.	Kerabari CF	Jogbudha-6	292.24	71	395
159.	Dharam*Paani* CF	Jogbudha-7, 8	211.64	45	198
160.	Ambika Hariyali CF	Jogbudha-5	143.48	37	224
161.	Siddhanath CF	Jogbudha-5	65	76	504
162.	Sundar Hariyali CF	Jogbudha-5	172.3	86	172
163.	Sitaram CF	Jogbudha-4	85.42	63	462
164.	Shiv Sundari CF	Jogbudha-4	215.5	237	1537
165.	Thakayal Women CF	Jogbudha-2, 3	158.4	141	810
166.	Tripura CF	Jogbudha-3	78	63	443
167.	Sundar CF	Jogbudha-4	152.42	78	498
168.	Shital Women CF	Jogbudha-4	60	56	433
169.	Shantikunj Women CF	Jogbudha-4	221.02	76	473
170.	Basbari CF	Jogbudha-4	50	16	90
171.	Siddhanath CF	Jogbudha-2, 3	120	137	910
172.	Yasodhara Women CF	Jogbudha-4	129.7	48	334
173.	Indreni Women CF	Jogbudha-4	253.61	148	942
174.	Jhilmila Chure CF	Jogbudha-4	184.8	93	553

175.	Salleri CF	Jogbudha-5	186.12	38	239
176.	Baijnath Salleri CF	Jogbudha-4	175.83	37	202
177.	Siddhanath CF	Jogbudha-5	88.89	46	248
178.	Siddhanath CF	Jogbudha-5	127	29	89
179.	Baijnath CF	Jogbudha-5	129	22	89
180.	Laxmi Women CF	Jogbudha-5	135	21	138
181.	Satrupa CF	Jogbudha-4	78.65	40	257
182.	Madhu Sundari CF	Jogbudha-3	115	64	443
183.	Bhairavnath Chure CF	Jogbudha-4	276.24	86	373
184.	Saraswati CF	Jogbudha-5	39	23	145
185.	Trishul CF	Jogbudha-5	123	29	130
186.	Bhagawati Women CF	Jogbudha-5	152	23	145
187.	Shanti CF	Jogbudha-5	175.56	92	584
188.	Madhuban CF	Jogbudha-5	37.77	12	60
	Total		**27,009.86**	**13,374**	**81,053**

Annex 17: Existing policy provisions and status of enforcement

Table 24: Current policy provisions and relevant observations

Policy Provision	Ground Reality	Recommendations
Municipalities (local governments) are empowered to prepare and implement programs with regard to forests, vegetation, biodiversity, soil conservation, and environmental conservation in the village development area (per section 28(h) of the LSGA, 1999). Municipalities are required to assist environment conservation by managing air, land and water pollution within their jurisdiction; this work includes conserving forest, plants and other natural assets, and collecting, transporting, and disposing	Although the LSGA has been in force for the past 18 years, local bodies have not given priority to developing separate programs for conserving biodiversity. The municipalities in the watershed area have also focused limited energy on collecting and disposing waste.	Need greater focus on conservation of aquatic biodiversity through site-specific policy provisions in support of local communities and establishment of strong monitoring mechanisms. Awareness raising and formulation of local level by-laws and strict

solid waste of the municipality area (per section 96(1)(c) of the LSGA).	People not aware of the existing Aquatic Animal Protection Act, 1961.	implementation are needed
The National Park Regulations 1974 provide detailed provisions for hunting license issuance (rules 5-13). However, these regulations contain no specific provisions relating to fish, but the definition of wildlife includes fish as well.	Community Based Anti-poaching Units (CBAPU) and Rapid Response Teams (RRT) have been established and work in the watershed in some instances.	Conservation activities should be mainstreamed through development planning to ensure effective implementation.

Annex 18: Water supply and sanitation user groups

Table 25: Water supply and sanitation user groups in the Rangun Khola watershed

S.N.	Name of user Committee	Address	Households benefiting
1.	Unikot Khanepani Yojana	Gankhet-01	14
2.	Unikot Khanepani Yojana	Gankhet-05	5
3.	Unikot Khanepani Yojana	Gankhet-01	11
4.	Joshina Khanepani Yojana	Gankhet-09	26
5.	Hamtad Khanepani Yojana	Alital-04	25
6.	Mallo Chaud Khanepani Yojana	Alital-04	27
7.	Hamtad Khanepani Yojana, Scheme No. 2	Alital-05	25
8.	Asladi Khanepani Yojana	Alital-09	23
9.	Chaud Khanepani Yojana	Sirsha-04	17
10.	Makail Khanepani Yojana	Sirsha-04	33
11.	Taudina Khanepani Yojana	Sirsha-03	25
	Total		**231**

Annex 19: Statuses of existing environment management plans

Table 26: Existing environment management plans by location, type, and current status

Location	WMP	CAPA	LAPA	WUMP	LDRMP
Parshuram NP	3	3	1	1 (only for Shirsha VDC)	3
Alital VDC	3	3	1	1	3
Gankhet VDC	3	3	1	1	3
Chhatiwan VDC	3	3			3

Legend: WMP – water management plan; CAPA – community adaptation plan of action; LAPA – local adaptation plan of action; WUMP – water use master plan; LDRMP – local disaster risk management plan

1 = in place; 2 = not in place; 3 = in place, needs updating

Annex 20: Key stakeholders – organizations and offices

Table 27: Key organizations and offices relevant to watershed health

SN	Name	Address
	A. Government Organizations	
1	District Coordination Committee	Dadeldhura
2	District Soil Conservation Office	Dadeldhura
3	District Forest Office	Dadeldhura
4	District Agriculture Development Office	Dadeldhura
5	District Livestock Service Office	Dadeldhura
6	Irrigation Sub-Division	Dadeldhura
7	Women and Child Development Office	Dadeldhura
8	District Technical Office	Dadeldhura
9	Parshuram Municipality	Jogbudha, Dadeldhura
10	Alital Rural Municipality	Godam, Dadeldhura
11	Distrct Health Office	Dadeldhura
12	District Administration Office	Dadeldhura
13	Centre Bureau of Statistics	Dadeldhura

14	Road Division	Dadeldhura
15	Jorayal Rural Municipality	Jorayal, Doti
16	District Education Office	Dadeldhura
17	Water Supply and Sanitation Division Office	Dadeldhura
	B. Non-Government Organizations	
1	KISAN	Dadeldhura
2	Promoting Agriculture, Health and Alternative Livelihoods (PAHAL)	Dadeldhura
3	Rural Village Water Resources Management Project (RVWRMP)	Dadeldhura
4	Rural Access Programme (RAP)	Dadeldhura
5	Rural Women Development and Unity Center (RuWDUC)	Dadeldhura
6	SUAAHARA-Good Nutrition Program	Dadeldhura
7	Multi-Purpose Development Society (MPDS)	Dadeldhura
8	Integrated Development Society (IDeS)	Dadeldhura
9	Building Climate Resilience of Watersheds of Mountain Eco-regions (BCRWME)	Dadeldhura
10	HIMAWANTI	Dadeldhura
11	Nepal Red Cross Society	Dadeldhura
12	Rural Environment Development Center (REDC)	Dadeldhura
13	Human Rights Commission	Dadeldhura
14	Oxfam	Dadeldhura
15	UNFCO	Dadeldhura
16	Rural Infrastructure Development Program (RIDP)	Dadeldhura
17	UNICEF	Dadeldhura
18	Feminist Dalit Organization (FEDO)	Dadeldhura
19	Federation of Community Forest Users' Nepal (FECOFUN)	Dadeldhura
20	National Federation of Irrigation Water Users' Association, Nepal (NFIWUAN)	Dadeldhura
21	Nepal Federation of Indigenous Nationalities' (NEFIN)	Dadeldhura
22	Federation of Drinking Water and Sanitation Users' Nepal (FEDWASUN)	Dadeldhura
23	Nepal Federation of Environmental Journalists (NEFEJ)	Dadeldhura

24	Federation of Nepalese Chambers of Commerce and Industry (FNCCI)	Dadeldhura
25	GIZ	Dadeldhura
26	UNDP	Dadeldhura
27	CARE Nepal	Dadeldhura
28	Environment, Culture, Agriculture, Research and Development Society, Nepal (ECARDS)	Dadeldhura
29	Lutheran World Federation (LWF)	Dadeldhura
30	Food and Agriculture Organization (FAO)	Dadeldhura
31	Rural Development Promotion Center (RDPC)	Dadeldhura
32	International Wheat and Maize Improvement Center (CIMMYT)	Dadeldhura
33	Leasehold Forestry Programme	Dadeldhura
34	World Food Programme (WFP)	Dadeldhura
33	UNFPA	Dadeldhura

Annex 21: Vision building framework employed for compiling the Rangun Khola watershed profile