RANGUN WATERSHED HEALTH REPORT

Community Vision - "Model prosperous Rangun watershed: social, economic and environmental prosperity through bio-diversity conservation, sustainable utilization and equal distribution of benefits"

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What is a watershed?

A watershed is an area of land that contains a common set of streams and rivers that drain into a single larger body of water, such as a river (Figure 1). But watersheds include more than streams and rivers; they also consist of all the people, forests, wildlife, villages, infrastructure, terrain, climate, and agriculture within the landscape.

It is important to think about a watershed in its entirety – upstream and downstream – instead of only looking at one element of the watershed. This is because water flows and connects various aspects of a watershed. What happens upstream has an impact on what happens downstream. For example, gravel mining upstream can increase sedimentation for downstream residents. Similarly, water diversions upstream for irrigation can reduce the amount of water available downstream for people and aquatic species.

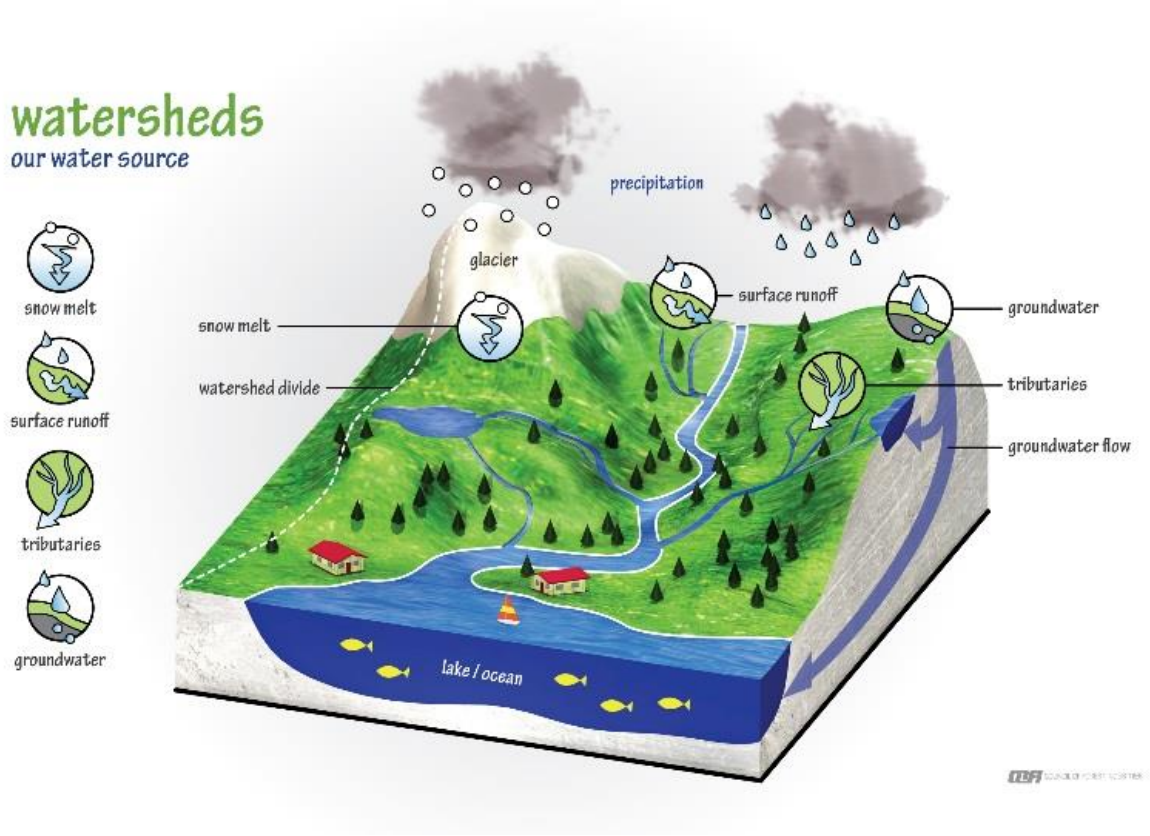

Figure 1: Diagram of a typical watershed

The goal of this watershed health assessment is to help people living in the Rangun watershed make better decisions, protect and restore the watershed, reduce risks, and create sustainable economic opportunities.

This watershed report uses indicators to measure different aspects of a watershed to determine if the landscape is healthy and able to provide ecosystem services to people living in that watershed. The indicators in this report were determined through a combination of local stakeholder use priorities and watershed health as defined in the literature.

The health indicators in this report are grouped under larger categories of 1) nature, 2) wealth, and 3) power, each of which explores related aspects of the watershed from that particular viewpoint. A full profile of the Rangun watershed has also been prepared.

River Basin	Rangun
Province	Number 7
Total Watershed area	690.1 km^2
Number of streams	135
Major rivers	Rangun, Puntura Gad, Sirsha Gad, Sun Khola, Sandani Khola
Lakes and wetlands	Ali Tal, Pipalkot Tal, Kumad Gad
Land use	Forest, 91%; agricultural land, 6.3%; grazing land, 1.6%
Municipalities	Parshuram Municipality, Alital Rural Municipality, Jorayal Rural Municipality
Population	53,109 (48% male; 52% female)(CBS, 2015)
Ethnic groups	Brahmin (9.6%), Chhetri (66.2%), Janajati (8.8%), Dalit (15.2%)

The Rangun Watershed is located in Dadeldhura and Doti Districts in southwestern Nepal (Figure 2). The watershed falls primarily falls within the Siwaliks along the Mahakali River basin. For management purposes, the watershed includes three streams that each flow directly into the Mahakali River: the Rangun, the Sirsha, and the Sandani. The watershed has many steep slopes and stretches from the mountains (about 2,500 meters) to the Tarai (about 300 meters, at the confluence with the Mahakali), creating an environment susceptible to floods, landslides, and river cutting, all of which contribute to high sedimentation and inundation downstream. These dangers also pose major threats to aquatic habitats throughout the watershed.

Water is available for drinking, irrigation and domestic uses but varies by season and location. Locally established micro-hydropower plants generate some 80.5 KW electricity. The largest hydropower plant, Daha Gad micro-hydropower, generates 25 KW. The watershed is a mosaic of ethnic diversity. Major ethnic groups in the watershed include Brahmin, Chhetri, Thakuri, Dalit, Magar, Tharu and Gurung.

The key threats to local water management are natural hazards, which human activities can make worse (e.g., river cutting, soil erosion, flooding, landslides), forest degradation, and deforestation due to illegal timber harvesting.

Nature

Health indicators in this section include various aspects of the watershed ecosystem, including water, biodiversity, and land use.

Water

The condition of water resources within a watershed depends on a large number of factors that affect the water cycle. In Rangun watershed, these include rainfall, minimal snow melt, infiltration, and withdrawals for irrigation, among other factors.

Rainfall

There are very few rainfall stations in the Rangun watershed. One station at Jogbudha located in southwestern part of the area has rainfall records from 2009 to 2016. Combining data from Jogbudha with data surrounding rainfall stations in Mahendranagar, Kola Gaun and Dadeldhura show that rainfall decreases spatially from south to north, and from the higher mountains (about 3,500 mm) to the lowlands (900 mm, at Jogbudha). The average monsoon season rainfall (Jun to Sept) is many times higher than that of the pre-and post-monsoon and winter months.

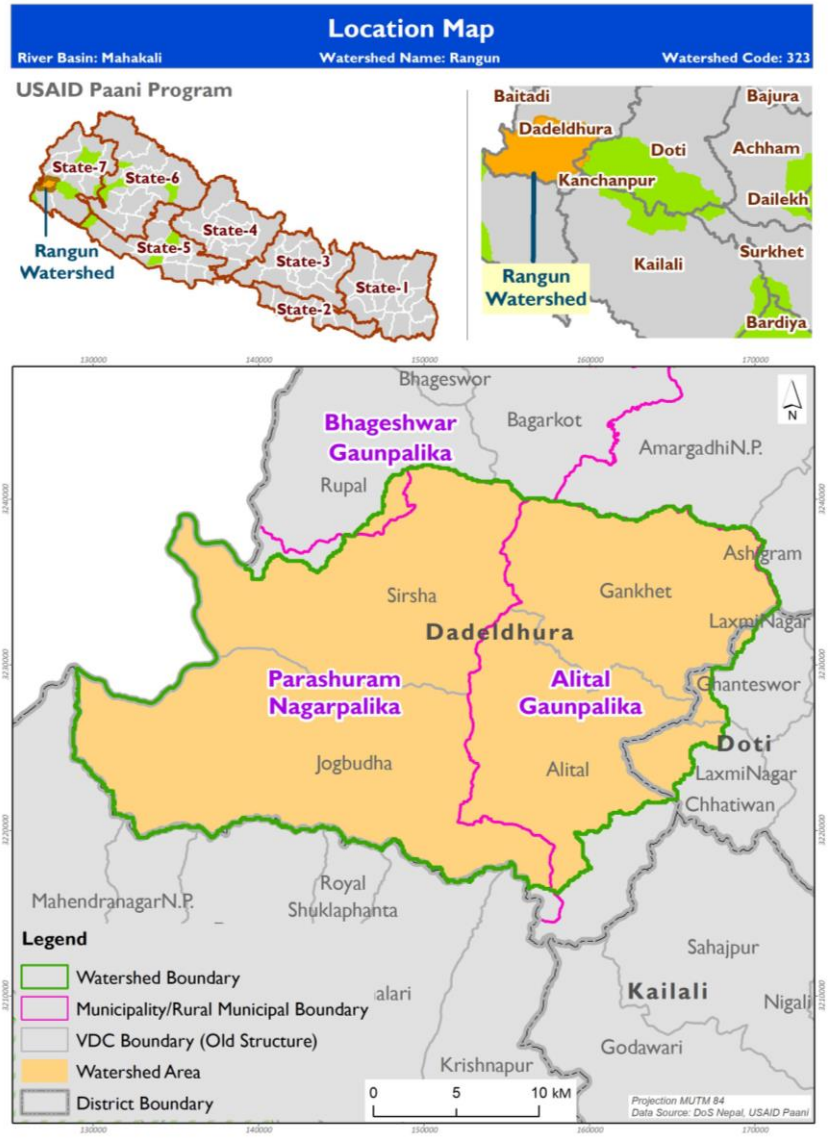

Figure 2: Location map of the Rangun watershed

Water availability and accessibility

Rivers, streams and springs provide water in the Rangun watershed. The Rangun Khola and its tributaries are the primary source. However, in spite of plentiful streams and rivers, water distribution is uneven and several places are considered water scarce, including Bantal, Gothana, Baseli and Gallek. To overcome the deficit, the Parashuram Municipality has a project on drinking water. In a 2017 survey conducted by NFIWUAN, 23% of households reported spending more than 30 minutes per day to obtain water. Of those who reported that their water sources have been drying, 82% faced difficulties due to these drying water sources.

Water accessibility, on the other hand, 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 watershed, 9% of

Janajati, 12% of Brahmin/Chhetri/Thakuri (BCT), and 21% of Dalits said they *did not* have equal access to available water.

When asked about barriers to access, 68% of respondents cited the long distance to water as the primary barrier, followed by 64% who noted caste-based discrimination, and 52% who noted water shortage as another significant issue.

River and lake water quality

Due to growing urbanization and improperly managed solid and other household wastes, water pollution has been increasing in the watershed. Solid waste released from cluster settlements, such as Katal, Parigaon, Jogbudha Bazaar, Aampani, Gharelu, Kainpani, Godam, and Buder, has become the main source of pollution in the Rangun Khola. Other pollution sources include runoff agro-chemicals, draining sewage, dead animal disposal, and plastics/rubbish. People reported that declining water quality may be contributing to a rise in allergies, livestock disease, and declining populations of aquatic animals.

Five points in the watershed were selected and measurements taken during dry and wet seasons from seasonal and perennial streams (Figure 3). Water samples were collected and tested for pH, iron, nitrite-nitrogen, ammonium, phosphate, and temperature. Generally, water quality in the Rangun watershed falls within accepted ranges for drinking, agriculture, irrigation, and aquatic life.

9%

Households perceive the quality of water they drink IS good/excellent.

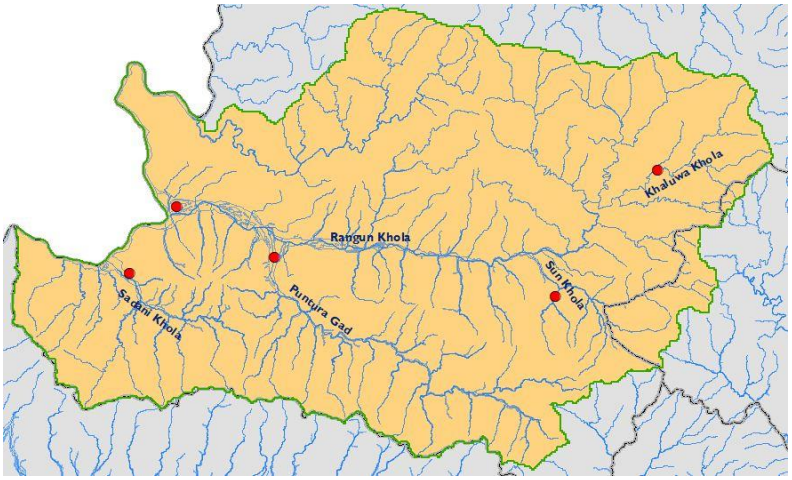

Figure 3: Water sampling points in the Rangun watershed

Biodiversity and habitat

Biodiversity and habitat speak to the overall environmental strength of an area to support a wide range of animal and plant species and also human uses, such as fishing or agriculture.

Land use and land cover

Nearly 91% of land cover in Rangun is covered by forest, 6.39 is cultivated for agriculture, and 1.6% is grazing land comprised of grass and bushes. Rivers and streams cover 1.4% of the land area. In the northern parts of the watershed, most of the streams are perennial, but in the south they are seasonal with low water content in the winter months.

Fish diversity

Respondents said 13 species of fish can be found in the watershed, including *Schizothorax spp* (Asala), *Acrossocheilus spp* (Katle), *Tor tor* (Sahar), and *Barilies spp.,* among others. Buduna, Sanosahar, Chuche Bam, Asala, Sano Asala, Fagate are found in the Sandani, but Asala and Chuche Bam are almost extinct. Two species of migratory fish have been noted in the area: Gerada and Kadanga.

Fifty-three percent of respondents said they believed native fish populations had declined in the watershed. The reasons for the decline included a decrease in forest cover, and landslides that destroy fish holes, kholas, and lakes. In particular, respondents said that *Asala* in the Sandani Khola and tributaries had been affected by the loss of headwater spring sources.

53%

Respondents opined that native fish population has decreased compared to last 5 to 10 years

Wealth

Indicators in this category refer to the current economic conditions within the watershed as well as future prospects. In this section, we focus on the most prominent forms of industry and livelihood in the Rangun watershed.

Infrastructure and extractives

The design and construction of infrastructure, such as roads and hydropower plants, have 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 within the watershed. Sustainable infrastructure should provide equitable distribution of benefits with minimal long-term, environmental impacts.

Hydropower

No large hydropower exists in the watershed. Five microhydro plants are operative (at Dahagad, Gairagaon, Sankhola, Selakhola, Makail, and Sirshagad), generating a collective 80 kW of electricity. The government has issued two additional licenses for plants that could be constructed in the next decade. Initial assessments showed some level of interaction between microhydro and aquatic biodiversity, but further studies are needed to establish the links of this relationship.

Capture fishery practices

No households or communities we surveyed were fully dependent on capture fishing. Rather, fishing was seen as a means to enrich family nutrition, undertaken primarily by men. Diverting streams is the most common form of fishing, particularly in the dry season, but net fishing has become more common, especially during monsoon.

Most fishers today tend to come from traditional fishing communities. There seems to be a declining community interest in fishing, influenced by declining fish stocks in the rivers and streams.

Development work is also having a negative effect on fishing. The area between Deuba village and the Rangun Khola has been a reliable fishing area for years, but newly opened roads have precipitated landslides, which have destroyed local fishing holes.

Irrigation and sustainable agriculture

Farming in the Rangun watershed is supported by robust irrigation facilities, but river cutting and drying water sources threaten the effectiveness of this system, particularly in downstream communities. Terracing could be one remediating option, but those are rare in the watershed, except for Jogbudha and Sirsha. For this reason, smallholding farmers are more vulnerable to water availability and the impacts of climate change, and the potential for conflict over irrigation access is high.

83%

Households perceived significant reduction in agricultural production

Gravel mining

Gravel is mined from several locations in the watershed, along the banks of the Puntura, Sunkhola, Rangun, and Sandani kholas. The material is supplied to Jogbudha, Parigaon, Katal, Gharelu, Godam, and Budar to build local infrastructure, such as houses, roads, canals, and retaining walls.

Despite this activity, gravel mining does not currently contribute significantly to sedimentation in the river or the degradation of water habitats. However, should gravel mining continue to increase in the watershed, it will exacerbate the effects of floods and landslides each year that inundate valuable farmland. Therefore, greater regulation of mining may be necessary.

Roads

There are no black-topped roads in the Rangun watershed, 47 km of gravel roads (from Buder to Lipna), and 119.5 km of earthen roads built by village and district authorities. Most rural roads in the study were constructed without conducting an Initial Environment Examination (IEE). Respondents said they believed rural road construction had contributed to sedimentation downstream, which degrades aquatic habitats and ecosystem functioning.

Irrigation

Analyzing irrigation systems helps evaluate water availability, potential impacts on river systems, and the status of aquatic life in different water bodies. The extent to which water is diverted for irrigation directly affects local aquatic life. In other words, river systems need to maintain a base environmental flow to keep aquatic life supported and intact.

In the Rangun watershed there are 14 irrigation projects in operation with varying degrees of operation and coverage. Some projects do not run properly (e.g., Upper Parigaon and Sandani) due to drying water sources in the area. Most irrigation projects in this watershed were constructed after conducting an IEE to understand how they would impact local ecosystems. The IEE is required, however, only for larger irrigation schemes. Small-scale schemes (<300 hectares) do have to file such a report.

Nonetheless, the study found that irrigation systems in the watershed had little impact on watershed health in the area.

Climate resilience and disaster risk reduction

Increased human activity combined with climate change impacts is intensifying environmental degradation in many parts of the Rangun watershed, in some cases, intensifying the likelihood and effects of natural hazards such as floods and landslides. For this reason, a focus on building climate resilience and disaster risk reduction in the area is warranted.

The District Disaster Preparedness Response Plan, Dadeldhura (2017) shows that Parshuram Municipality and Alital VDC (now a Rural Municipality) of Rangun Watershed are considered high-risk, while Gankhet VDC is rated medium risk for a range of hazards, including floods, drought, landslides, forest fires.

Twenty-five percent of households in the watershed say they have adopted practices to adapt to changes brought by climate variability.

Early warning systems

One early warning system has been set up along the Mahakali River at Parigaon and Shirsagad; this system carries over into the Rangun watershed. When hazards appear, the District Administrative Office (DAO) alerts communities through SMS, radio, mobile phones and newspapers. The alerts sent through SMS, radio, and television run for 24 hours. After the alert is sounded, the DAO mobilizes local security forces for potential rescue and response efforts, and to help households relocated to higher ground.

Only 14% of households said an early warning system exists in their community. Of that 14%, 92% reported that they had equal access to the information.

Power

Indicators in this section refer to the strength and accessibility of governance institutions in the watershed, as well as the level of inclusiveness across gender, caste, and ethnicity in decision-making processes.

Local institutions and inclusiveness

There are numerous organizations, federations and line agencies in the watershed that are responsible for managing the watershed to provide public services. One-hundred and eighty-eight Community Forest User Groups (CFUGs) support watershed management and forest regeneration efforts in the area.

3%

Women and marginalized castes and ethnic group community members hold key positions in user groups

Participation of women and marginalized community members has increased in local groups such as CFUGs, irrigation groups and cooperatives; however, very few women or marginalized persons hold key positions within those groups. Raute women have reported feeling discriminated against when they participate in mixed groups and being excluded from decision making.

There is only middling awareness of available local representative groups in Rangun. Thirty-two percent of Janajati, 54 % of Brahmin/Chhetri/Thakuri, and 52 % of Dalit reported awareness of which formal groups were present in the watershed. On the question of affiliation with available groups by caste and ethnicity, the study found that only 15% of Janajati, 25% of Brahmin/Chhetri/Thakuri, and 28% of Dalit reported affiliation with a local representative body.

Policies, frameworks and regulations

The Constitution of Nepal 2015 guarantees the right of every person to live in a clean and healthy environment. Accordingly, the national government has ratified numerous policy provisions and programs for conserving natural resources and promoting environmental management. A few examples of these policies include the National Park and Wildlife Conservation Act - 2029 (1973); the Soil Conservation and Watershed Management Act – 2039 (1983); the Forest Act – 2049 (1993); and the Environmental Protection Act – 2053 (1997).

Importantly, the Local Self-Governance Act – 2051 (1999) allocates authority to local governments to manage a wide range of natural resource and water-related issues including agriculture, rural drinking water, irrigation, river control, soil conservation, and the development of tourism and cottage industries.

In the watershed, government line agencies – such as the soil conservation office, forest office, and drinking water and sanitation office – are positioned to assist with watershed health issues in Rangun. These institutions will also lend expertise for implementing programs to improve sustainable disaster management and climate change adaptation. Institutions also have a shared commitment to achieve 33% female participation in government work and decision making about natural resources. Despite these aspirations, only 8% of respondents said they were aware of local planning processes and only 4% of women and members of marginalized groups hold key positions in local user groups. In addition, residents still expressed concerns about the lack of coordination, responsiveness, and human resources at local levels to insure consistent application and monitoring of watershed management practices.

Several governance opportunities may be capitalized upon in the next few years, as the recently-elected parliament means fresh local representation for watershed concerns. A move toward a federalist structure could mean greater responsibility at local levels, which could improve responsiveness in regard to meeting pressing environmental challenges in the watershed, upstream and downstream. Effective preparation and implementation of IEEs for road and hydropower construction are recommended. Concerns remain about adequate budgets for local level governance.

8%

Households aware of local planning processes

Watershed health assessment – Summary

The list of health indicators presented in this section takes into account factors related to biophysical health, infrastructure, socio-economic and governance within the watershed. Each of these indicators was assessed through consultation with stakeholders in the Rangun watershed and assigned a score between 0-5 points.

We are concerned with assessment *and* monitoring, and employ the following rating system.

Color Symbol	Description	Treatment measures
[4-5 points] 	Good health condition, no additional treatment required	Intervention required to keep condition intact
[2-4 points]	Fair condition, functioning at risk, be alert to maintain and improve condition of the watershed	Promotion of good practices needed to improve health condition; special attention if not additional treatment may be necessary.
[<2 points] 	Poor condition, impaired functioning, decreased quality and quantity of ecosystem services in the watershed	Special measures must be adopted to restore watershed health conditions and ecosystem services

Based on the designated indicators for assessment, we rate the health status of the Rangun watershed as ***moderately good*** (Table 1)**.** Water quality, household sanitation practices, and general land cover are among the most positive factors impacting watershed health. Water availability and declining agricultural productivity pose the most serious and immediate challenges to residents in the area. Unsustainable irrigation, fishing practices and gravel mining are areas that need more attention in the future.

Table 1: Summary of health indicators for the Rangun watershed

Theme	Watershed health indicators	Watershed indicator rating	Rationale for rating
WATER 	Water availability		- 82% of households experience difficulties due to drying water sources
	Water accessibility for community, agriculture		- Only 18% of households have year-round water for irrigation
	Water quality for drinking, irrigation and energy generation		- 9% households perceive the quality of water they drink as good/excellent.
BIODIVERSITY & HABITAT 	Household sanitation		- 97% of households use toilet for defecation
	Solid waste disposal		- Solid waste and garbage are seen in all major local market areas and villages - 15% of households report throwing solid waste in the river.
	Land use land cover		- 91% of the watershed is covered with forest
	Species diversity [Fresh water]		- 53% of households report the number of native fish has decreased over the last decade
	Invasive species [Aquatic]		- Only 7% households report having seen new plant species in the watershed - Only 1% households report the number of non-native fish has increased over the last decade
	Quantity of fish [Local]		- 53% of households report the number of native fish has decreased over the last decade

	Fishing practices		- Increasing destructive fishing practices have been observed in the area
SUSTAINABLE AGRICULTURE	Soil management [conservation, fertility]		- 83% households reported that soil fertility has decreased over the past decade
	Sustainability of hydropower		- No large hydropower in the watershed but several microhydro plants with other planned for construction
	Sustainability of gravel mining and construction materials		- Under extraction of gravel has led to over deposition of sediment in the river
SUSTAINABLE INFRASTRUCTURE & MINING [e-friendly framework]	Sustainability of rural roads		- Many rural roads constructed without conducting an IEE
	Sustainability of irrigation		- Conflict over distribution of irrigation water due to water sources drying up
	Climate induced threats – intensity and severity [landslides, floods and landslides]		- Many threats present in the watershed, including high intensity floods and landslides
CLIMATE RESILIENCE AND DISASTER RISK REDUCTION	Community response, measures to adapt to CC impacts		- Only 25% households reported undertaking climate resilience activities
	Community access to early warning systems		- Of the 14% of respondents who said an early warning system (EWS) exists, 92% reported that they have equal access to EWS information

	Inclusive participation in local planning; Women, marginalized castes and ethnic groups hold key positions in NRM groups		- Less than 3% of women and marginalized group members hold leadership positions in user groups
	Persistence of active NRM groups [Biodiversity, disaster, climate change, water, agriculture, forest, irrigation, farmers]		- Only 24% people engaged in local community groups and representative bodies
GOVERNANCE AND EQUALITY 	People comply with laws and policy provisions, including local norms and standards		- Only 8% households aware of local planning processes
	Mechanism placed to resolve outstanding issues, benefit sharing, sand mining, irrigation, hydropower		- Communities work together to resolve outstanding issues and benefit sharing in most cases
	Equitable access and benefit sharing arising from use of Natural resources (ecosystems services and products)		- Few women or marginalized persons hold decision making positions within user groups. Women of some ethnic groups report being excluded from decision making.
	Coordination between the, municipalities [rural] municipalities, provinces and line agencies		- Cross-jurisdiction and coordination between VDCs, municipalities, districts, and provinces is not apparent

	Adoption of climate-smart, environment and watershed management friendly practices [across all thematic areas]		- Only 4.2% households adopting good practices

References

Central Bureau of Statistics, Nepal (CBS). 2*015 Statistical Year Book Nepal*. Kathmandu: Government of Nepal. Accessed January 11, 2018. (http://cbs.gov.np/image/data/2017/Statistical%20Year%20Book%202015.pdf).