TILA KARNALI WATERSHED HEALTH REPORT

Vision Statement: “ To create an inclusive and prosperous Tila Karnali watershed, support green infrastructure and ecotourism, and responsibly manage biodiversity.”

USAID
FROM THE AMERICAN PEOPLE

USAID PAANI PROGRAM

युएसएड पानी परियोजना

What is a watershed?

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

Watershed should be understood in its entirety – upstream and downstream – instead of only looking at one element of the watershed. This is because water flows connect various aspects of a watershed. What happens upstream has an impact on what happens downstream. For example, landslides and soil erosion upstream can increase sedimentation for downstream residents. Similarly, water diversions upstream for irrigation reduces water available downstream for people and aquatic species.

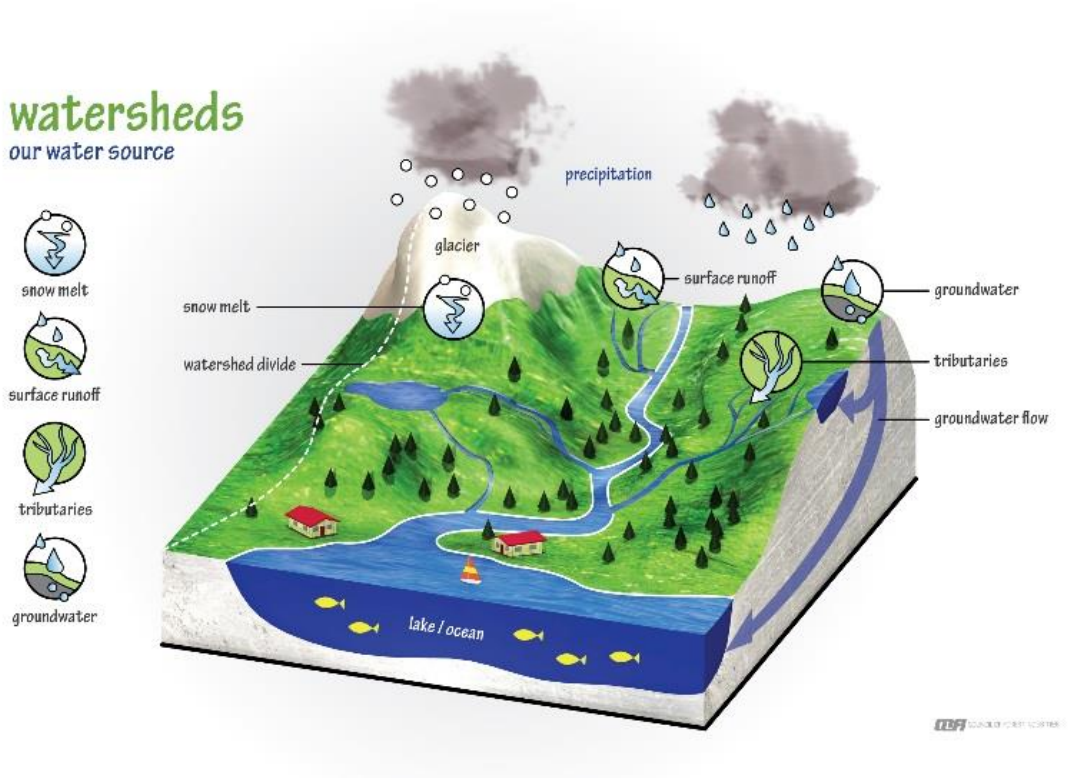

Figure 1: Diagram of a typical watershed

This watershed health report is one of several being written for watersheds across Nepal to inform development visions and processes. The goal of this watershed health assessment is to help people living in the Tila Karnali Watershed make better decisions, protect and restore the watershed, reduce risks, and create sustainable economic opportunities.

This watershed health 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 Tila Karnali Watershed has also been prepared.

River basin	Karnali
Provinces	No. 6
Total watershed area	767.5 km^2
Number of streams	20
Major rivers	Bhartagaad, Baligaad, Tila River, Poripali, Padamgaad
Lakes and wetlands	None
Landcover	Forest (56%), grazing land (25%), cultivation (16%), barren land (2%) and water bodies (1%).
Municipalities	Khadachakra and Tilagufa
Rural municipalities	Tila, Mahabai, and Subha Kalika
Population	52,402 (49.9% male; 50.1% female)
Population density	68 people/km^2
Ethnic groups	Brahmin/Chhetri/Thakuri (77.1%); Dalit (21.0%), Janajati (1.6%)

The Tila Karnali Watershed sits in the Karnali Basin of Nepal in the northwestern part of the country and extends across Kalikot and Jumla Districts (Figure 2). Five smaller municipalities are contained within the watershed: Khandachakra and Tilagufa nagarpalika (NP), Shubha Kalika and Mahabai gaunpalika (GP) of Kalikot, and Tila GP in Jumla.

The population of Tila Karnali is 58,996, of which 76% identify as BCTS, 16% as Kami, 5% as Damai/Dholi, and the rest as Janajati. The total area of the watershed is 767.5 km^2 and the population density is low – 68.2 people per km^2. The elevation of Tila Karnali ranges from 4,790 m in the north to 738 m in the south.

The land cover is primarily forest and shrub-land (56%), followed by grazing land (25%), cultivated land (16%), barren land (4%), and bodies of water (1%). Twenty-five percent of the cultivated land is irrigated.

Roads to Rara Lake pass through Tila Karnali, which has meant more traffic and connectivity with other areas to the north and south. This location also offers some opportunity to develop eco-tourism in the area.

Hydropower is a rising concern in the watershed, as commercial interests seek to utilize the high flow rates of the steep rivers. At the time of this report, 10 micro-hydropower projects are operating, with four large projects planned for the area. Of those four, Tila 1 and Tila 2 are expected to generate 440 MW and 420 MW of electricity, respectively. These projects will affect hydrological flows in Tila Karnali.

Hydropower, however, is not the only factor affecting hydrological flows in the watershed. Through numerous consultation and hundreds of surveys, respondents listed many other phenomena that are changing the availability of water in Tila Karnali, including deforestation, climate change, mining, rural road construction, steep slow cultivation, landslides, and erratic rainfall patterns.

These stressors on hydrological flow, in turn, affect the aquatic and terrestrial landscapes, which contain an impressive and environmentally crucial biodiversity.

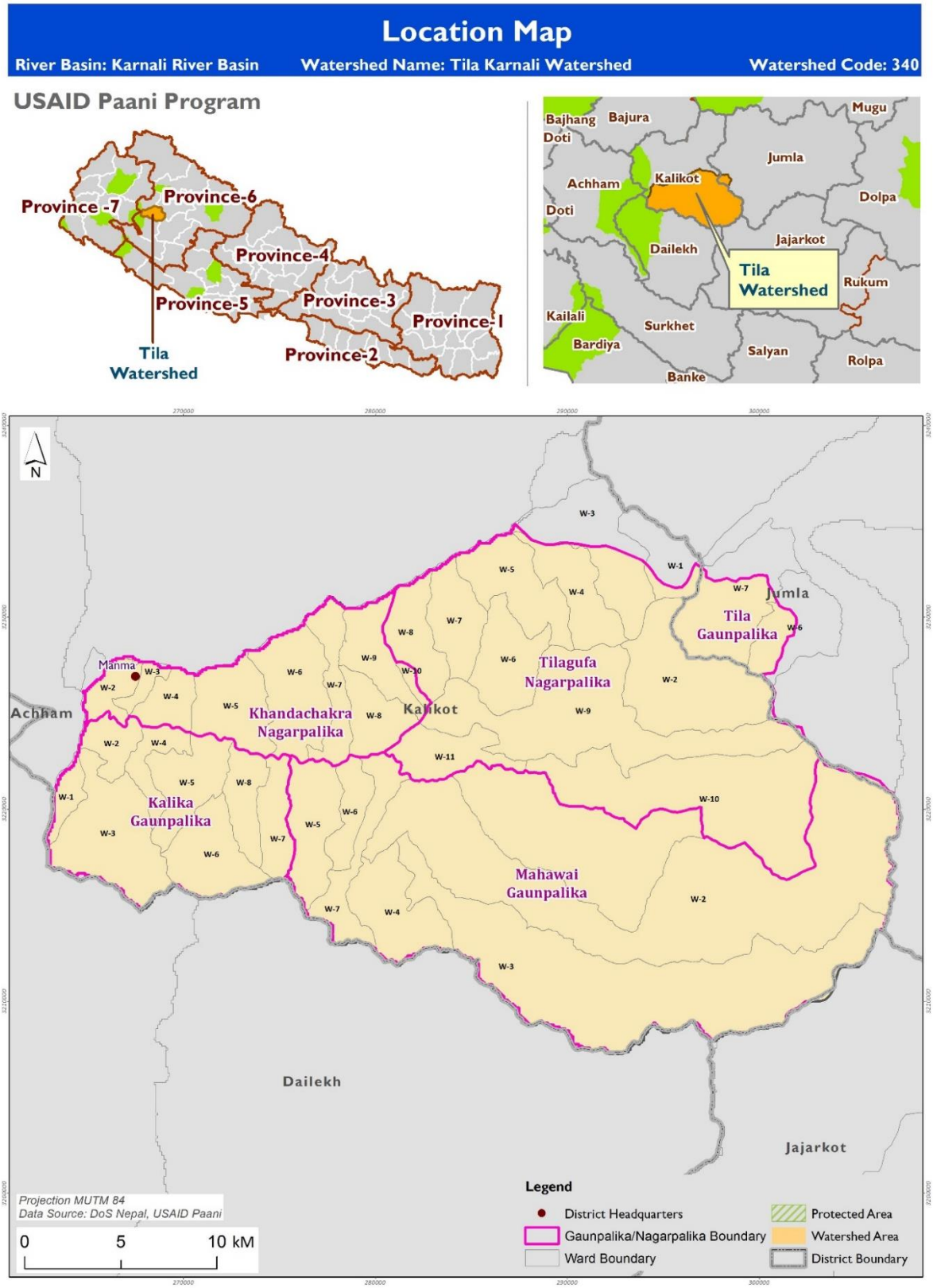

Figure 2: The Tila Karnali Watershed and administrative unit

Nature

This section examines the environmental and natural resource dimensions of the watershed, including climate and weather, hydrology, biodiversity, and land use within the Tila Karnali Watershed, paying special note to trends and changes that may threaten the health and sustainability of these assets.

Water

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

Rainfall

Long-term rainfall data records in Tila Karnali are available only at Sherighat, in the western part of the watershed, near the outlet of the Tila River. This lone station does not, however, provide sufficient information to account for the significant topographical variation of the watershed. Stations at Nagma, Thirpu, and Bijayapur Raskot were used as well to provide a fuller picture of rainfall history and rainfall trends.

Spatial and seasonal variations in rainfall change trends are observed in the watershed. Annual rainfall is decreasing at a rate of 10 mm/year. However, the observed trend of change in seasonal rainfall is not consistent in the watershed. Mean monsoon (Jun – Sep) rainfall and mean pre-monsoon (Mar-May) rainfall rates are decreasing by 10 mm/year and 3 mm/year, respectively. Mean winter rainfall (Dec – Feb) is increasing at a rate of 1.8 mm/year. Mean post-monsoon (Oct-Nov) rainfall change varies from a rate of -1 mm/year to 1 mm/year, moving from the western to eastern part of the catchment.

The Theissen polygon method was used to estimate the average rainfall of the watershed. The highest and lowest rainfall amounts were observed in the months of July/August and November, respectively. The average rainfall by seasons were 124 mm in winter, 187 mm in pre-monsoon, 681 mm in monsoon, and 48 mm in post-monsoon. The average annual rainfall for the watershed is 1.031 mm

49% of households say they need 30 or more minutes per day to collect sufficient water

Water availability and accessibility

Water availability is a major source of concern in the Tila Karnali Watershed. Only 1% of the watershed area is covered by water bodies, and 96% of respondents said that water resources had declined over the past decade.

Household surveys (n=394) found that nearly 5% of households have water on the premises, while another 80% must walk less than 30 minutes to obtain sufficient water for daily needs. The remaining 15% walk more than 30 minutes. Disaggregating these statistics by caste/ethnicity, we find that 81.5% of

BCTS families have water within 30 minutes of home, compared to 77.5% of Dalit families, while 13.4% of BCTS families and 18.0% of Dalit families must travel more than 30 minutes per day.

Regarding water access, 81.9% of households reported having equal access to public water resources in the watershed, while 18.1% claimed unequal access. Those who reported unequal access include 22.1% of the 178 Dalit households and 15% of the 216 BCTS households. The most common reason reported for unequal access was caste-based discrimination (42.9%), followed by water scarcity (37.1%), religious restrictions (24.3%), long distances to water (10%), and security concerns (2.9%).

Water quality and discharge

Water discharge rates are important because of their impact on water quality and on the aquatic life in streams and rivers. Flow rates determine the kinds of organisms that can live in the stream (some need fast-flowing areas; others need quiet pools), and they also affect the amount of silt and sediment carried by the stream. Sediment introduced to quiet, slow-flowing streams will settle quickly to the stream bottom. Fast moving streams will keep sediment suspended longer in the water column. Lastly, fast-moving streams generally have higher levels of dissolved oxygen than slow streams because they are better aerated.

Table 1 shows discharge rates as measured in the Tila Karnali Watershed, including water quality scores and ratings. Notably, areas with higher discharge rates have better water quality because high flow dilutes waste and pollution present in the water.

Table 1: Discharge rates and water quality measurements in selected waterways in the Tila Karnali Watershed

SN	Location	Latitude	Longitude	Elevation	Discharge (l/s)	WQI Index	Status of water quality
1	Ghatte Khola	29.11	81.70	1,095.01	127	584.78	Poor
2	Bhaisigauda	29.13	81.80	1,600.67	NA	60.12	Good
3	Hima Khola	29.21	81.91	2,036.29	NA	62.94	Good
4	Pattlher Khola	29.21	81.91	2,004.05	314	52.57	Good
5	Kathina Ghatte Khola	29.22	81.95	2,129.88	NA	68.36	Good
6	Bhang Khola	29.19	81.91	1,953.01	88.61	317.75	Poor
7	Dhand Khola	29.14	81.77	1,483.70	88	107.55	Poor
8	Poripali	29.13	81.60	821.10	0.25	300.18	Poor
9	Baligaad	29.11	81.66	1,043.50	813	48.42	Good

SN	Location	Latitude	Longitude	Elevation	Discharge (l/s)	WQI Index	Status of water quality
10	Bhartagaad	29.12	81.61	854.90	344	44.65	Good

Biodiversity and habitat

The Tila Karnali Watershed is considered high mountain, and is home to numerous and diverse habitats. The forests are primarily mixed hardwoods: oaks, banjh, birch, maple tree, deodar, and fir. These forests are jointly managed by the District Forest Office (DFO) and numerous Community User Forest Groups (CFUGs) in the watershed.

The Tila River shares a similar aquatic biodiversity to the Karnali River, though some species and numbers are under threat from climate change and anthropogenic causes. The watershed hosts 29 species of fish, including five species of trout, or asala. Two species – the snow trout and mahseer – are considered endangered.

The Tila River has two altitudinal zones in which different fish thrive and predominate (Shrestha 1990).

- Snow trout zone (1,800 – 3,000 m): fast-flowing, snow fed water. Sucker heads and loaches also found in this zone.
- Stone carp mixed zone (1,200 – 1,800 m): fast-flowing cold water; many species in this zone, including catfish and trout.

The Tila River and its tributaries also host some flagship species that bring high value to the watershed: Chuche asala and Kapre. Long-distance migratory fish include the Golden Mahseer, Sahar, and Rajabam. Some local migratory species include the snow trout, blunt-nosed trout, and the spotted snow trout.

Only one invasive species was recorded in the watershed – banmara (Lantana camera). This plant is aggressive in agricultural areas. Some farmers attempt to burn it as a means of control, which is risky and hazardous.

Land use and land cover

Forest is the dominant land cover in Tila Karnali (56%), followed by grazing land (25%), cultivation (16%), barren land, (2%) and bodies of water (1%). In the forests of Tila Karnali, mixed hardwoods are the most common species (71.3%), though Banjh oak (15.6%), Sal pine (9.4%), and Himalayan fir (1.9%) are also important species.

The total forest area is 42,181 hectares. From 2000-2016, forest cover declined slightly. According to data from Global Forest Watch, the watershed has lost 101 hectares of forest while gaining eight hectares in other areas. Open grazing and excessive firewood collection are the most significant concerns about local forests, while increasing dryness in the region also suggests forest fire awareness is warranted in the future.

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 Tila Karnali Watershed.

Capture fishery

Less than two percent of the population in Tila Karnali is engaged in capture fishing, but that low number belies the importance of fish and fishing to the overall watershed and residents' concerns about the long-term sustainability of fish in the area. Many respondents expressed fears that increasing mining along the rivers and the impending Tila 1 and Tila 2 hydropower projects would negatively affect fish migration and fish reproduction over time.

Of the 2% who fish as a form of livelihood, approximately 60% belong to traditional fishing communities. Typically, these communities rely on traditional methods for harvesting fish, though some respondents noted that large *Jharuala* (nets) were more commonly used, which can take up to 200-250 fish at time. Combined with the use of illegal fishing methods (e.g., poison, electric current), many residents are concerned that already declining fish numbers will fall even further, depriving the watershed of an important economic and nutrition resource.

Local opinions about fish numbers reflect these anecdotal observations. Twenty-four percent of respondents say that fish stocks have declined, while 21.3% note that fish varieties had also fallen. Half of the respondents say that they have had to change their fishing locations in the last five years to find available catch.

Irrigation and sustainable agriculture

Rivers, streams, and rivulets are the main sources of water used for drinking, irrigation, sanitation, energy and domestic purposes. 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. Environmental assessments are required for medium and large projects (>300 ha), but not for smaller projects.

Most irrigation in the watershed is rain-fed and snow-fed through fifteen streams. There are 83 canals in Tila Karnali, built through support from local governments and NGOs. As for irrigation water sources, 56.3% depend on rainfall, 12% draw water from the river, 13.5% use ground water, and the remaining 17.3% use a variety of technologies, including rainwater harvesting and solar lift pumps. Only 22.3% of respondents said they had sufficient water to irrigate year-round.

As noted in this profile, 44.3% of watershed residents claim agriculture as their primary livelihood. Approximately 16% of the watershed land is under cultivation and 45% of that land is irrigated. Staple crops grow well here and off-season vegetable farming is becoming more common as a means to supplement income. Livestock rearing is common: goats, cattle and buffalo play an integral role in local farming systems. For surplus crops, markets are available in Galje, Sera, Manma, Humla, Bali, and Nagma.

Soil fertility was a significant concern among Tila Karnali residents: 94% said that fertility had declined over the past decade. Among the reasons given for this decline were deforestation, over-grazing of livestock,

and a rise in non-point source pollution. In addition, many respondents noted that traditional farming practices on steep hillsides and slopes oftentimes contributed to soil erosion problems. To compensate for difficult growing conditions, farmers were starting to turn to chemical inputs instead of organic manure. Soil analysis of the watershed revealed a predominance of sandy loam and sandy clay. Tila Karnali soil is rich in organic matter, nitrogen, and phosphate.

Gravel mining

Currently, mining in the watershed occurs at a negligible rate, but demands for roads and other development infrastructure may increase this activity, particularly in the Tila River.

Hydropower

Due to its remote location and steep north-to-south decline, the Tila River has long been a focus for hydropower development. Currently two large projects – Tila 1 and Tila 2 – are slated to begin construction in the next decade. If completed, they will generate a combined 860 MW of electricity.

Presently there are 10 micro-hydropower projects operating in the watershed generating a combined total of 355 kW. Residents inform the research team that none of these projects conducted an environmental impact assessment before construction. While no one would negate the impact on aquatic life in the watershed likely to result from these projects, some residents did note that the jobs and electrification that come with hydropower construction are attractive. Thus, these trade-offs often take place without proper due diligence.

Roads

Roads play a crucial role in economic development and, accordingly, road building is a high priority in all parts of Nepal, including the Tila Karnali Watershed. However, the economic advantages of roads can be offset, sometimes tragically, if road construction does not follow guidelines to ensure environmental responsibility.

The most important road in Tila Karnali is the portion of the Karnali Highway that cuts through the watershed, connecting Humla to Nagma, with 90 kms of black-top road. The Karnali Highway is a key road for many villages in the Karnali River Basin, providing transport to people and products from Mugu to Nepalgunj near the Indian border. There is also 64.7 kms of district roads in the watershed. These roads are earthen and link many villages together.

Climate change resilience and disasters risk reduction

Climate change impacts are being compounded by an increasing rate of infrastructure development in Tila Karnali. The combined force of these impacts is raising the intensity and frequency of natural hazards in the watershed.

Focus group discussions throughout Tila Karnali revealed concerns about decreasing snowfall and rainfall, making water scarcer. In Tadi, residents said there had not been snowfall in that area for the past 5-6 years. In Kalika, residents said that the dry months used to be April and May, but are now extended into June and July, complicating crop growth. The diminished water flow was also affecting irrigation and water-powered grinding mills that now operate at sub-optimal levels.

In light of these impacts, many residents have adopted climate-smart technologies and practices to adapt to the changing environment. Some of these technologies and practices included recharge ponds, rainwater harvesters, wastewater collection barrels, drip irrigation, Napier grass, and hedgerow planting to address soil erosion.

Early warning system

There are no EWS systems operating in the Tila Karnali Watershed. However, the need for such a system is great, as floods and landslides have become more common occurrences.

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 Tila Karnali Watershed. 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 institution and inclusiveness

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

For these reasons, awareness, access, and inclusion of local NRM planning is a strong indicator of watershed health.

The community-based forestry system instituted in the 1990s has been a large success in Tila Karnali and across Nepal for promoting sustainable use of forest and NTFPs. In addition, the guidelines for community forestry also mandate inclusive practices, ensuring that women and other marginalized groups have access to benefits and representation among leadership. For example, if a male is the chair of the group, one of the vice-chairs must be a woman, and 50% of overall membership in the group must be comprised of women and persons from marginalized groups.

Presently, there are 97 CFUGs in the Tila Karnali Watershed, collectively managing 85.35 km2 of forest. There are also 16 leasehold forest user groups that manage another 1.76 km2. However, in spite of this broad representation, focus group discussions about benefit sharing revealed that, while women and Dalits are welcomed by community forest groups (and other NRM groups), their meaningful participation is limited, and traditional hierarchies of power persist within the groups' operations.

Looking at membership numbers, household surveys reveal that only 10% of leadership positions in NRM groups were held by women and/or Dalits. Access to NRM planning processes is another controversial topic in Tila Karnali: 38% of respondents said they did not have equal access to NRM processes and available services.

CFUGs and leasehold forest groups receive additional support from forest-related government authorities, and national organizations such as Federation of Community Forest Users Nepal (FECOFUN) and Dalit Alliance for Natural Resources Nepal (DANAR). These organizations provide technical and

managerial guidance to user groups seeking to improve their operations in terms of representativeness, sustainability, and capacity for developing value-added products from forest resources.

Policies, Frameworks, and Regulation

The Government of Nepal developed the Constitution of Nepal 2015, which 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). The Government of Nepal's Aquatic Biodiversity Conservation Act – 2017 BS, could not be properly implemented due to limited awareness and readiness of bureaucrats and others who could not play a crucial role in aquatic biodiversity conservation in Nepal.

Importantly, the Local Self-Governance Act – 2051 (1999 A.D.) 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.

Compliance with local laws and policies is weak, as is the implementation of these measures. Although Nepal guarantees its citizens the right to live in a clean and healthy environment, measures like the Solid Waste Management Act are weakly enforced. As a result, many households continue to dispose of solid waste in streams, rivers, and open space.

Though the 1961 Aquatic Animals Protection Act prohibits the use of poison, gill nets, and electric current for fishing, these practices go largely unchecked throughout the watershed, leading to a decline in fish numbers and diversity over the past 5 to 10 years, as reported by local residents.

Similarly, the recently enacted Disaster Risk Reduction and Management Act has had low impact, as unregulated rural road construction continues in the watershed. Residents are requesting infrastructure development for quality-of-life improvements as well as for employment. Therefore, local governments may unintentionally contribute to further degradation of watershed health by pursuing these projects without adequate consideration for environmental impacts.

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 Tila Karnali Watershed and assigned a score between 0-5 points.

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

Rating	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 Tila Karnali Watershed as ***poor*** (Table 2)**.** Low invasive species and high participation in NRM groups are among the most positive factors impacting watershed health. Water accessibility, declining fish and soil fertility, and improperly constructed roads pose the most serious and immediate challenges to residents in the area. Unsustainable irrigation, fishing practices and point source pollution are areas that need more attention in the future.

Table 2: Summary of health indicators for the Tila Karnali Watershed

Theme	Watershed health indicators	Rating	Rationale
WATER 	Water availability		– Many reports of drying water sources – 49% of households report needing 30 or more minutes to collect daily water
	Water accessibility		– 81.9% respondents are responding that they have equal access to water resources
	Water quality		– All tested parameters fell within normal range on average – Concerns about unmanaged waste and rising use of agro-chemicals
	Household sanitation		– 27% percent of households do not properly manage solid household waste – 92% of households have personal toilet

Theme	Watershed health indicators	Rating	Rationale
	Point source pollution		– 11.9% respondents said that solid waste from urban areas and settlements often discarded in streams, rivers, and open spaces – 65.2% respondents incinerate some household waste – 29% of respondents throw wastewater directly into the river
BIODIVERSITY & HABITAT 	Quantity of fish		– 23.4% of respondents said fish numbers were declining in the Tila River – Increasing demand for fish in the market place has inspired rise in use of destructive fishing practices
	Fishing practices		– Rise in use of destructive fishing methods, including poison and electric current
	Invasive species		– No invasive species reported
	Species diversity		– 27 types of fish reported in the watershed – Overfishing is a concern regarding diversity of species
SUSTAINABLE AGRICULTURE 	Land cover		– Solid forest cover (56% of watershed) – Forest fires and changes in land use have decreased forest cover since 2000
	Soil fertility		– 94.2% of households report that soil fertility has declined over the past decade – Rising use of chemical fertilizers in the watershed
	Agricultural production		– 90% of respondents report a decline in productivity over past decade – 61% of respondents say they use chemical pesticides
SUSTAINABLE INFRASTRUCTURE & MINING	Sustainability of hydropower		– Large hydropower (Tila I and Tila II) projects under construction on the Tila River; these projects will impound water and disrupt river flow

Theme	Watershed health indicators	Rating	Rationale
	Sustainability of gravel mining		– Gravel mining is minimal but desire for infrastructure will intensify this activity
	Sustainability of rural roads		– Many roads constructed without proper environmental assessment beforehand – Roads have poor drainage, exacerbating the conditions for landslides
	Sustainability of irrigation		– 78% of households with irrigation say water is available only in wet seasons – Irrigation user groups function poorly – Poor maintenance of existing irrigation canals
CLIMATE RESILIENCE AND DISASTER RISK REDUCTION 	Areas vulnerable to landslides, floods and landslides		– High levels of open grazing and improper road construction accelerate forest degradation
	Households taking action to address climate change through climate-smart best practices		– Low use of climate-smart technologies, but awareness is growing, especially for water re-use and harvesting
	Households with access to Early Warning Systems		– No early warning system in the watershed
GOVERNANCE AND EQUALITY 	Household members engagement/participation in local planning processes		– Low general participation of residents in NRM groups – 53.6% (25.3% Dalit and 37% BCTS) of all residents who are affiliated with at least one NRM group participate in the local planning processes
	Women, marginalized castes and ethnic groups hold key positions in NRM groups		– Only 9.9% of key position in NRM groups are held by women and/or persons from marginalized groups

Theme	Watershed health indicators	Rating	Rationale
	People comply with laws and policy provisions and local norms and standards		– Low compliance with existing regulations regarding solid waste disposal, rural road construction, and soil and water conservation
	Government enforces laws and regulations		– Low enforcement of existing regulations regarding solid waste disposal, rural road construction, and soil and water conservation
	Conflicts over NRM [Water/benefit sharing, watershed issues, sand mining, irrigation, hydropower] issues are resolved		– Many complaints about lack of transparency in NRM benefit sharing processes
	Good coordination between the, municipalities/rural municipalities, and provinces including government line agencies in the watershed		– Lack of role clarity and coordination between local authorities and the provincial levels of government