TILA KARNALI WATERSHED PROFILE

STATUS, CHALLANGES AND OPPORTUNITIES FOR IMPROVED WATERSHED MANAGEMENT

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USAID PAANI PROGRAM

युएसएड पानी परियोजना

Cover photo: A view of the confluence of the Tila Karnali and the Humla Karnali rivers in the Tila-Karnali Watershed, Kalikot.

Photo credit: USAID Paani Program

TILA KARNALI

WATERSHED PROFILE:

STATUS, CHALLENGES AND OPPORTUNITIES FOR IMPROVED WATER RESOURCE MANAGEMENT

Program Title:	**USAID Paani Program**
DAI Project Number:	**1002810**
Sponsoring USAID Office:	**USAID/Nepal**
IDIQ Number:	**AID-OAA-I-14-00014**
Task Order Number:	**AID-367-TO-16-00001**
Contractor:	**DAI Global LLC**
Date of Publication:	**March 28, 2019**

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ABBREVIATIONS

AKC	:	Agriculture Knowledge Centre
ASHA	:	Adaptation for Smallholders in Hilly Areas Project
BCTS	:	Brahmin/Chhetri/Thakuri/Sanyasi
CAPA	:	Community Adaptation Plan of Action
CBS	:	Central Bureau of Statistics
CBOs	:	Community-based Organizations
CFUGs	:	Community Forest User Groups
CSOs	:	Community Service Organizations
DADO	:	District Agriculture Development Office
DANAR	:	Dalit Alliance for Natural Resources
DCC	:	District Coordination Committee
DDC	:	District Development Committee
DDRC	:	District Disaster Risk Reduction Committee
DEECC	:	District Environment and Energy Coordination Committee
DFO	:	Division Forest Office/Officer
DFRS	:	Department of Forest Research and Survey
DNF	:	Dalit NGO Federation
DSCO	:	District Soil Conservation Office/Officer
DSCWM	:	Department of Soil Conservation and Watershed Management
DWASH	:	District Water and Sanitation and Hygiene
EAP	:	Emergency Action Plan
EIA	:	Environmental Impact Assessment
FECOFUN	:	Federation of Community Forestry Users, Nepal
FEDO	:	Feminist Dalit Organization
FEDWASUN	:	Federation of Drinking Water and Sanitation Users Nepal
FGD	:	Focus Group Discussion
GON	:	Government of Nepal
GP	:	Gaunpalika
Ha	:	Hectare
KIRDRAC	:	Karnali Intregated Rural Development and Research Centre
HCRDC	:	Himalyan Community Resource Development Centre
HURENDEC	:	Human Rights and Environmental Development Centre
IEE	:	Initial Environmental Examination
IRBM	:	Integrated River Basin Management
IUCN	:	International Union for Conservation of Nature
KII	:	Key Informant Interview
km	:	Kilometer
kw	:	Kilowatt
LAPA	:	Local Adaptation Plan of Action
LGOA	:	Local Government Operation Act 2017
LSGA	:	Local Self-Governance Act
MAPs	:	Medicinal and Aromatic Plants
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
mm	:	Millimeter
MUS	:	Multiple Water Use System
MSC	:	Multi-stakeholder Consultation
NCCSP	:	Nepal Climate Change Support Program
NEFIN	:	Nepal Federation of Indigenous Nationalities
NFIWUAN	:	National Federation of Irrigation and Water Users' Association
NNDSWO	:	Nepal National Dalit Social Welfare Organization
NP	:	Nagarpalika
NPC	:	National Planning Commission
NRM	:	Natural resource management
Paani	:	USAID Paani Program
RDN	:	Rural Development Nepal
RPN	:	Red Panda Network
Sec.	:	Second
USAID	:	United State Agency for International Development
VDC	:	Village Development Committee
VDSEF	:	Village Development and Save the Environment
WECS	:	Water and Energy Commission Secretariat
WWF	:	World Wildlife Fund
WUMP	:	Water User Master Plans
°C	:	Degree Celsius

ACKNOWLEDGEMENTS

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 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 cooperatives, forest user groups, water user groups and, especially, the communities dependent on aquatic biodiversity and local water management. Leaders from Tila municipality, or gaunpalika (GP), Tilagufa rural municipality, or nagapalika (NP), Khadchkra NP, Subhakalika GP, and Mahawai GP and 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, SNV, and NESS that works closely with Nepal's Water and Energy Commission Secretariat (WECS) and draws on support from the WECS' member agencies. Paani enriched the watershed profile by compiling and reviewing secondary data and by collaborating with the Federation of Community Forestry Users, Nepal (FECOFUN) who carried 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 Feminist Dalit Organization (FEDO), Dalit Alliance for Natural Resources Nepal (DANAR), Dalit NGO Federation (DNF), Nepal National Dalit Social Welfare Organization (NNDWSO), Human Rights and Environment and Development Center (HURENDEC), Himalayan Community Resource Development Center (HCRDC), Village Development and Save the Environment Forum (VDSEF), Rastriya Dalit Network (RDN), District Forest Office (DFO), Agriculture Knowledge Center (AKC), Federation of Drinking Water and Sanitation Users Nepal (FEDWASUN), Adaptation for Smallholders in Hilly Areas Project (ASHA), Nepal Climate Change Support Programme (NCCSP), District Water and Sanitation and Hygiene (DWASH) and other government agencies 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 water resource management and aquatic biodiversity for the multiple users within the Tila Karnali watershed, which lies within province No. 6, Karnali Province.

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

This watershed profile provides critical baseline information for local government, commnity, civil society, and private sector stakeholders within the Tila Karnali watershed to strengthen water resource management to benefit human development and protect 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]

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 1). Five smaller municipalities are contained within the watershed: Khandachakra and Tilagufa nagarpalika (NP) and 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 Tila Karnali watershed is a priority watershed of the Karnali Basin, which extends across Kalikot and Jumla districts (Figure 1). Five local governments exist within the watershed: Khandachakra and Tilagufa NP and Shubha Kalika and Mahabai GP of Kalikot, and Tila GP in Jumla. The land cover is

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[1] It should be noted 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), are being superseded by new units such as the municipality (*nagarpalika)*, rural municipality (*gaunpalika*), 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 of the new federal system.
Watersheds occasionally sit within a single province, 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, the watershedprovides an integrated perspective of environmental and socio-economic change.

primarily forest and shrubland (56%), followed by grazing land (25%), cultivated land (16%), barren land (4%), and water bodies (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 ecotourism 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 in the watershed and four larger projects are planned for the area. Of those four projects, 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.

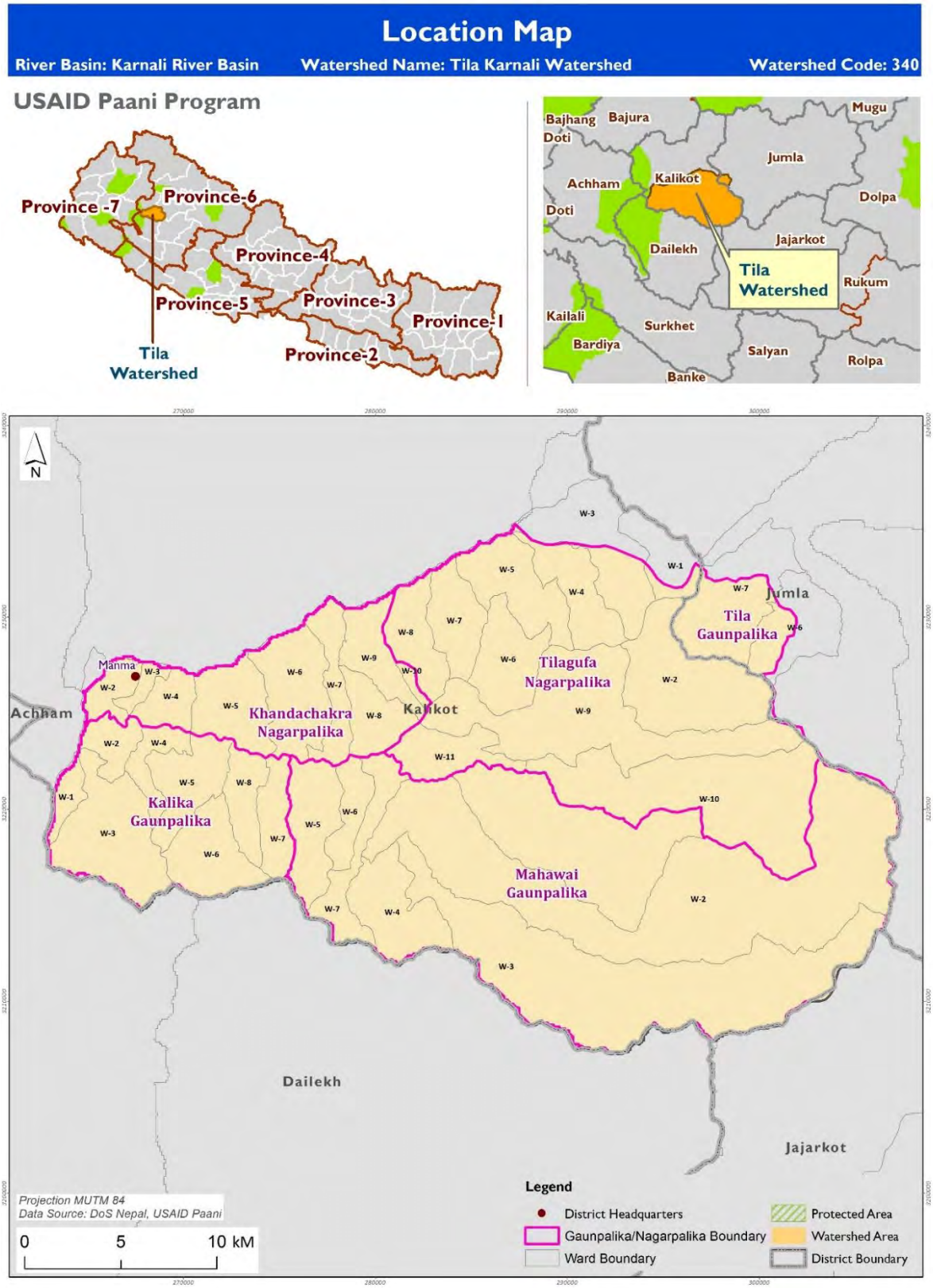


Figure 1: The Tila Karnali watershed and administrative units

Priority Issues for the Tila Karnali watershed

The following priority challenges in the Tila Karnali watershed were identified through a series of data collecting methods, including a multi-stakeholder workshop, household surveys and field observations. The challenges are summarized in Table 1 and described below with recommendations for addressing each challenge. Figure 2 below maps the location where these threats were noted by stakeholders.

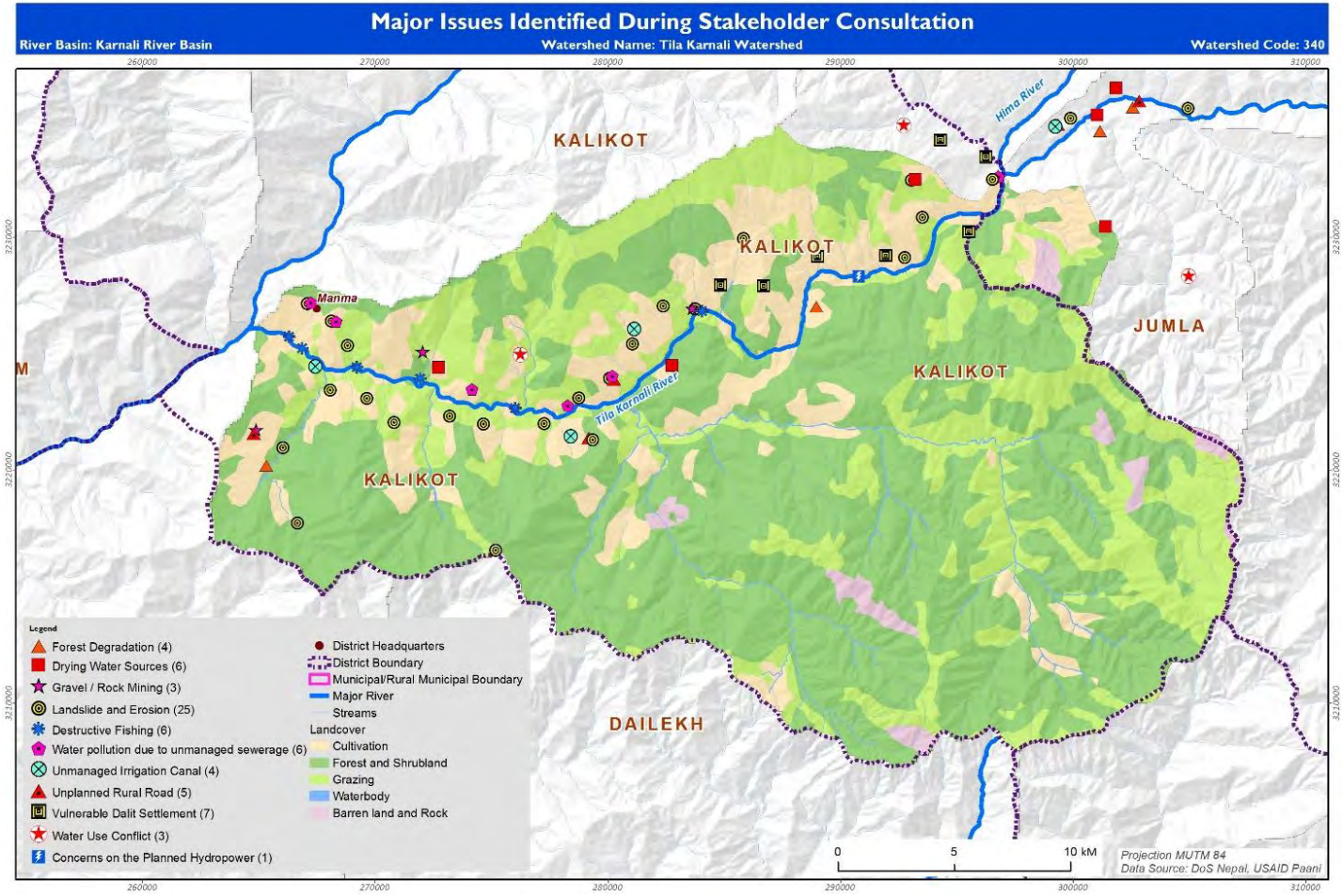


Figure 2: Map of natural hazard vulnerabilities in the Tila Karnali watershed

Table 1: Priority issues and threats to freshwater conservation and aquatic biodiversity in the Tila Karnali watershed

SN	Issues/Threats	Impacts
I	Declining fish numbers	A rise in the use of destructive fishing methods is leading to unsustainable fish harvesting levels in the watershed. Traditional fishing communities are disproportionately affected as the struggle to compete with commercial ventures.
II	Improperly constructed roads	Road building in the Tila Karnali watershed is key to development efforts to improve the economic prospects of the area. However, roads are often built withour proper environmental assessment prior to construction. These roads often intensify and exacerbate the conditions for landslides that damage property and degrade aquatic habitats.
III	Drought and drying water sources	Declining available water sources in the area mean that households must spend more time collecting water and struggle to meet their irrigation needs. Investments are needed to improve water source protection and promote more efficient water use.
IV	Discrimination against Dalits in terms of natural resource access	The Dalit caste of residents in Tila Karnali have limited participation in user groups and planning processes related to natural resource management, benefit sharing and decision-making.
V	Forest degradation and wildlife poaching	Overharvesting of timber and non-timber forest products (NTFPs) are threatening long-term sustainability and food security. Furthermore, the removal of tree and shrub root systems from local forests destabilizes slopes, decreases water retention, and increases the likelihood of forest fires.
VI	Ineffective solid waste management	Tila Karnali watershed lacks infrastructure and services to manage rising amounts of solid waste in the watershed, which affects local drinking water and degrades aquatic habitats. Furthermore, the practice of open defecation still occurs in some parts of the watershed.

I. Declining fish numbers

Human threats are affecting fish numbers in the Tila Karnali watershed. A rise in the use of destructive fishing methods (e.g., poison, electric current) is not only pushing unsustainable harvest levels, but also marginalizing traditional fishing communities that cannot compete with commercial interests. Furthermore, improper road building and climate-induced natural hazards (e.g., landslides) degrade aquatic habitats. Policy exists that prohibits destructive fishing methods, but enforcement in the watershed is low.

Recommendations:

- Form aquatic animal conservation groups and mobilize these groups for conservation efforts;
- Develop an aquatic animal conservation act and enforce capture fishing guidelines;
- Initiate dialogue with relevant government agencies to coordinate conservation efforts;
- Monitor biodiversity changes with community biodiversity register maintained by local fishing communities;
- Promote ecotourism in the region (e.g., sport fishing, catch and release);
- Provide leadership and advocacy training for fishing groups, civil society organizations, community-based organizations, and community forestry user groups;
- Conduct awareness-raising events focused on the importance of conserving aquatic biodiversity; and
- Encouage community to advocate for release of minimum environmental flows through hydropower projects according to recommendations in associated Environmental Impact Assessments (EIA).

II. Improperly constructed roads

The government of Nepal has increased substantially the available budget for road construction, particularly in rural areas. However, this rise in financial support has meant that many roads are built quickly and without proper environmental assessment beforehand. These roads, often built into steep hillsides, exacerbate the conditions for landslides and soil erosion, which put human settlements at risk for disaster, decimate available water sources, and degrade aquatic habitats.

Recommendations:

- Improve implementation and enforcement of disaster preparedness plans and response, such as Local Adaptation Plans of Action (LAPA) and Water Use Master Plans (WUMP).
- Raise awareness about the Environment-Friendly Local Governance Framework to local GP and NP officials;
- Provide trainings for low-cost stabilization techniques on slopes and river banks (e.g., Gabion boxes);
- Support local agencies to develop regulatory frameworks for environment-friendly rural road construction; and
- Require all road projects to include environmental mitigation plan prior to construction.

III. Drought and drying water sources

Respondents have identified four major drivers for the disappearance of water sources in Tila Karnali watershed: 1) improperly constructed roads, 2) extended dry spells, 3) forest degradation, and 4) landslides and other climate-induced hazards. Furthermore, erratic rainfall in the watershed is making agriculture a less reliable livelihood.

Recommendations

- Raise awareness for sustainable water use and promote rainwater harvesting technologies;
- Promote replantation around water sources and barren land in the watershed;
- Restore traditional *khaals* (ponds) constructed in the upper ridges of mountains to store water;

- Promote recharge/conservation ponds and construct eyebrow pits to promote infiltration activities; and
- Implement springshed management activities for restoring flow discharge in the watershed.

IV. Discrimination against Dalits in terms of natural resource access

While issues of natural resource access are important to all groups in Tila Karnali, research shows that marginalized communities in the watershed – primarily Dalits – suffer a disproportionate level of discrimination on this topic. To improve biodiversity and freshwater conservation in Tila Karnali, it will be important that all groups receive equal responsibility for and equal access to natural water, forests, and other natural resources.

Recommendations:

- Facilitate access of local communities to aquatic and natural resources;
- Sensitize local actors and authorities on the need for inclusive development principles in decision-making;
- Draft and enforce inclusive policies and programs that preclude the possibility of discrimination;
- Mobilize media to raise awareness in the watershed regarding discrimination; and
- Provide trainings and capacity building to local Dalit leaders to improve their understanding of local planning processes.

V. Forest degradation and wildlife poaching

Overharvesting of timber and non-timber forest products is eroding the overall health of the watershed and increasing the likelihood of forest fire. As trees and plants are removed from the forest, less water is retained, soil erosion increases, and the animal habitats in the area, which depend on these resources, weaken. Poaching of ghoral, musk deer, wild boar, and porcupines has also risen in recent years, despite explicit legal prohibition of these animals and others.

Recommendations:

- Raise awareness about forest fires and the factors that lead to their occurrence;
- Promote replantation programs and conservation activities;
- Initiate community-based anti-poaching activities through community forest user groups (CFUGs),
- Support the formation of anti-poaching groups; and
- Mobilize media to help promote awareness of poaching activities in the watershed.

VI. Ineffective solid waste management

The increase in "modern" products in rural areas has meant a rise in plastics, bottles, and other forms of solid waste. Unfortunately in Tila Karnali, like other places in western Nepal, appropriate systems and infrastructure for properly disposing waste is not available or insufficient to handle the amount of waste produced. Many households still incinerate solid waste or dispose this waste into nearby fields or waterways. Rising solid waste problems have been noted in Hulma Bazaar, Manma, Serabada, Bali, Galje, and Nagma, especially.

Recommendations:

- Introduce waste management principles such as reduce, reuse and recycle;
- Provide solid waste management trainings for local government representatives, NGOs, and CBOs;
- Promote proper waste management in schools and throughout the community; and
- Advocate for stronger enforcement of existing solid waste policies and laws.

1. TILA KARNALI WATERSHED: NATURE, WEALTH AND POWER

This Tila Karnali 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 2016-18, the Paani program conducted a series of literature reviews, household surveys, focus group discussions, 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, 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

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.

2.1. TILA KARNALI WATERSHED

The Tila Karnali watershed lies in the Karnali Basin of Nepal in the northwestern part of the country and extends 767.48 km^2 across parts of Kalikot and Jumla districts. Parts of the watershed extend into two nagarpalika – Khadachakra (11.3%) and Tilagufa (31%) – and three gaunpalika – Tila (3.1%), Subha Kalika (12.5%) and Mahawai (42%). According to the Government of Nepal's classification system, Tila, Mahawai, Subhakalika, and Tilagupha are considered "very remote," and Khandachakra is "remote."

The watershed is rich in natural resources, especially forest. The elevation ranges from 4,790 m at the top of Mahabai Mountain and descends sharply to 738 m in the southern end of the watershed. The steep slopes of the hillsides are a defining characteristic of this area, as farmers must contend with soil erosion and landslides while they try to cultivate available land for crops.

The Tila River is the primary waterway of the watershed and flows southwesterly 45 kilometers across the watershed before joining the Karnali River (Figure 3). The primary tributaries of the Karnali include Hima, Padamgaad, Baligaad, Bhartagaad, Dhandkhola, Kathina (Ghatte Khola), Khallagaad, Banchugaad, and Narmagaad.

The watershed is sparsely populated with communities scattered throughout the area. 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 average family size is 5.96 people per household.

Tila Karnali also host the Red Panda and several other flagship species, such as the Himalayan musk deer. The Red Panda is considered an indicator of high-elevation freshwater springs. The river network in the watershed hosts 27 species of fish, incuding several economically important ones such as the Asala (snow trout).

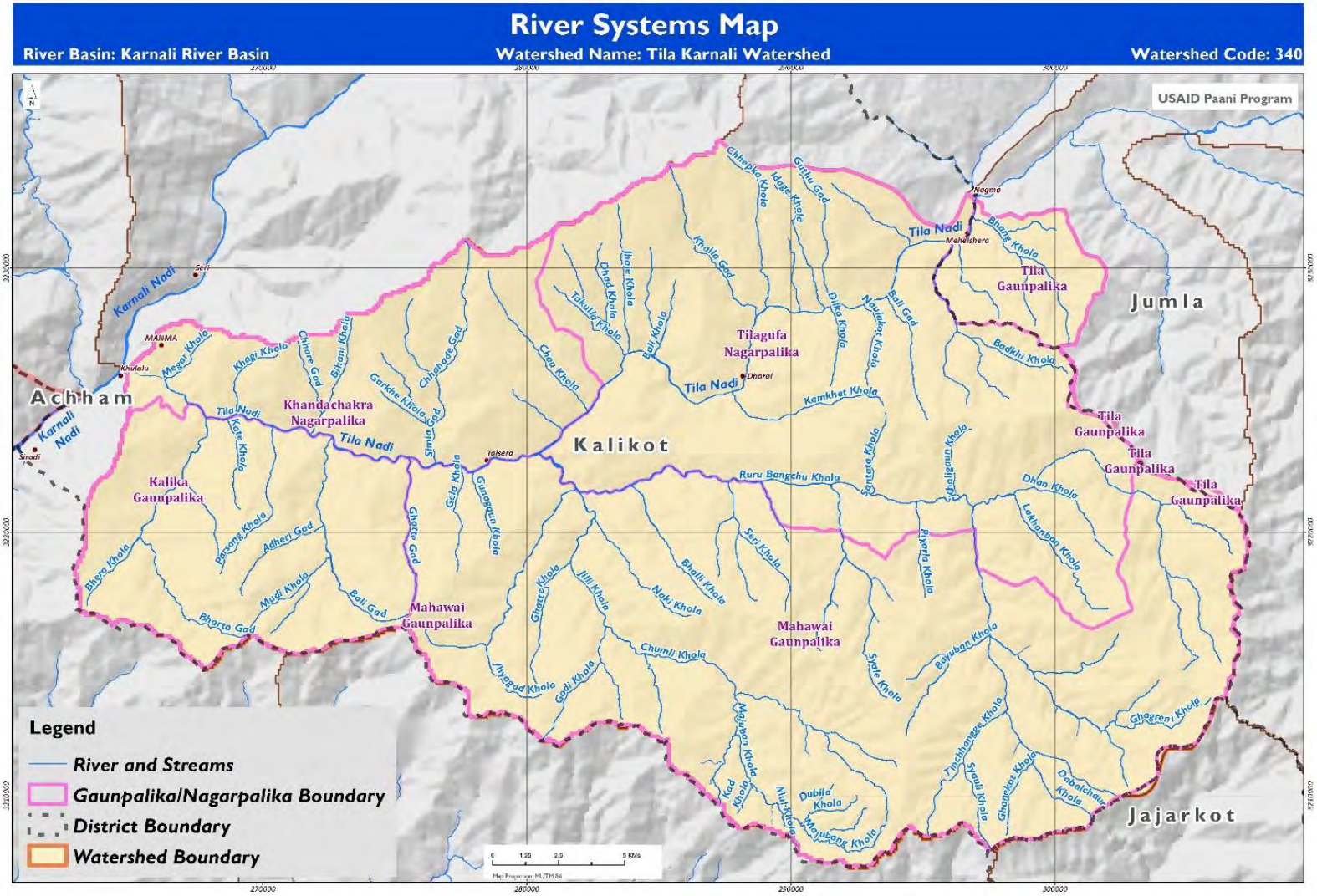


Figure 3: Map of Tila Karnali watershed overlaid on the river network

The steep topography of the watershed has attracted interest from the hydropower industry. Two large projects – Tila 1 and Tila 2 – have been scheduled to begin construction in the next ten years. They will generate 420 and 440 MW of electricity, respectively.

Agriculture is the most common livelihood in Tila Karnali (44.3%), followed by wage labor (29.9%), government employees (10.9%), and trade/business (3.3%). Fifty-six percent of the land is covered by forest (35% of which is considered national forest). Only 16% of the land is under cultivation and primarily rainfed. Non-timber forest products provide supplemental income as residents sell the medicinal and aromatic plants that can be found here.

Kalikot district, in which 97% of the watershed is contained, is considered among the poorest in the country and the least developed in terms of infrastructure and available services to residents. Like many places in Nepal, many people are now growing abraod for work to India to supplement their agricultural income.

2.2. WATER AVAILABILITY AND QUALITY

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% have water on the premises, while another 80% need to walk less than 30 minutes to obtain sufficient water for daily needs. The remaining 15% walk more than 30 minutes (Table 3). 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.

On the question of access, 81.9% of households overall reported having equal access to public water resources in the watershed while 18.1% claim unequal access. Of those families who report unequal access, we find this group includes 22.1% of the 178 Dalit households and 15% of the 216 BCTS households. When inquiring the reasons for unequal access, the most common reason offered 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 discharge and quality

Water discharge rates are important because of their impact on water quality and on the aquatic life in streams and rivers. Flow rates, which increases as the volume of the water in the stream increases, determines the kinds of organisms that can live in the stream (some need fast-flowing areas; others need quiet pools). It also affects 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.

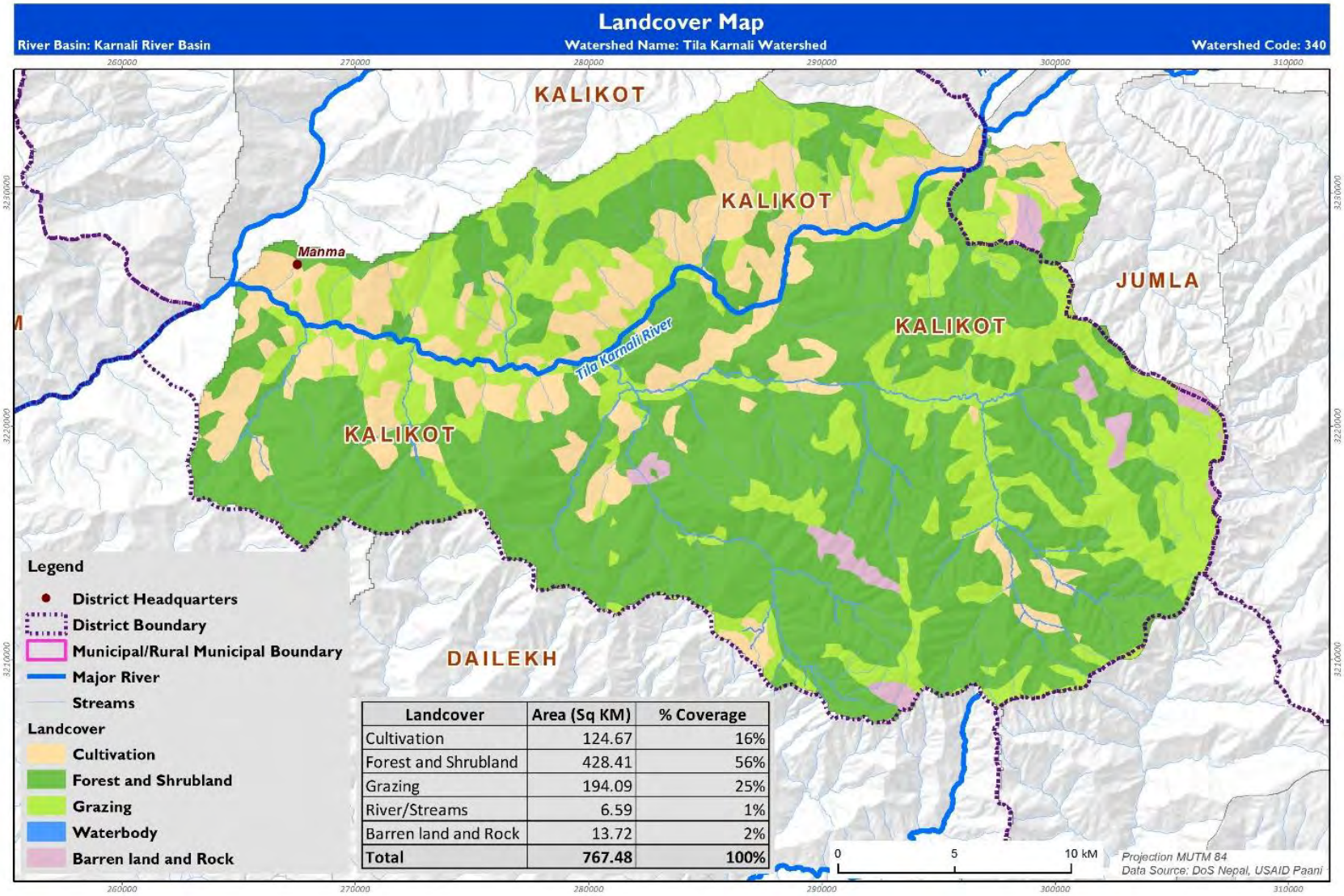
Table 2 shows discharge rates as measured in the Tila Karnali watershed, including water quality scores and ratings. Notably, areas with higher discharge rates have better water quality because high flow dilutes waste and pollution present in the water.

Table 2: River and stream discharge rates and water quality ratings 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
10	Bhartagaad	29.12	81.61	854.90	344	44.65	Good

2.3. LAND USE AND LAND COVER

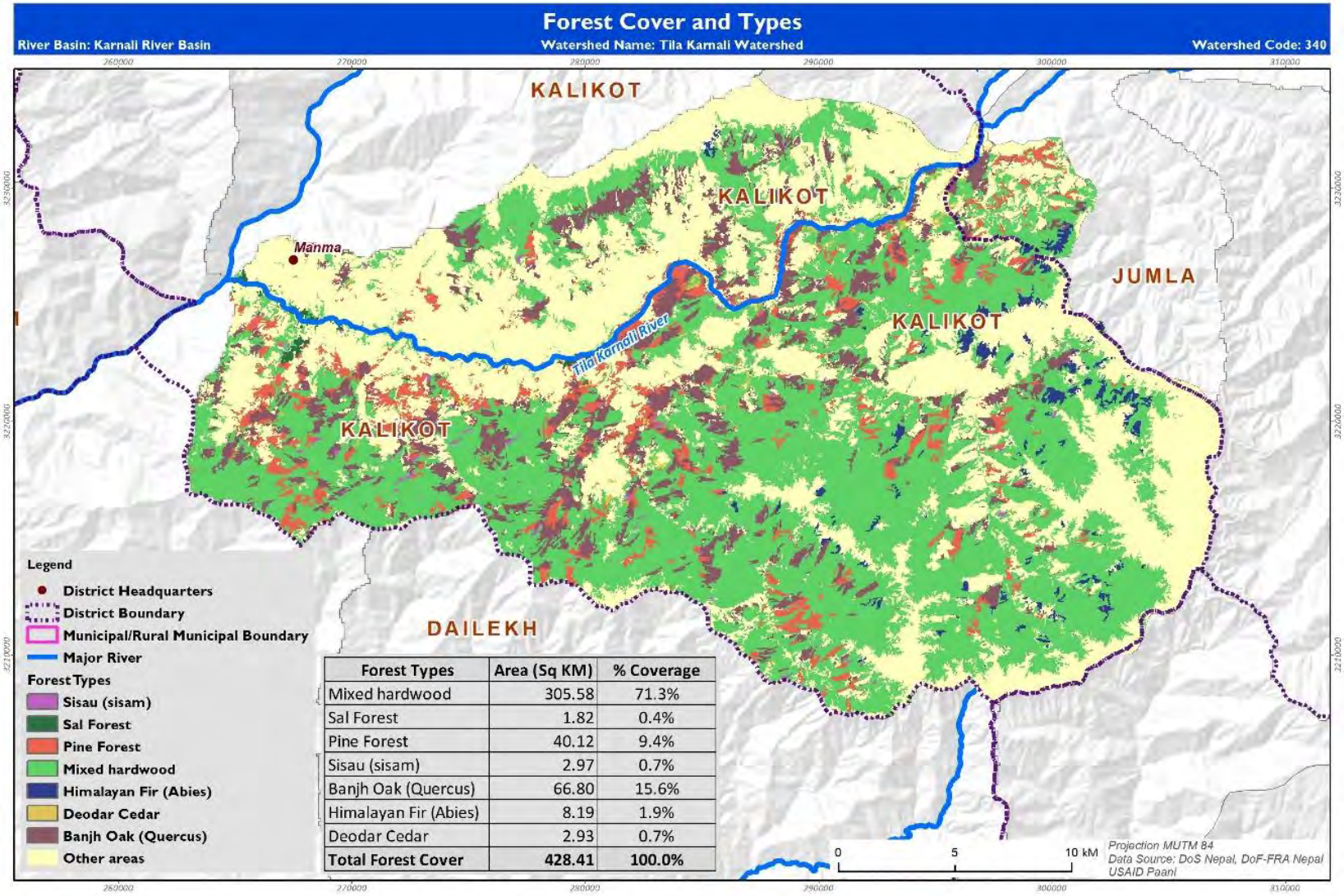
Forest is the dominant land cover in Tila Karnali (56%), followed by grazing land (25%), cultivation (16%), barren land (2%) and water bodies (1%). Figure 4 illustrates the land use land cover throughout the watershed.



Landcover	Area (Sq KM)	% Coverage
Cultivation	124.67	16%
Forest and Shrubland	428.41	56%
Grazing	194.09	25%
River/Streams	6.59	1%
Barren land and Rock	13.72	2%
Total	**767.48**	**100%**

Figure 4: Land cover and land use map of the Tila Karnali watershed

In the forests of Tila Karnali, mixed hardwoods are the most common species (71.3%). Banjh oak (15.6%), Sal pine (9.4%), and Himalayan fir (1.9%) are also important species (Figure 5).



Forest Types	Area (Sq KM)	% Coverage
Mixed hardwood	305.58	71.3%
Sal Forest	1.82	0.4%
Pine Forest	40.12	9.4%
Sisau (sisam)	2.97	0.7%
Banjh Oak (Quercus)	66.80	15.6%
Himalayan Fir (Abies)	8.19	1.9%
Deodar Cedar	2.93	0.7%
Total Forest Cover	**428.41**	**100.0%**

Figure 5: Forest cover and forest types in the Tila Karnali watershed

The total forest area is 42,181 hectares. From 2000-2016, forest cover declined slightly (Figure 6). 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.

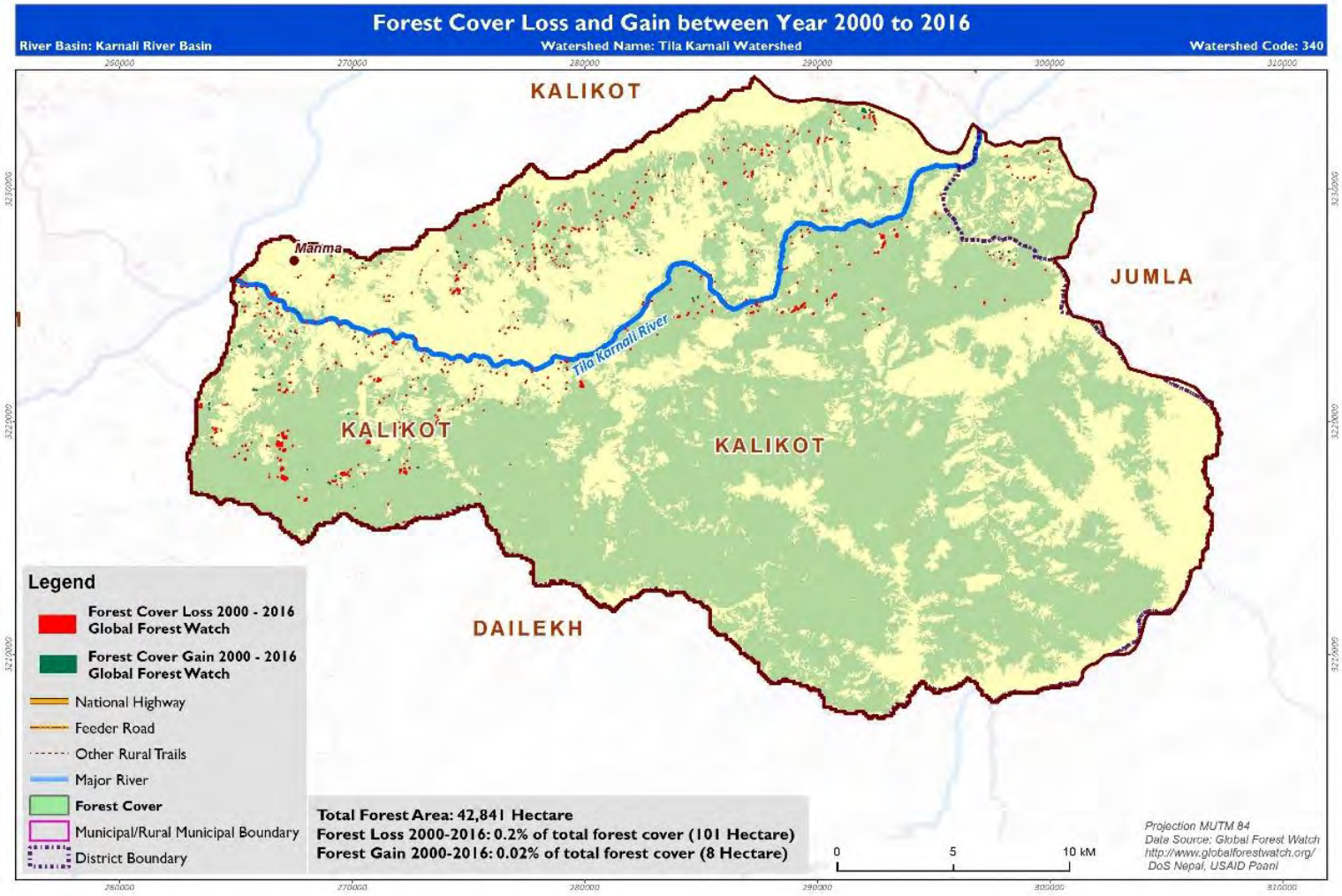


Figure 6: Forest cover loss and gain in the Tila Karnali watershed, 2000-2016

Related annexes
Annex 2: Land cover and land use
Annex 6: Forests

2.4. BIODIVERSITY AND INVASIVE SPECIES

The Tila Karnali watershed is considered high mountain, home to numerous and diverse habitats. As mentioned in Section 2.3, the forests are primarily mixed hardwoods: oaks (Quercus leucotrichophora and Quercus semecarpifolia), banjh (Quercus species), birch (Betula species), maple tree (Acer species), deodar (Cedrus deodara), and fir (Abies species) 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, snowfed 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 (Schizothorax progastus) and Kapre (Pseudecheneis sulcatus). Long-distance migratory fish include the Golden Mahseer (Tor puttitora), Sahar (Tor tor), and Rajabam (Anguilla bengalensis). 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 as a means of control, which is risky and hazardous.

Focus group discussions (FGDs) on biodiversity yielded some compelling insights:

- Repsondents unequivocally confirmed that fish numbers had declined, as well as the diversity of fish. As evidence, they cited the disappearance of *Paa* and otters from local rivers. While many suggested changes in water temperature had contributed to the disappearance of *Paa*¸ otters were seen to have declined as a result of poaching.
- The number of jackals had increased, likely as a result of the decline of leopard numbers. Jackals, they reported, had in some cases spread rabies and killed some livestock.

With support from Paani, stakeholders at a fish vulnerability workshop were asked to identify and map key sites where fish spawn, nurse, and are overfished (Figure 7). Having located these crucially-important areas will enable local authorities and households to develop appropriate long-range plans for conserving fish numbers and diversity.

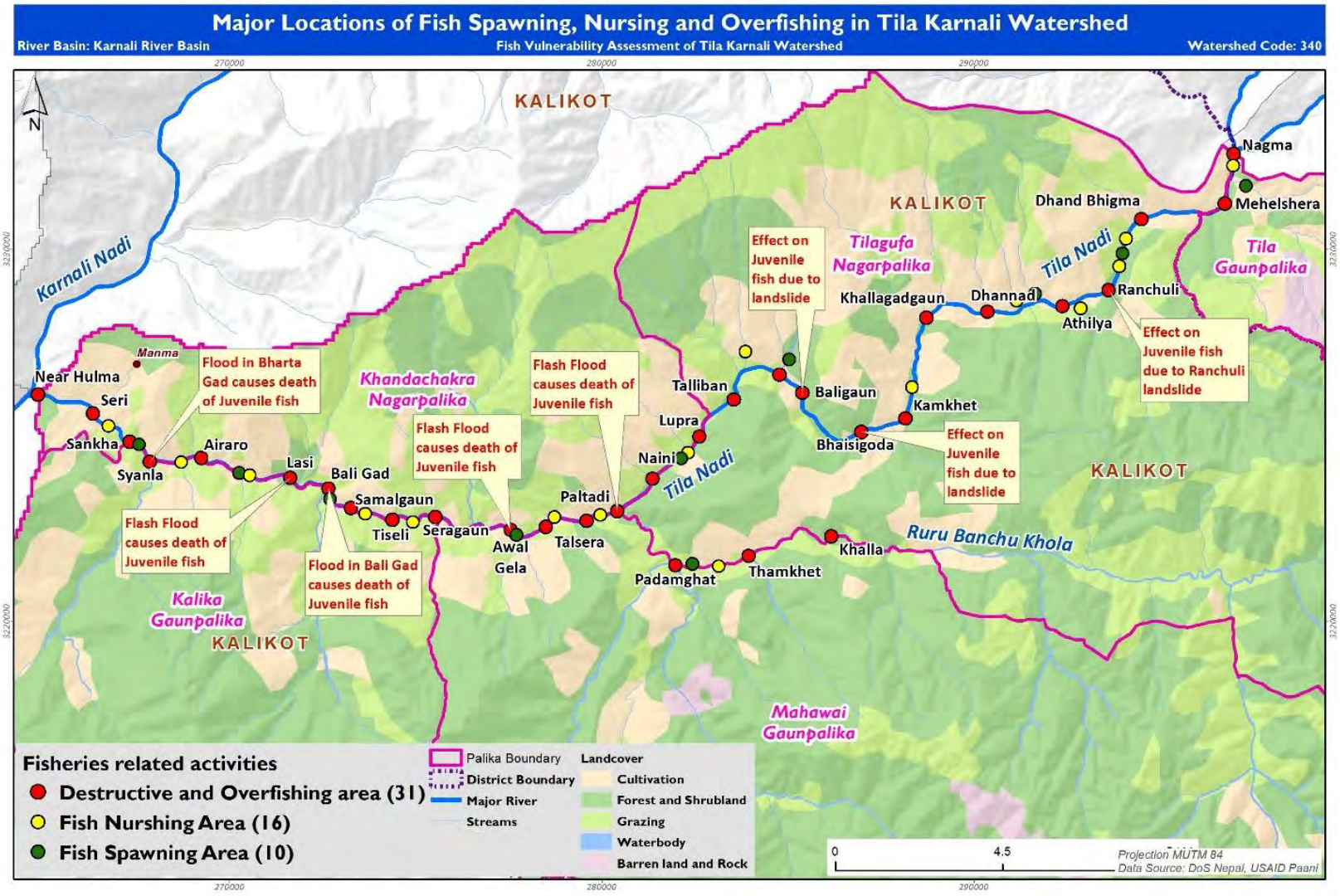


Figure 7: Spawning, nursing and fishing sites in the Tila Karnali watershed

Stakeholders were also asked to help identify threats to local fish populations by focusing on three key species – Asala, Kapre, and Katle – and applying a rating to each threat in terms of its severity (Table 3). The most serious threats included illegal fishing methods, gravel mining, floods and landslides, and improper road construction.

Table 3: Threats to key stone species of Tila Karnali watershed

SN	Threats	Asala	Kapre	Katle	Rating
1	Low water flow in winter	-	X	X	
2	Inadequate food sources for fish	-	X	-	
3	Illegal fishing methods (e.g., gill nets, poison, electric current)	X	X	X	
4	Floods that precipitate poisonous weeds and soils	X	-	-	
5	Floods and landslides	X	X	X	
6	Gravel mining	X	X	X	
7	Improper waste and sewage disposal	X	-	X	
8	Lack of community awareness	X	-	-	
9	Inadequate legal provisions to protect fish numbers and diversity	X	-	-	
10	Natural habitats and predators	X	X	X	
11	Overfishing	X	-	X	
12	Improper road construction	X	-	-	

Source: Paani Fish VA workshop 2018

Related annexes

Annex 7: Fish
Annex 8: Mammals
Annex 9: Reptiles
Annex 10: Birds

2.5. CLIMATE AND PHYSIOGRAPHY

There are four prominent climatic seasons in Nepal: winter (Dec-Feb), spring/pre-monsoon (Mar-May), summer/monsoon (Jun-Sept) and autumn/post-monsoon (Oct-Nov). Temperature and rainfall variations persist not only by season but also by altitudinal gradients.

2.5.1. TEMPERATURE

There are no long-term temperature recording stations in the Tila Karnali watershed, so records taken at Jumla, Dailekh, and Dipayal Gaun located slightly east of the watershed were used to analyze temperature trends for the watershed (Figure 8).

The long-term average monthly temperature varation in Tila Karnali is shown in Figure 10. The average monthly temperature of the watershed varies from 3°C, in winter to approximately 16°C in summer. Similarly, the minimum and maximum monthly temperatures vary between -5°C and 11°C during the coldest months, and from 12 °C to 22 °C in the warmest months. The maximum temperature in the watershed is observed in June/July and the minimum temperature is observed in January. The average annual temperature varies from 1.3°C, in the east to 19°C in the west as shown in Figure 9. The average topographic elevation of the watershed decreases from east to west. Therefore, the western part of the watershed is warmer than the eastern part.

In the Tila Karnali watershed, an increasing temperature tread was observed in winter, pre-monsoon, monsoon and annually at a maximum rate of 0.04 ˚C/year whereas the post-monsoon temperatures are observed to rise at a maximum rate of 0.02 ˚C/year. The rate of temperature rise in the eastern part of the watershed is observed higher compared to the western part.

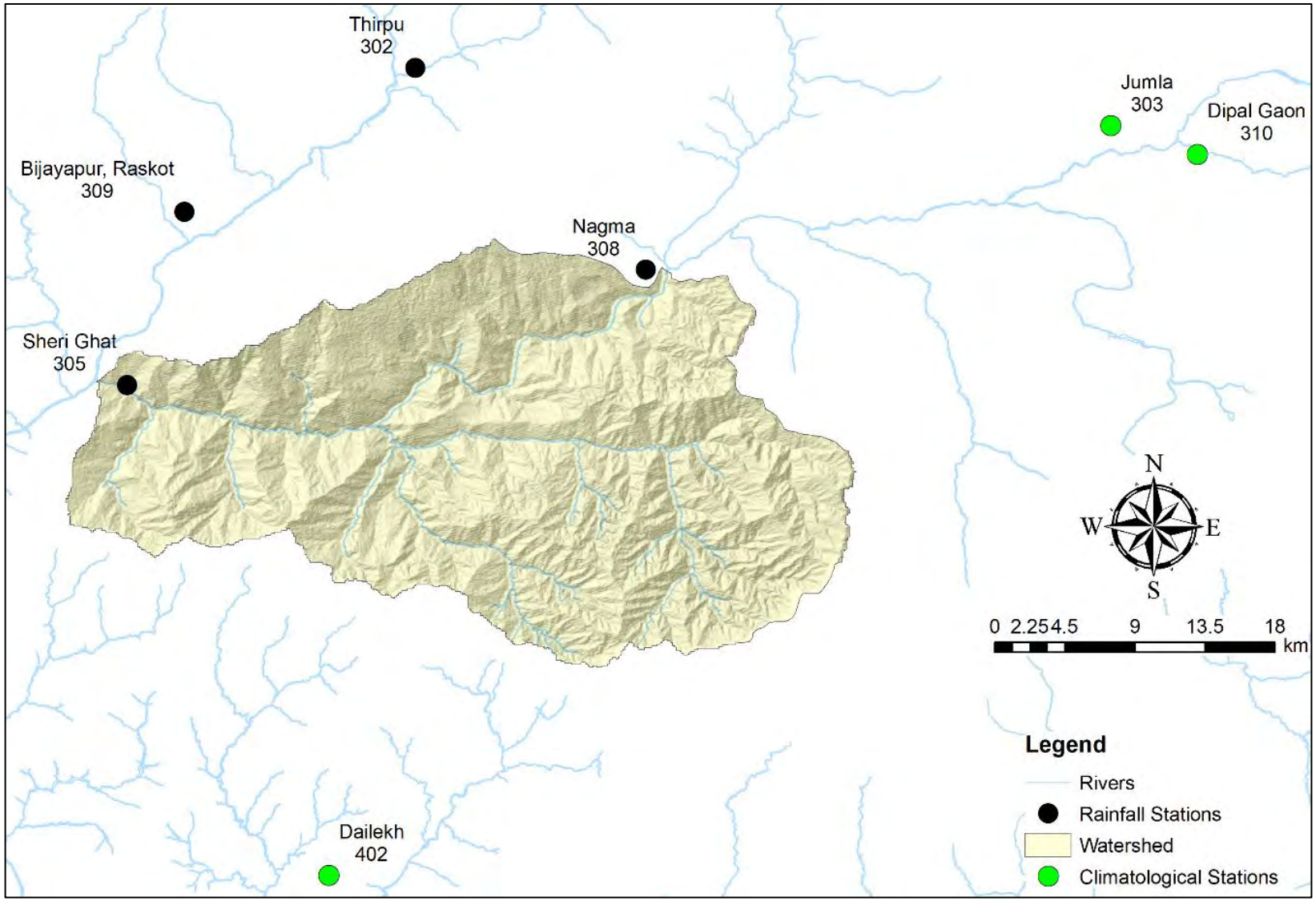


Figure 8: Meteorological stations in the vicinity of Tila Karnali Watershed used for temperature and precipitation analysis

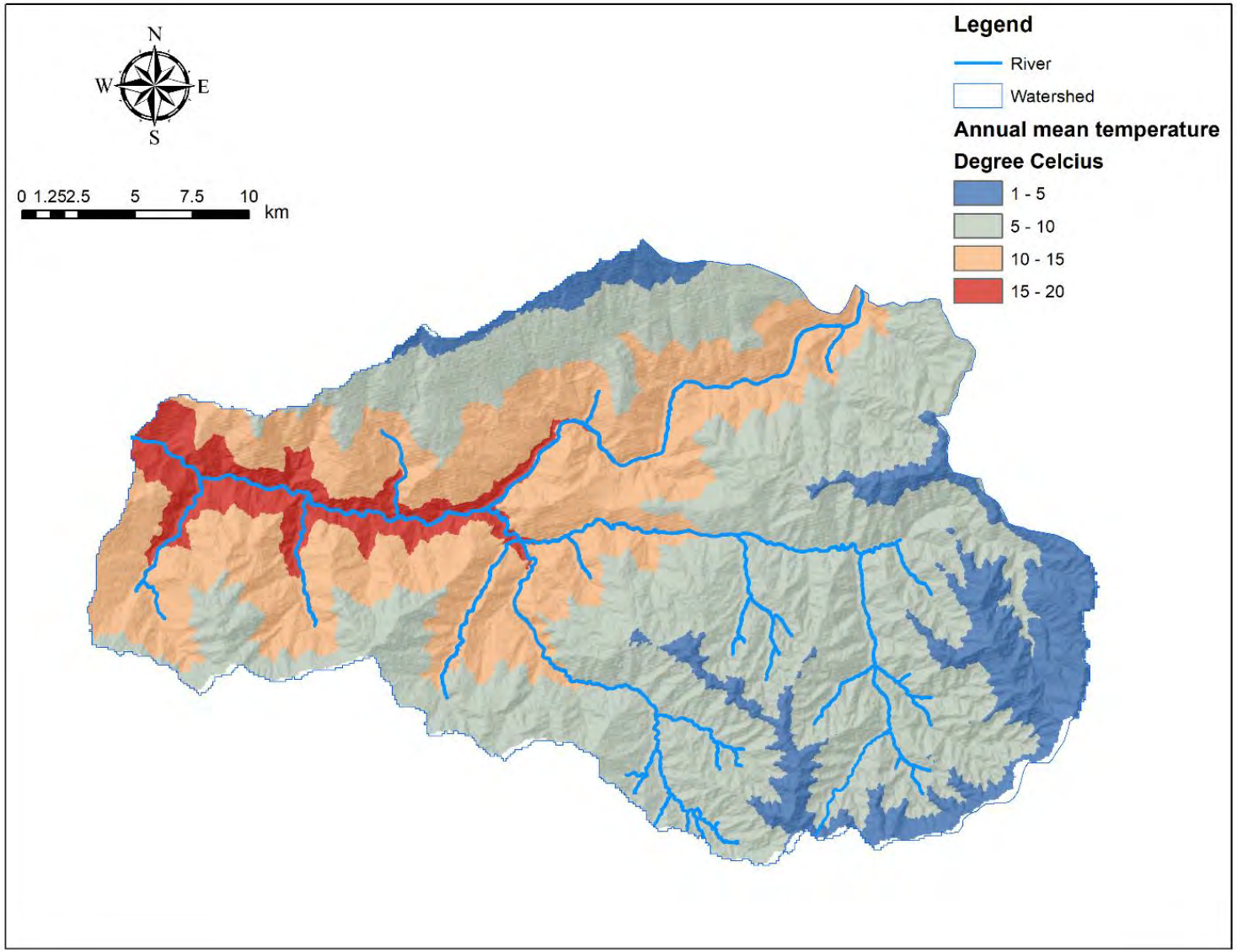


Figure 9: Mean annual temperature (°C) distribution in Tila Karnali watershed

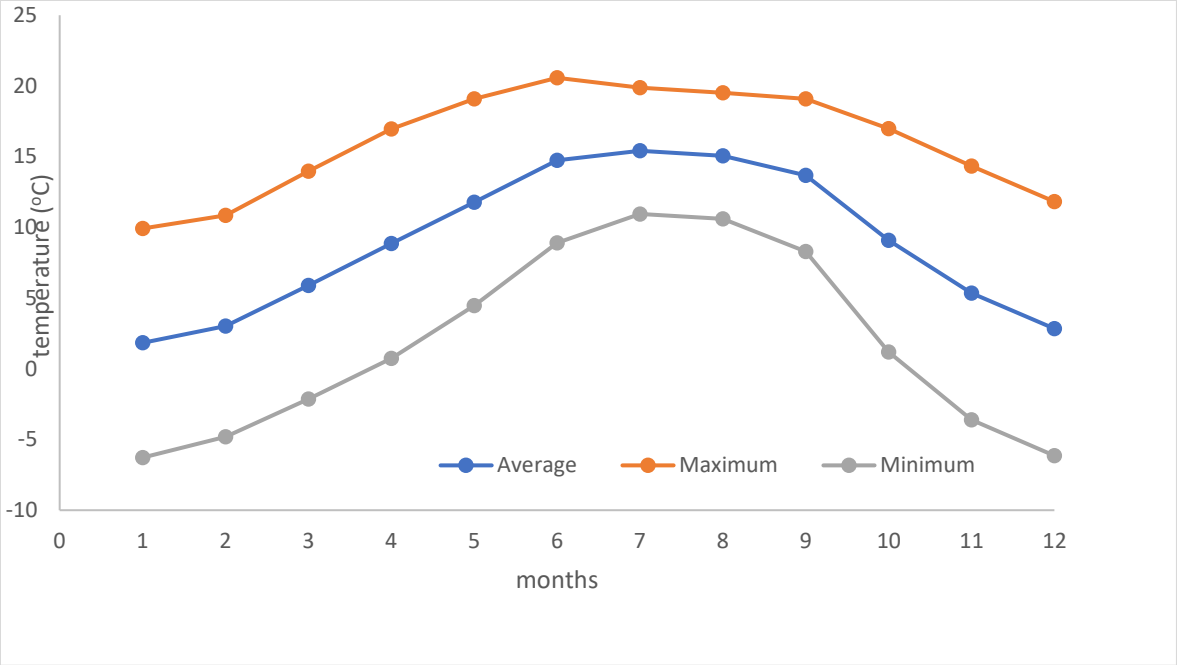


Figure 10: Maximum, minimum and average long-term monthly temperature (°C) in the Tila Karnali watershed

2.5.2 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 (Figure 11).

Spatial as well as seasonal variations in rainfall change trend are observed in the watershed. The annual rainfall in the watershed is in decreasing at the rate of 10 mm/year (Figure 13). However, the observed trend of change in seasonal rainfall is not consistent in the watershed. Mean monsoon (Jun – Sep) rainfall and the mean pre-monsoon (Mar-May) rainfall are decreasing at the rate of 10 mm/year and 3 mm/year respectively. Mean winter rainfall (Dec – Feb) is increasing at the rate of 1.8 mm/year. The mean post-monsoon (Oct-Nov) rainfall change rate varies from -1 mm/year to 1 mm/year, moving from the western part to the eastern part of the catchment.

The Theissen polygon method was used to estimate the average rainfall of the watershed (Figure 12). 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.

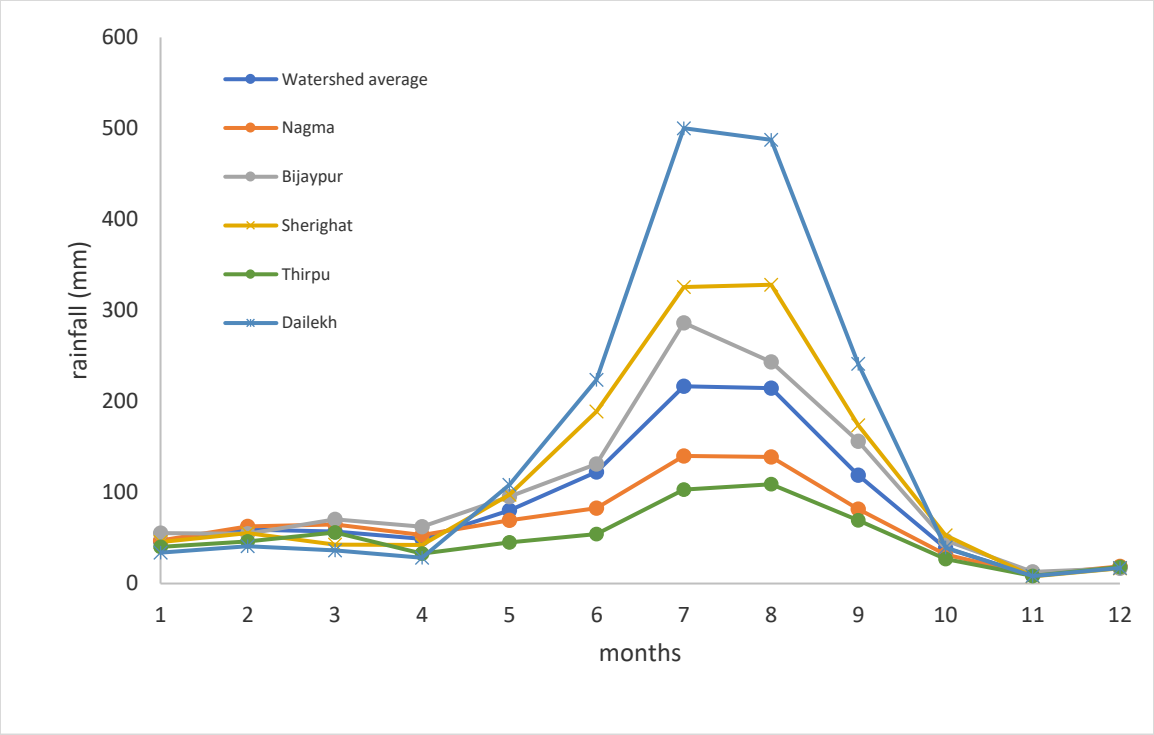


Figure 11: Long-term average monthly rainfall (in mm) estimated for the Tila Karnali watershed

2.5.3 RIVER DISCHARGE

Long-term daily discharge measurements for the Tila Nadi are collected by the Department of Hydrology and Meteorology (DHM) at Nagma, which lies near the upstream boundary of the watershed. Figure 12 displays our analysis using the observed discharge rates from 1970 to 2008 to derive the current flow rates in the Tila Nadi for pre-monsoon (23 m3/s), monsoon (91 m3/s), post-monsoon (45 m3/s), and winter (19 m3/s).

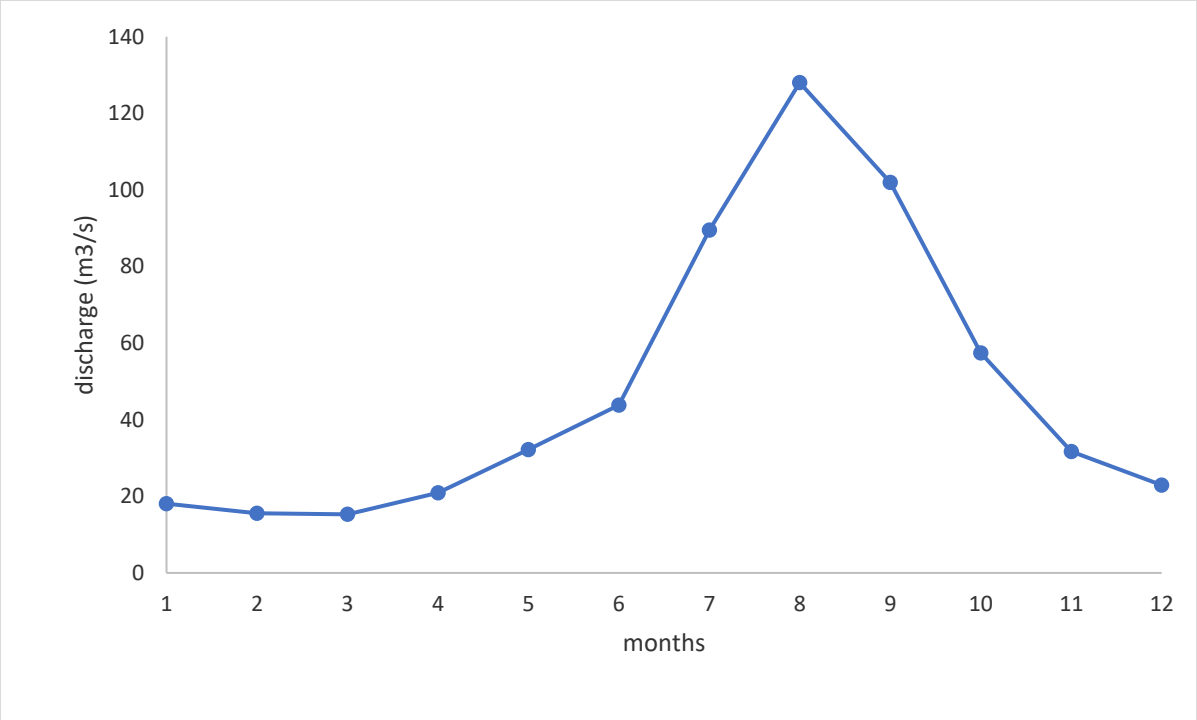


Figure 12: Long-term average monthly discharge of the Tila River observed at Nagma

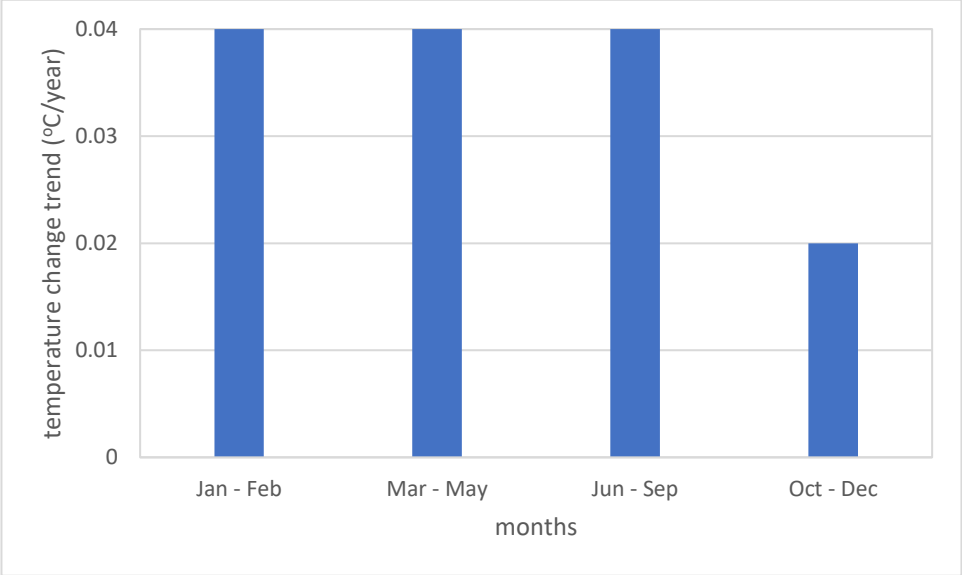


Figure 13: Seasonal temperature change trend (°C/year) observed in Tila Karnali Watershed

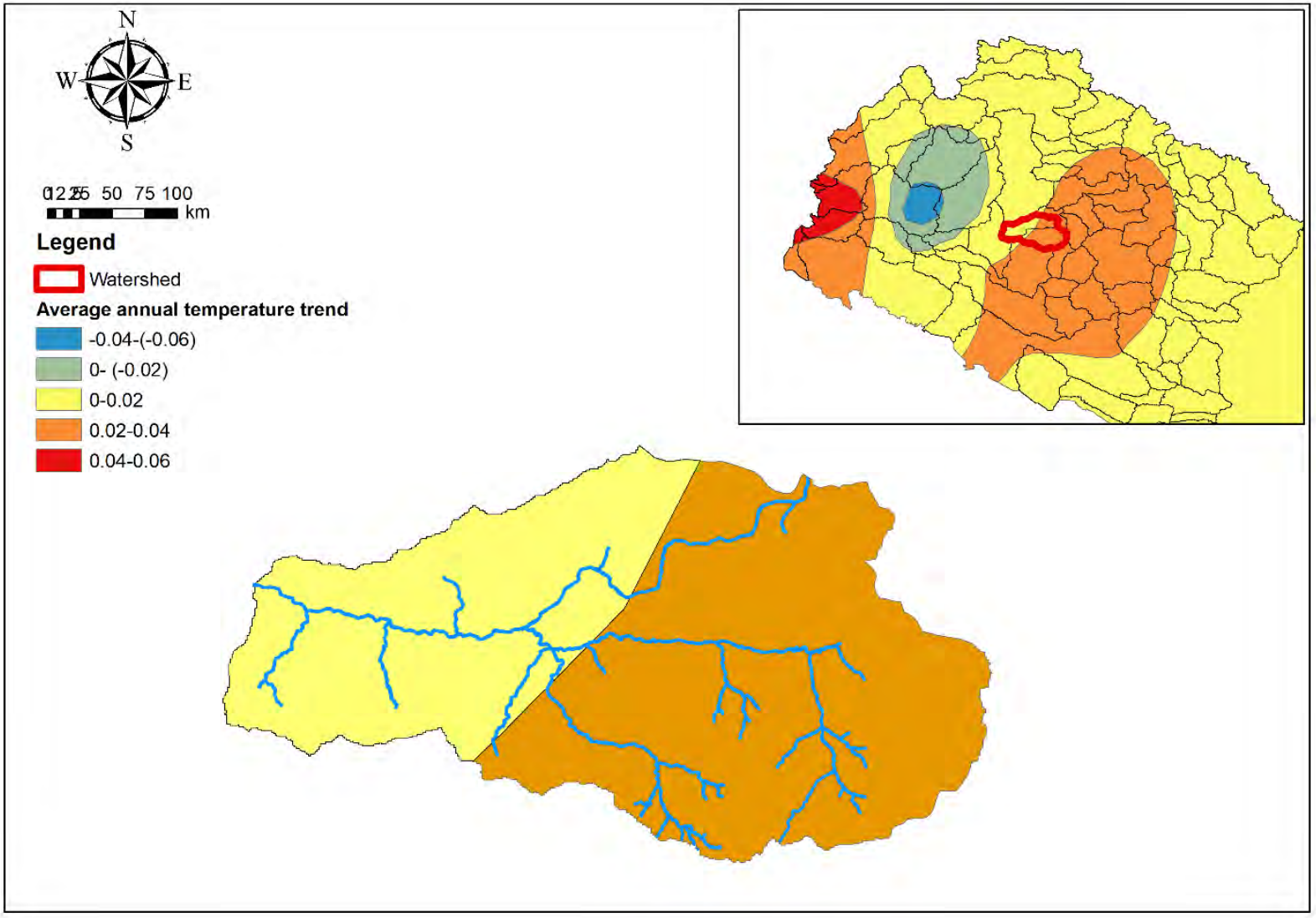


Figure 14: Annual mean temperature change trend in Tila Karnali Watershed (Marahatta et al., 2009)

Related annexes
Annex 4: Precipitation and temperature

2.6. CLIMATE RESILIENCE AND DISASTER 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 stories and concerns about decreasing snowfall and rainfall, making water more scarce. 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 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 were observed by Paani to have adopted climate-smart technologies and practices to adapt to the changing environment. Some of these technologies/practices included recharge ponds, rainwater harvesters, wastewater collection barrels, drip irrigation, Napier grass, and hedgerow planting to address soil erosion.

Looking to the future, government officials in Kalikot sat with residents in five separate sites to evaluate and rate various natural hazards in the watershed as identify by stakeholders (Table 4). Information like this can be used by local governments and civil society organizations to plan and prioritize adaptation and resilience efforts in the coming years.

Table 4: Natural hazards in the Tila Karnali watershed by location and threat levels

SN	Location	Threat	Threat level
1	Khandachakra NP	Landslide	High
		Flood	Low
		Disease	High
		Drought/hunger	Medium
		Fires	Medium
2	Shubha Kalika GP	Landslide	Low
		Flood	High
		Disease	Low
		Drought/hunger	High
		Fires	Medium
3	Mahabai GP	Landslide	Low
		Flood	Medium
		Disease	Low
		Drought/hunger	Low
		Fires	Low
4	Tilagupha NP	Landslide	Low
		Flood	Low
		Disease	Medium
		Drought/hunger	Low
		Fires	High
5	Tila GP	Landslide	Low
		Flood	Low
		Disease	Medium
		Drought/hunger	Medium

SN	Location	Threat	Threat level
		Fires	NA

3. WEALTH

The population of the Tila Karnali watershed is 58,996, three-quarters of which is BCTS followed by Dalits (23%) and Janajati (1%). Among the Dalits, 70% are Bishwokarma or Kami.

Agriculture is the most common livelihood in Tila Karnali (44.3%), followed by wage labor (29.9%), government employees (10.9%), and trade/business (3.3%). Fifty-six percent of the land is covered by forest (35% of which is considered national forest). Only 16% of the land is under cultivation and primarily rainfed. Non-timber forest products provide supplemental income as residents sell the medicinal and aromatic plants that can be found here.

Rice, maize, millet, wheat, and barley are the major cereal crops, while significant amounts of potato, beans, oil seed, and herbal products are also cultivated for household consumption and sale in the marketplace. Major export items from Tila Karnali include apples, walnuts, ghee, goats, and various medicinal and aromatic plants (MAPs). The sale of apples, in particular, has driven a sharp rise in the number of apple tree nurseries.

Despite these economic opportunities in agriculture and wage labor, sufficient income remains a steady challenge to households in Tila Karnali. To buffer against shocks and climate chang impacts, many households maintain second livelihoods and employ climate-smart practices and technologies to ensure their crop productivity and well-being. Field observations found households are constructing check dams, hedgerow planting, and rainwater harvesting tanks.

Traditional agricultural practices still predominate in the watershed; few farmers have adopted available tools and improved seed varieties. Some farmers have begun using chemical fertilizers instead of organic to cultivate off-season vegetables. Use of these fertilizers began in 2008, when road services first reached the watershed.

Banking with formal institutions is rare in the Tila Karnali Watershed. Only 20.6% of households reported having a bank account. However, some government and private financial institutions are available in the watershed (Annex 12).

Many residents are looking toward hydropower and infrastructure as a potential means of employment and economic development. Two large hydropower projects – Tila 1 and Tila 2 – are slated for construction within the decade. However, as covered in other parts of this profile, infrastructure development presents significant challenges to freshwater and biodiversity conservation.

3.1. FISHING PRACTICES

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 that two percent who fish as a livelihood, approximately 60% belong to traditional fishing communities. Typically, these communities rely on traditional methods for harvesting fish. But 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.

Additionally, with more individuals turning to fishing as a supplementary livelihood, pressure on fish numbers could increase even more. Current prices for fish at local market places range from 400-450 NPR per kilogram. And with the improvement of roads in the watershed, selling fish may become a more attractive option for local residents and draw higher numbers to the river side.

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 (see Section 2.4 more information).

In a focus group discussion, residents said they were concerned about the impending Tila River hydropower projects. One workshop attendee said he had attended a meeting organized by the hydropower contractor regarding the environmental impact assessment. The attendee said the meeting did not address the potential impact on fish nor provide any information on how fish would be accommodated with fish ladders and other safeguards.

3.2 AGRICULTURE PRODUCTIVITY

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.

In spite of these favorable conditions for cultivation, poverty rates and food insecurity levels are still high. Part of this is related to the challenging topography of the area and the generally small land holdings per family. As Table 5 illustrates, nearly 60% of families have 1 hectare or less for cultivation

Table 5: Average land holdings by size in the Tila Karnali watershed

SN	Land holding area (ha)	Percentage of households
1	0.1	2.5
2	0.1 - 0.5	16.67
3	0.5 - 1	40.75
4	0.1 - 3.0	37.9
5	3.0 - 5.0	1.98
6	5.0 - 10	0.2
	Total	**100**

Source: Annual Agricultural Development Program, 2015

Not surprisingly perhaps, food insecurity rates are also high. 85.5% of households have less than six months of food in reserve (Table 6). For a difficult growing season or a prolonged dry season, these reserves are not sufficient to maintain family health and work rates.

Table 6: Food security levels of households in the Tila Karnali watershed

SN	Food reserves	Percentage of households
1	Less than 3 months	37.35
2	4 to 6 months	48.15
3	7 to 9 months	9.60
4	10 to 12 months	5.25

3.1.1. SOIL MANAGEMENT AND FERTILITY

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 probems. 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.

Soils in Tila Karnali continue to benefit from transhumance, or livestock migration, as herders bring their flocks down south in winter to graze in warmer climates. These flocks leave substantial amounts of manure, which contributes to the overall fertility of the area. However, this herding practice is currently threatened by raising conflicts about rangeland management, wherein some stakeholders would prefer to make their land holdings private.

Conflicts in rangeland management and use have also been identified as a threat to the continuation of trans-human systems across pasture lands of Chulipatan of Khadachkra Municipality, Mahawai rural municipality and Chilkhaya of Tilagufa municipality. Despite certain level of conflicts and competition on the use of rangeland management, this system helps improve soil fertility in the high mountain. The Government Nepal also has the Range Land Management Policy 2068 for regulating the pasture land as well as trans-human pastoralism.

3.3 INFRASTRUCTURE

The design and construction of infrastructure can affect watershed health if they are not constructed with due consideration of the environment. For example, rural road construction that does not follow environment-friendly guidelines can greatly increase soil erosion and the likelihood of landslides. Hydropower plants that impound water can negatively influence aquatic life or downstream farmers who need minimum levels to support their livelihoods. Irrigation canals, if not designed properly, can reduce the water available to some farmers while inequitably delivering more water to others. As these examples

demonstrate, the design, construction and operation of infrastructure need to account for a range of social, economic, and environmental impacts within a watershed. Sustainable infrastructure should provide equitable distribution of benefits with minimal long-term environmental impacts.

3.3.1 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. Figure 15 maps all the proposed projects for Tila Karnali over the next decade.

However, the operation of these plants will necessarily impact fish and aquatic life in the watershed. Water will be impounded at certain times of the year to insure hydropower generation (i.e., winter months), and fish and plant life will be affected. In spite of local concerns, hydropower authorities have assured residents that water impounding will raise the water level "no higher than the level of monsoon flow" in the river, and that steps would be taken to fortify river banks in the vicinity.

Presently there are 10 micro hydropower projects operating in the watershed (Figure 20) 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 state that these projects do not have an impact on aquatic life in the watershed, residents noted that the jobs and electrification that come with hydropower construction are also attractive. Thus, these trade-offs often take place without proper due diligence.

Key informant interviews revealed skepticism about the value of micro hydropower projects in the watershed. Some respondents report that the household investment of NR 15,000 per has not yielded the proposed benefits in terms of power and profit.

Big hydropower projects are proposed in the area of Tila Karnali watershed. As seen in Table 11, 913 MW electricity will be produced from the five large proposed projects in the watershed. In this sense, this watershed would serve as a "hydro-hub" area of Karnali province.

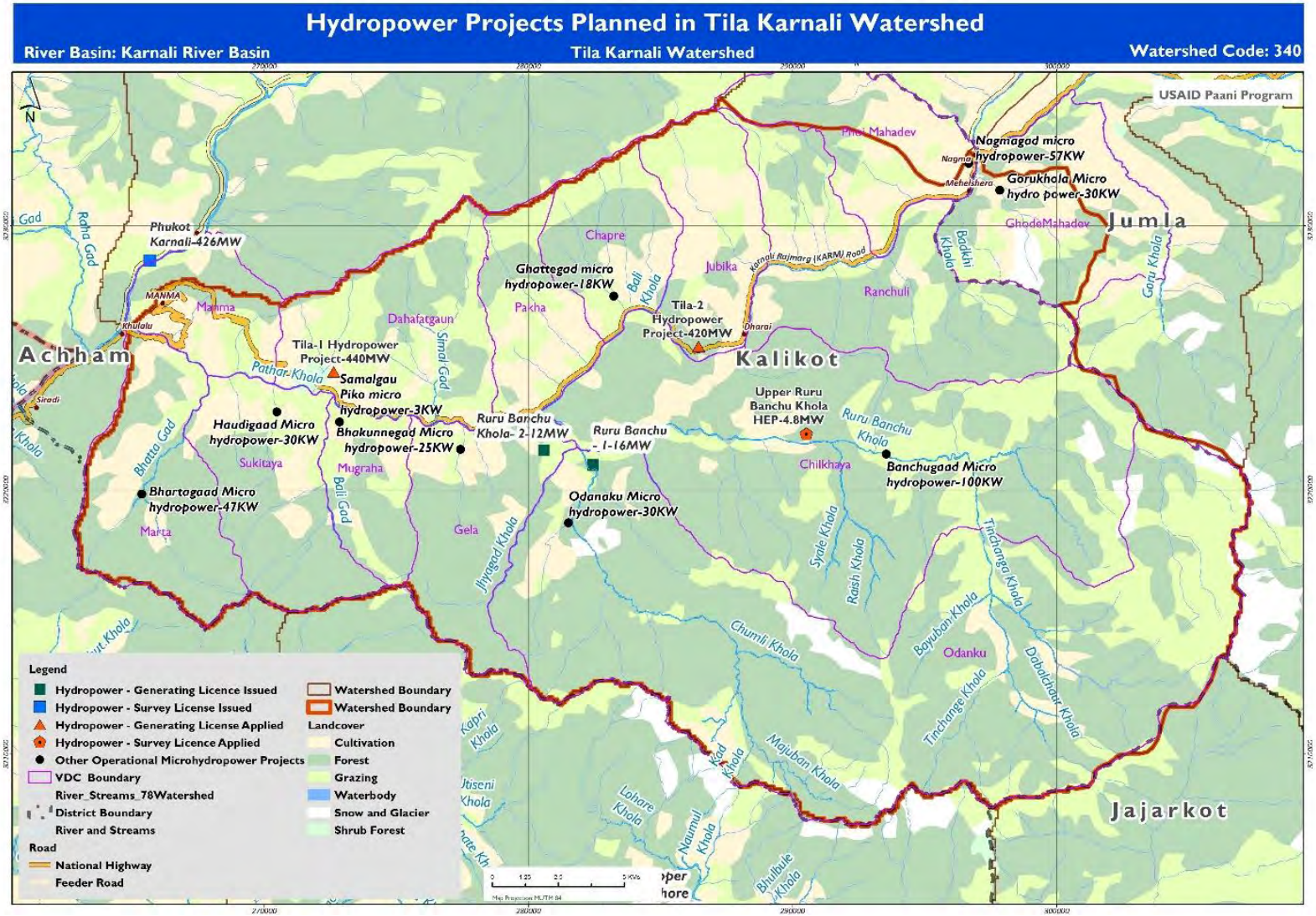


Figure 15: Proposed hydropower projects in Tila Karnali watershed

Related annexes
Annex 11: Hydropower

3.3.2 GRAVEL MINING

Tila Karnali sits within one of the most under-developed regions in Nepal, due to its steep topography and remote location. In recent years, government-sponsored infrastructure projects have risen sharply, raising demand for construction materials, much of which is mined from local rivers: sand, gravel, and boulders (Table 7).

These materials, however, provide important sanctuary and breeding grounds for aquatic life, and overharvesting of these materials can have far-reaching negative impacts on the biodiversity of the area. Furthermore, heavy machinery is often used to extract these materials, and they often directly impact the ecosystems in which they operate.

Like hydropower, gravel mining in Tila Karnali is an important source of jobs and revenue for local govenrments. The sand along the Tila River near Balibazaar, especially, is high quality and fetches good prices in the market place.

Trumalin and kinets can be found along the riversides in Bharta in Shubha Kalika GP. These high value minerals have potential for income and employment, but residents said outside interests come into the watershed illegally to harvest this material.

Focus group discussions revealed that prior environmental assessment had not been conducted for any of the mining sites currently in operation, nor was any local government taxing any of the materials harvested.

Table 7: List of mining sites in the Tila Karnali watershed

SN	GP/NP	Mining sites	Remarks	Impact level
1	Khadachkra NP	Chhare Khola	Gravel mining	Low
2	Tilagufa NP	Tallo Bali	Sand mining	Low
3	Tilagufa NP	Sukatiya	Slate	Low
4	Subhakalika GP	Bharta	Turmalin and kinets	Medium

3.3.3 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 insure environmental responsibility.

In 2006, the Nepalese Army used explosives to clear through some rocky slopes for the Jumla Highway. The concussion and vibrations of the work triggered significant landslides and soil erosion in the area. Large amounts of sediment fell into the rivers below, decimating aquatic habitats along the banks. Respondents also said the sounds of the explosions drove bears, leopards, and monkeys from the region.

The most important road in Tila Karnali is the portion of the Karnali Highway that cuts through the watershed, connecting Hulma to Nagma, 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. As well, there are 64.7 kms of district roads in the watershed. These roads are earthen and link many villages together (Table 8).

Apart from the impacts of improperly constructed roads (see executive summary), many respondents also noted that rural roads were often of such poor quality, they could not accommodate continuous vehicle traffic. Each spring, when winter thaw arrived, respondents said most rural roads would be washed out or flooded because they lacked proper drainage. Residents also expressed hope that enforcement of environmental guidelines for road building would improve so as to minimize the likelihood of landslides in the future.

The Rural Access Programme, a non-governmental advocacy group, has become a champion for environmentally-friendly road building. In Kalikot, they have succeeded in having bio-enginering activities (e.g., Gabion boxes and replantation) included as part of road construction in Siuna and Sipkahana – two villages just outside the watershed. Residents hope these activities can be reproduced in Tila Karnali.

Table 8: Status of rural roads in the Tila Karnali watershed

SN	Name	GP/NP	Type	Beneficiary (HH)	Length (km)	Bridge (m)	Status
1	Karnali Highway (Hulama to Nagma)	Khadchkra NP and Tilagufa NP (Khadackra, Tilagufa, and Tila)	Strategic Road	57,432	60	-	Black top
2	Hulma-Bharta	Khadchkra NP and Subhakalika GP (Bharta)	Local Road	7,075	22.2	-	Earthen road (under construction)
3	Hulma-Sukatiya-Mugraha-Gela-Odanaku-Chilkhaya	Khadchkra NP, Subhakalika GP, Mahawai GP. Tilagufa NP (Sukatiya, Mugraha, Gela, Odanku, Chikhaya)	Local Road	20,146	42.5	48	Earthen road (under construction)
4	Pakha-Chapre-Jubhitha	Khadchkra NP and Tilagufa NP (Pakha, Chapre, Jubhitha)	Local Road	10,249	19.3	16	Earthen road (under construction)
5	Nagma-Phoi Mahadev	Tilagufa NP (Phui Mahadev)	Local Road	3,418	4.25	-	Earthen road (under construction)

SN	Name	GP/NP	Type	Beneficiary (HH)	Length (km)	Bridge (m)	Status
	Total			**98,320**	**148.25**	**64**	

3.3.4 IRRIGATION

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 rainfed and snowfed through fifteen streams. There are 83 canals in Tila Karnali, built through support from local governments and NGOs (Table 9). Prior to these schemes, some communities had attempted to build their own independent systems, but today most look to the government to provide financial and technical support.

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.

Table 9: Irrigation schemes in the Tila Karnali watershed

SN	Name	Number of canals	SN	Name	Number of canals
1	Bharta	4	**8**	Manma	9
2	Chhapre	3	**9**	Odanaku	6
3	Chilkhaya	6	**10**	Pakha	8
4	Daha	8	**11**	Phoimahadev	8
5	Gela	6	**12**	Rachuli	11
6	Jubitha	2	**13**	Sukatiya	5
7	Kalika	5	**14**	Ghodemahadev (Jumla)	2

Focus group discussions revealed a general discontent with the increasing use of concrete irrigation channels, which many respondents said were affecting spring discharge from the water table. These respondents said they preferred traditional earthen channels for irrigation.

Related annexes
Annex 13: Irrigation

3.4 SOLID WASTE MANAGEMENT

Solid waste (e.g. garbage, plastics, glass, cloths etc.) in the watershed emanates from a number of sources, and the lack of sanitation systems threatens the water quality and aquatic life. The prime sources of waste are sewage and wastewater disposal from settlements along the Karnali Highway and Tila River. Respondents voiced concerns that growing urban areas in the watershed will continue to become more polluted unless local authorities allocate resources to develop a proper waste infrastructure. Furthermore, many stakeholders stressed the need for raising awareness in local communities about the impacts of unregulated waste disposal.

Surveys revealed that most households use a variety of disposal methods – some safe and others not safe – for their domestic waste products and waste water (Table 10). Perhaps most concerning is the fact that 65% of households still burn some solid waste, while 14% dispose household waste water into nearby water bodies.

Table 10: Solid waste and waste water disposal practices by percentage in the Tila Karnali watershed

Type	Method of disposal	Percentage of HH using this method[3]
Solid waste management practices	Landfill site	34.0
	Dumping site	13.5
	Composting	52.0
	Burning	65.2
	River, Canal	11.9
	Nothing	6.1
Waste water management practices	Safety tank	16.0
	Sewer system	23.9
	Kitchen garden	75.4
	Water bodies/open spaces	13.2
	No management, i.e., allowing sewage to flow "naturally" through waterways	7.1

[3] Totals in this table add up to more than 100 because respondents were permitted to list more than one method.

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 conservation, and adaptation to climate change are planned and operationalized within the Tila Karnali watershed. Analysis indicates there is a need to better understand how current institutional arrangements related to, for example, fisheries and gravel mining are positioned (or not) to improve resource sustainability and benefit sharing with local populations. Prior to the government's constitutionally-mandated switch to a federal structure and elections to the local government in 2017, the District Development Committee (DDC) 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 (GP or NP). Licensing promotes economic development but often impedes indigenous and local 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 about natural resource use and management in the Tila Karnali watershed.

The 2015 Constitution of Nepal (Section 57) declared that the newly devised federal system would delegate significant authority to local municipalities, including many related to water resource management and relevant environmental issues. 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. We did learn of one police case filed by Dalit families that was eventually remediated through negotiation. One family sought remedy against the discrimination and/or untouchability perpetuated against him and his family, which is prohibited by Article (24) (1) of the Constitution Nepal.

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 government (NP and 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).

To date, most policies implemented by local governments regarding natural resources do not contain special provisions to safeguard women and marginalized groups. However, there is an exception in Tila Gufa GP, which asserts the government will exercise more control over fish harvesting for purposes of increasing its tax revenue. With this funding, authorities state they will give priority to programs that benefit women and marginalized groups.

In other regards, the Tila Karnali watershed is beset by caste-based discrimination that dates back centuries. Prejudice regarding Dalits persists and is occasionally used to limit or minimize Dalit access to public water sources.

Encouragingly, the representation of women and Dalits in different institutions has increased. For example, 11 women and two men sit on the executive committee for the Masta Dev Mahila community forest user group (CFUG) in Khadachakra NP.

4.1.1. ACCESS TO WATER FOR DOMESTIC AND AGRICULTURAL USE

Drying water sources are a major cause for concern in the Tila Karnali 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.

As reported in section 2.2, 85% of households in Tila Karnali need less than 30 minutes to obtain sufficient water for their daily domestic needs. On the question of access, 81.9% of households overall reported having equal access to public water resources in the watershed, while 18.1% claim unequal access. Of those families who report unequal access, we find that this group includes 22.1% of the 178 Dalit households and 15% of the 216 BCTS households. When inquiring on the reasons for unequal access, the most common reason offered 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%).

Looking more closely at local action, some encouraging developments have taken place recently. The village assembly in Khandacharka NP passed a resolution in 2018 to conserve all drinking water sources within its jurisdiction and pledged to deliver safe drinking water to all its constituents. In Shubhakalika GP, authorities will provide all of its citizens access to clean drinking water over the next five yers by managing rainwater and ground water. Tila Gufa NP claims that one of its achievements in 2013 was the completion of 10 drinking water and sanitation schemes as part its “one house, one drinking water scheme" initiative, which has benefited approximately 1,500 households.

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 agencies are the main ones responsible for water resource management in the Tila Karnali watershed:

- District Coordination Committees (Kalikot and Jumla)
- Rural / Municipalities (Khandachakra, Tilagupha, Mahabai, Shubha Kalika in Kalikot and Tila Gaunpalika in Jumla)
- Irrigation Development Divisions (Jumla)
- Water Supply and Sanitation Division Offices (Kalikot and Jumla)
- Soil Conservation and Watershed Management Office (Jumla)
- Division Forest Offices (Kalikot and Jumla)
- Agriculture Knowledge Center (Kalikot and Jumla)

- District Administration Offices (Kalikot and Jumla)
- District Plant Resource Office (Jumla)
- Tila I and Tila II Hydropower Projects (Kalikot)

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Gender and Social Inclusion (GESI) issues: On the topic of water access, women and Dalit groups encounter a disproportionately high level of burden and discrimination. In 97% of households, women and girls bear responsibility for obtaining water for daily needs. As water sources are drying up in Tila Karnali, this often means women and girls spend more time each day collecting water. Over the course of a week, this labor can add up to several hours. For girls, this time means sacrificing time for study and other important activities. For women, this means adding more work to an already challenging work load.

Dalits and other marginalized groups have limited access to water facilities, primarily due to persistent cultural discrimations against these groups. If Dalit people arrive at a water tap when members of higher castes are present, they are expected to wait to fill their buckets last. If Dalits use a tap reserved for higher castes, or a public tap before a higher caste, the tap will be closed and "sanitized." Such practices not only reinforce destructive cultural ideas, but also unnecessary time into the day of Dalit family needing to collect water.

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

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 occurences.

4.1.3 ACCESS AND INCLUSION IN LOCAL NRM PLANNING

The land, water, flora and gravel of the Tila Karnali watershed comprise the major natural resources of the area. And 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 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 foresty 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 community forest user groups (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, FGDs 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 contestatory 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 FECOFUN and 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.

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 Tila Karnali 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 solar-powered irrigation pumps, plastic water storage ponds, drip irrigation, and farming techniques that do not require tillage for planting seeds.

Around the watershed, surveys and interviews revealed that few local governments have established formal plans and mechanisms for climate change adaptation and disaster risk reduction. Only two VDCs had drafted Local Adaptation Plans of Action (LAPA)[4]. In Shubhakalika GP, the local government allocated funds in the 2018 budget to formulate a disaster management plan. To begin this process, they will identify areas prone to natural hazards and develop checklists for action in response to potential disasters in these areas.

Similarly, local awareness of climate change and disaster risk management planning is low. Only 32% of respondents claimed to know about government planning on these topics, and only 25% said they had participated in meetings.

4.2.2. NATURAL RESOURCE MANAGEMENT (NRM) GROUPS AND ACTIVITIES

As noted above in section 4.1.3, there are 97 CFUGs and 16 leasehold forest groups currently managing a combined 89.6 km^2 of forest in the Tila Karnali watershed. More than 11,500 households benefit from the work of these groups.

[4] VDC stands for "village development committee." The VDC is the former local unit of governance in Nepal.

Not only do forest-related user groups promote the sustainable use and management of forests, but in recent years they have begun to dedicate efforts to conserving important plant and animal species. In Mahabai GP and Tila GP, community groups design their plans to benefit musk deer, red pandas, and the Himalayan yew tree.

At the household level, many families reported having adopted at least one climate-smart technology or practice (Table 11). Replantation, household resettlement, and water source conservation were the most common ones in use. The popularity of these climate-smart ideas may help households anticipate and recover from change in the coming years.

Table 11: Climate smart technologies and practices adopted in the Tila Karnali watershed

Options	Percentage of Households		
	Yes	No	Total
Gabion wire construction	7.7	92.3	100
Afforestation	86.5	13.5	100
Resettlement to secure place	32.7	67.3	100
Water Source Conservation	66.3	33.7	100
Drip irrigation/sprinkler system use	3.8	96.2	100
Early warning system support	1.0	99.0	100
Bio Fencing	1.9	98.1	100
Improved /hybrid variety use	1.0	99.0	100
Irrigation canal construction and maintenance	12.5	87.5	100
Tunnel farming (vegetables)	7.7	92.3	100
Solar lift irrigation system adoption	0.0	100.0	100
Drought tolerant variety use	1.9	98.1	100
Plastic/ Cement pond construction	2.9	97.1	100

Related annexes
Annex 14: Forest group management

4.2.3. COMPLIANCE WITH LAWS AND POLICY PROVISIONS

Surveys and focus group discussions 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 and limited education of many communities that 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 fact that the Aquatic Animals Protection Act prohibits many forms of destructive fishing, these practices were widely reported in our research.

Similarly, at the organization and/or commercial level, environmental-friendly guidelines for road building and hydropower construction must be enforced.

The Solid Waste Management Act 2011 requires local governments to construct appropriate facilities and services (e.g., landfills, composting plants, transfer stations, and biogas plants) to manage local by-product. However, interviews and field observations revealed that few local authorities have been able to meet the standards of the legislation.

On the topic of gravel mining, focus group discussions revealed that in Tila Gupha NP, the local government collected revenues on the material taken from the river banks, but no IEE had been conducted prior to the operations of these sites.

4.3. GOVERNANCE

Governance and its responsiveness to community needs and aspirations offers a focal point for managing natural resources sustainably, strengthening community resilience, and conserving freshwater biodiversity. There are three level of governments (federal, provincial and local) in place following the 2015 election to switch to a federal form of governance.

The Local Government Operation Act 2017 (LGOA) provides municipalities and rural municipalities' powers, functions and duties to formulate, implement, and regulate local policies. LGOA also provides them powers and functions relating to local level disaster preparedness and response planning, early warning systems, and distribution and coordination of relief materials. Almost all nagarpalika and gaunpalika located in Tila Karnali watershed have been executing the above-mentioned powers and functions relating to disaster management.

The LGOA also provides nagarpalika and gaunpalika authority related to forests, wetlands, wildlife, birds, water use, environment, ecology and bio-diversity. However, given the current transition to this federal structure, some of these rights and duties have yet to be exercised and discharged by the local governments.

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 consensus that their lack of implementation would lead to conflict between communities on issues of fish, forests, and water. Moreover, increasing infrastructure development, in the form roads and hydropower, has raised general concerns about e-flows and maintaining sustainable agricultural production.

Survey responses indicate that coordination among GP, NP and provincial governments is quite low. Women and marginalized persons are not well represented in the formal and informal institutions and organizations in the watershed. Similarly, village and municipality level government planning and budgeting processes (e.g., LAPA, CAPA, WUMP) are neither transparent nor 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 15: Key stakeholders and offices

5. MAJOR ISSUES AND CHALLENGES

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

The lists below present weaknesses and challenges as identified by participants in an exit multi-stakeholder consultation (MSC) workshop. The lists were compiled after Paani presented its initial major findings about the Tila Karnali watershed. The workshop 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 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. The results are presented in Table 12.

Table 12: Major environmental issues prioritized for the Tila Karnali watershed

SN	Issues	Rank
1	Loss of aquatic habitats and declining fish stock	I
2	Drought and drying water sources	III
3	Construction of improperly designed rural roads and increased landslide	II
4	Limited access of Dalits to natural resources and their services	IV
5	Forest degradation, forest fire and wildlife poaching	V
6	Solid waste management	VI

6. TURNING THREATS INTO OPPORTUNITY

After the MSC participants prioritized the most serious environmental issues facing the watershed, they were asked to devise a list of opportunities each issue presented. The participants were asked not only to think about opportunities in terms of addressing the immediate issue, but also the larger concern for improving freshwater and biodiversity conservation. Their responses are presented in Table 13:

Table 13: Environmental issues and the opportunities presented for addressing each in the Tila Karnali watershed

SN	Issue	Opportunities
1	Loss of aquatic habitats and declining fish stock	o To develop and implement more comprehensive legislative framework for managing local fish species and harvesting; o To conduct awareness-raising programs about aquatic biodiversity and conservation; o To develop extended in-situ conservation of fish; o To build capacity in local user groups to manage capture fisheries; o To train or provide technology transfer for combating invasive freshwater species; and o To promote freshwater conservation and build resilience to climate change.
2	Drought and drying water sources	o To promote rainwater harvesting technologies; o To restore traditional khaals (ponds) constructed in the upper ridges of mountains; o To promote recharge pond construction and eye brow pits to increase water infiltration rates; o To promote conflict resolution and management among multiple water resource users; o To promote climate-smart practices; and o To produce scalable local solutions for improving resilience.
3	Construction of improperly designed rural roads and increased landslide	o To support local authorities and organizations to develop regulatory frameworks for environmentally-friendly road construction; o To promote low-cost bio-engineering techniques for landslide and soil erosion control; and o To provide local authorities and organizations with an orientation on environment-friendly local governance framework (EFLG), initial environmental examination (IEE) and environmental impact assessments (EIA).

SN	Issue	Opportunities
4	Limited access of Dalits to natural resources and their services	o To facilitate access for local communities to aquatic and natural resources; o To promte GESI-responsive awareness programs; o To sensitize local actors and decision-makers on inclusive development, particularly for Dalits; and o To support local bodies to develop or update Community Adaptation Plans of Action (CAPA), Local Adaptation Plans of Action (LAPA), and Water User Master Plans (WUMP).
5	Forest degradation, forest fire and wildlife poaching	o To build capacity in members of local government and user groups to oppose and stop poaching; o To support formation and mobilization of anti-poaching groups; and o To diversify livelihood opportunities for local communities.
6	Solid waste management	o To support reuse and recycle programs in the watershed; o To provide trainings on solid waste management to local government representatives, NGOs, CSOs and CBOs; and o To initiate work for developing an improved drainage system in villages.

7. VISION AND MISSION OF TILA KARNALI WATERSHED

The profile of Tila Karnali Watershed has been prepared through various consultative processes, actively engaging with stakeholders from media, civil society organizations, local government agencies, government offices, and environmental research institutions (e.g., universities).

7.1. VISION OF TILA KARNALI WATERSHED

To create an inclusive and prosperous Tila Karnali watershed, support green infrastructure and ecotourism, and responsibly manage biodiversity.

7.2. COMMITMENT FOR CONSERVATION OF TILA KARNALI WATERSHED

Reviewing the threats, challenges, and opportunities identified with regard to watershed health, participants of different consultation workshops described what they intended to do (Table 14) within their capacity to act (e.g., as residents, government representatives, NGO/CBO representatives, fishing communities, etc.).

Table 14: Commitments from different stakeholders for watershed management

Issue	Activities planned	Responsible Org.
Drought and drying water sources	Spring source protection, forest protection, strategic plan development	Mahawai GP
	Plantation around springs	Subhakalika GP
	Increased awareness of rules, regulations, and policies; increased accountability from local governments	FEDWASUN
	Manage settlements; plantation; spring source protection; and Gabion wall	FECOFUN
	Spring source protection, wetland protection, water recharge pond construction, water safety programmes	NGO Federation
	Plantation; spring source protection activities; rain water harvesting; study and research on ground water	Khadchkra NP
	Plantation, spring source cleaning and improvement, control forest degradation, control forest fires, empower CFUG members and committees, raise awareness about drying spring sources and drought	Tila NP
Forest degradation	Institutional development, plantation, workshops	FECOFUN Kalikot

Issue	Activities planned	Responsible Org.
and loss of biodiversity	Awareness activities, rules and regulation formulation	Tilagufa NP
	Engage CFUGs for plantation and forest fire control	NGO Federation
	Reduce forest fires and poaching activities	Dalit Federation,s Kalikot
	News related to forest conservation through communication activities such as print media and radio programs	Journalists, Radio reporters group
	Activate CFUGs, prepare forest and biodiversity conservation action plan, awareness raising activities	Tila NP
	Radio and print media to sensitize public about forest fires and their causes	Journalists, Radio reporters group
Increasing trends of landslide and soil erosion	Plantation, managed construction of rural roads	Mahawai GP
	Planation and gabion construction in water springs	Subhakalika GP
	Rural road construction estimate and budget should include EIA and mitigation activities, plantation, bio engineering and gabion wall formation for protection of river bank	FEDWASUN Kalikot
	Plantation, spring source protection, workshop, bioengineering and gabion wall	FECOFUN Kalikot
	Awareness activities, rules and regulation formulation	Tilagufa NP
	Rural road construction based on green-road standard, bioengineering,	NGO Federation
	Awareness and sensitization activities to control landslide and flood by sharing jingles	Journalists, Radio reporters group
	Plantation and forest protection	Khadchkra NP
	Conduct EIA, river bank protection with gabion check dam, plantation, make standard then carry plantation	Tila NP
Limited access of Dalit to natural resources and services	Awareness creation for the ending of caste discrimination and untouchability, formulate the law and policy to provide the opportunities for marginalized and poor community	Mahawai GP
	Awareness activities, develop directives (Aachar sahita)	Tilagufa NP
	Provide equity in access to resource and services to Dalit and marginalized community, risk and vulnerability assessment of Dalit settlement	NGO Federation
	Awareness raising activities related to gender and social inclusion, resettlement of vulnerable settlement	Dalit federation Kalikot
	Sensitizing and informing, early warning for vulnerable settlements	Journalists, Radio reporters group
	Carry out field studies, apply problem solving methods as per needs, plan and conduct activities for meaningful participation of Dalit community	Tila NP
	Manage vulnerable settlements of Dalit in safe sites	Subhakalika GP

Issue	Activities planned	Responsible Org.
Loss of aquatic habitats and declining fish stock	Develop the aquatic biodiversity conservation act and implementation	Mahawai GP
	Aquatic biodiversity conservation act development for five local governments of Tila Karnali Watershed	Subhakalika GP
	Act, law development and implementation, resource conservation	FEDWASUN Kalikot
	Community river group formation, law, policy formulation and implementation, workshop	FECOFUN Kalikot
	Awareness activities, rules and regulation formulation	Tilagufa NP
	Effectively implement aquatic biodiversity conservation act, control destructive fishing equipment	NGO Federation
	Landslide and flood control activities, local act, law policy rules and regulation formulation, awareness raising activities, action plan preparation for implementation	Tila NP
Solid waste management	Segregation of biodegradable and bio non-degradable solid waste. Make compost from the bio degradable waste, manage waste dump site, quality septic tank construction and control quality	Mahawai GP
	Separate pit construction for biodegradable and bio non-degradable waste for each household	Subhakalika GP
	Law, policy, rules and regulation preparation and implementation, manage dustbins, septic tanks and waste water drainage management	FEDWASUN Kalikot
	Waste management, sensitization, sharing workshop, campaign, interaction	FECOFUN Kalikot
	Awareness activities, rules, regulation, act, laws, policy formulation	Tilagufa NP
	Awareness raising activities, policy, rules and regulation developed and implemented from tole development committee, segregate biodegradable and bio non degradable waste	NGO Federation
	Awareness creation activities, law, policy and act development and implementation related to waste management	Dalit federation Kalikot
	Bazaar management drainage management	Khadchkra NP
	Increased awareness activities, action plan preparation for waste management	Tila NP

8. RECOMMENDATIONS

The Tila Karnali Watershed profile presents the status, major challenges and opportunities for water resources management for the multiple users located within the region. These recommendations were conceived and compiled based on input from all the participants at the exit MSC workshop, seeking to improve climate change adaptation and freshwater biodiversity in the watershed.

- Engage local government to develop and integrate plans for improved water governance and aquatic biodiversity management;
- Develop georeferenced information on aquatic biodiversity and fishery hotspots to improve fish management;
- Assess current knowledge gaps in capture fisheries to develop improved sustainable harvesting figures;
- Engage government agencies to establish and enforce updated regulatory frameworks for fishery co-management;
- Include conservation initiatives in local planning processes, and advocate for budget allocation to support those initiatives;
- Produce and disseminate communications materials (e.g., radio programs) to publicize environment-friendly water use and waste management practices;
- Advocate for increased enforcement of green infrastructure guidelines, particularly for road construction and hydropower;
- Support initiatives to improve the livelihoods of rural and margainalized groups who depend on traditional means (e.g., capture fisheries) or labor-intensive work (e.g., mining);
- Promote forest fire awareness among all forest user groups and reduce open grazing;
- Encourage conservation and governance initiatives to integrate gender and social inclusiveness in all programs;
- Renovate traditional natural ponds and protect spring sources to develop more comprehensive multiple water use systems;
- Promote multiple-use water technologies that maximize water use efficiency, such as sprinklers and drip irrigation;
- Plant trees and shrubs on barren land to reduce run-off, retain rainwater, and recharge natural springs;
- Support stronger enforcement of regulations that prohibit destructive fishing practices and educate local fishers about the importance of biodiversity conservation;
- Promote ecotourism as an alternative livelihood option for traditional fishing communities;
- Initiate dialogue with relevant stakeholders to discuss potential impacts of proposed hydropower projects on aquatic biodiversity;
- Encourage participation of downstream stakeholders in public hearings to ensure that all voices are heard on environmental concerns; and
- Raise awareness among community members about the environmental impacts of infrastructure development (e.g., roads, irrigation, and hydropower).

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ANNEXES

Annex 1: 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. The watershed profile reflects the collective understanding and aspirations of people in the Tila Karnali 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 Tila Karnali 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 Tila Karnali watershed area where Paani and other projects can provide support; and
- Providing a platform for consultation and advocacy for Tila Karnali 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-stakeholder consultation [MSC] conducted to

    a) Share preliminary results of watershed conditions,

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

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

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

Key Informant Interviews [KII] were conducted with specialists and champions to explore the causes and intensity of the particular environmental issues more deeply in the watershed. The team designed some checklists to capture the cause and effect dynamics around Paani focal interest areas, cross cutting areas including governance, gender and social inclusion and policy. The consolidated analytic results produced through i] Review and analysis ii] Outcomes of threat and vulnerability analysis and targeting iii] and champions stakeholder consultation iii] community surveys iv] water quality and discharge measurement.

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 the Tila Karnali

watershed. We also used this information to identify possible solutions and champions for leveraging knowledge and support through partnerships with local agencies and organizations.

To complement the surveys, Paani conducted a 394 household survey, 11 FGDs and 5 KIIs to investigate the key issues identified by households. Paani used the Akvoflow Mobile App to measure water quality and discharge.[5] To prioritize the collected issues, the program held an exit MSC in which we presented preliminary findings and asked 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 a potential mission statement for the watershed. We brought the various statements together and synthesized the ideas into the mission statement:

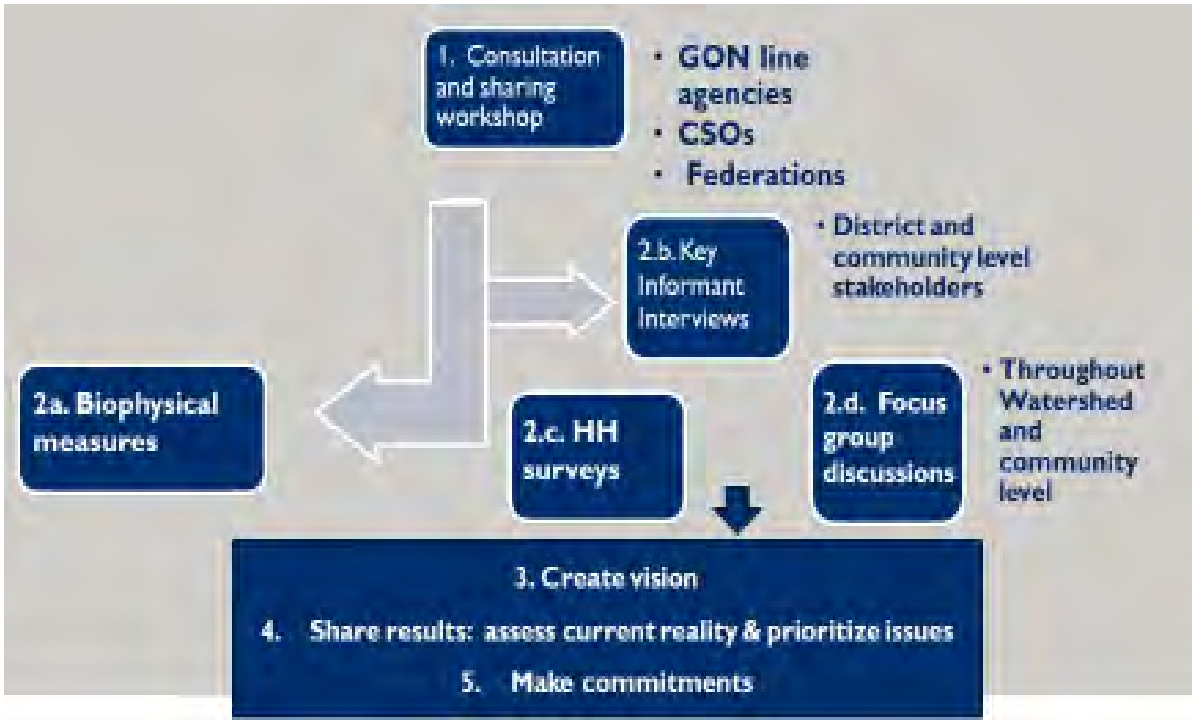

Figure 16: Methodological approach illustrated

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

Table 15: Household surveys conducted by caste/ethnicity in the Tila Karnali watershed

Caste/ethnicity	Households	Percentage
Dalit	178	45.18
BCTS	216	54.82
Janajati	0	0
Total	**394**	**100**

Annex 2: Land cover and land use

Table 16: Land cover by area and percentage in the Tila Karnali watershed

SN	Land cover	Area (km^2)	Percentage
1	Cultivation	124.67	16
2	Forest and shrub land	428.41	56
3	Grazing	194.09	25
4	River and streams	6.59	1
5	Barren land	13.72	2
	Total	**767.48**	**100**

Annex 3: Population

Table 17: Population of Tila Karnali watershed by sex and caste/ethnicity

Unit	Pop.	Male	Female	Janajati	BCTS	Dalit	Others	Total
Suva Kalika GP	14,080	7,026	7,054	-	10,099	3,825	156	14,080
Khandachakra NP	14,478	7,223	7,255	391	10,487	3,600	-	14,478
Mahawai GP	8,323	4,195	4,128	18	6,625	1,662	18	8,323
Tila GP	911	453	458	2	817	91	1	911
Tilagufa NP	14,610	7,267	7,343	296	11,461	2,828	25	14,610
Total	**52,402**	**26,164**	**26,238**	**707**	**39,489**	**12,006**	**199**	**52,402**

Annex 4: Precipitation and temperature

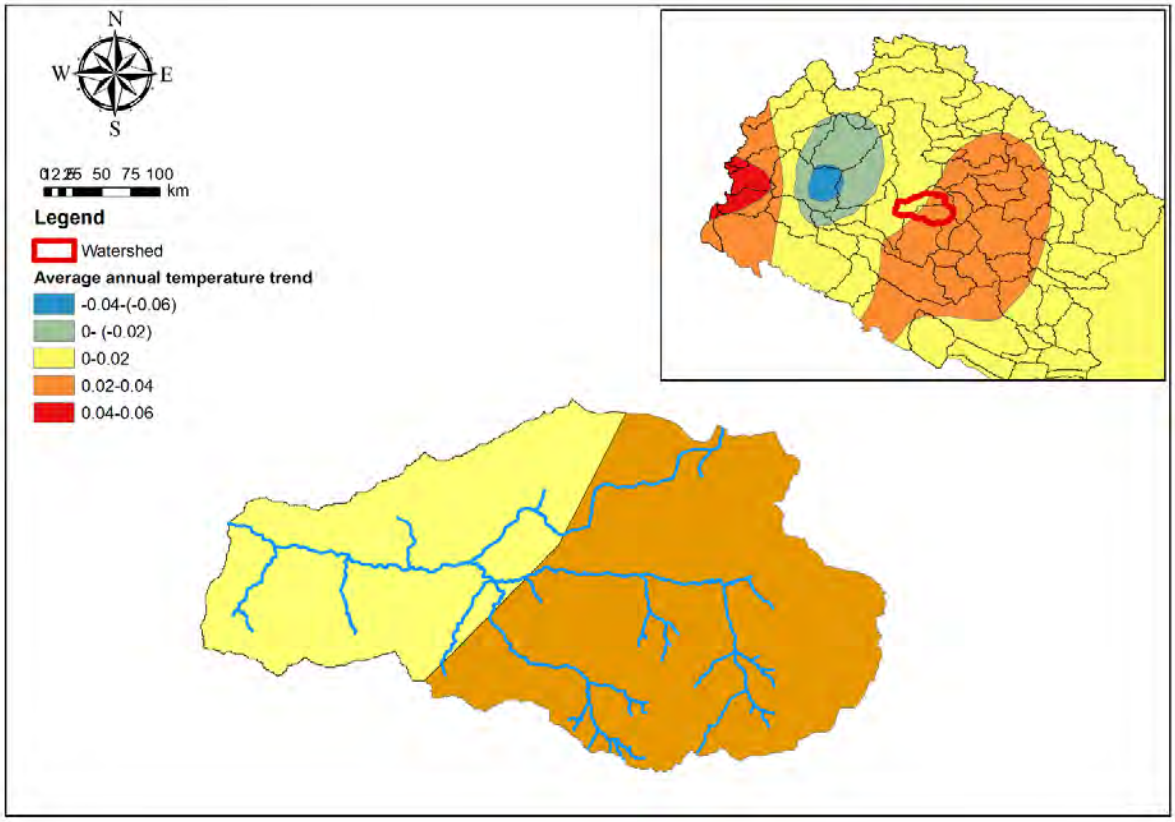

Figure 17: Annual mean temperature trends in the Tila Karnali watershed

Annex 5: Lakes, rivers and streams

Table 18: Streams and rivers in the Tila Karnali watershed

SN	Name	Category
1	Bhartagaad	River
2	Baligaad	River
3	Jhyagdkhola	River
4	Pathar Khola	Stream
5	Simalgad	Stream
6	Balikhola	Stream
7	Chumli Khola	Stream
8	Majuban Khola	Stream
9	Syale Khola	Stream
10	Raish Khola	Stream
11	Tinchange Khola	Stream
12	Daboulechaur khola	Stream
13	Bayuban Khola	Stream
14	Ruru Banchu Khola	Stream
15	Badkhi Khola	Stream
16	Majubn Khola	Stream
17	Goru Khola	River
18	Hima Khola	River
19	Tila River	River
20	Poripali	Stream
21	Padamgaad	River

Annex 6: Forests

Table 19: Types of forests in the Tila Karnali watershed, including area

SN	Type	Area (km^2)	Percentage of all forest
1	Mixed hardwood	305.58	71.3
2	Sal	1.82	0.4
3	Pine	40.12	9.4
4	Sissoo (Sisam)	2.97	0.7
5	Banjh oak (Quercus)	66.80	15.6
6	Himalayan fir (Abies)	8.19	1.9
7	Deodar cedar	2.93	0.7
	TOTAL	**428.41**	**100.0**

Table 20: Commercially-important non-timber forest products (NTFP) and medicinal and aromatic plants (MAP) in the Tila Karnali watershed

SN	Name	Scientific name	IUCN category	CITES category
1	Panchaule	Dactylorhiza hatagirea	N/A	Appendix II
2	Sugandhawal	Valerain Jatamansii	N/A	N/A
3	Lauth salla	Taxus baccata	N/A	Appendix I
4	Timur	Zanthoxylome armetum	N/A	N/A
5	Jatamasi	Nardostachys grandiflora	Red list	Appendix II
6	Allo	Girardinia diversifolia	Red list	DD
7	Padamchal	Rheum austral	N/A	N/A
8	Khiramlo	Polygonatum verticillatum	Vulnerable	DD
9	Chiraito	Swertia chirayita	Endangered	DD
10	Kutki	Neopicrorhiza scrophulariflora	DD	DD
11	Guchi Chyau	Morchela esculenta	Red list	DD
12	Bisjara	Aconitum bisma	Red list	DD
13	Godano	Pleurospermum dentatum	N/A	N/A
14	Pasanbed	Bergenia ciliate	N/A	N/A
15	Lokta	Daphne bholua	N/A	N/A
16	Satuwa	Paris polyphylla	N/A	N/A
17	Ghore mocha	Thymus linearis	N/A	N/A
18	Jaitun	Olea europaea	DD	DD

Table 21: Other important NTFPs and MAPs in the Tila Karnali watershed

SN	Local name	Common name	Scientific name
1	Suganghwal	Indian valerian	Valeriana jatamansii
2	Lokta	Daphnes	Daphne bholuwa
3	Bajradanti	NA	Potentilla fulgens
4	Somlata	NA	Ephedra geradiana
5	Timur	Winged prickly ash	Zanthoxylum armatum
6	Jatamashi	NA	Nardostachys jatamasi
7	Pasanbed	NA	Berginia ciliate
8	Kurilo	NA	Asparagus spp
9	Bishjara	NA	Aconitum spp
10	Satuwa	NA	Paris polyphylla
11	Chiraito	NA	Swertia spp
12	Bojho	NA	Acorus calamus
13	Padam Chal	Chinese rhubarb	Rheum australe
14	Amala	Indian gooseberry	Phyllanthus embilica
15	Ritha	Soap nut	Sapindus mukorossi
16	Amalbed, Aswagandha	Indian ginseng	Withania somnifera
17	Kakarsingi	Pistachio tree	Pisticia integerrima
18	Sisnu	Nettle	Utrica dioica
19	Kaulo	NA	Persia bombycina
20	Allo	Himalayan nettle	Gerardinia diversifolia
21	Kutuki	NA	Neopicorrhiza scrophulariifolia
22	Tejpat	Indian bay leaf	Cinnamomum tamala
23	Kukurdaino	NA	Smilax spp
24	Sunakhari	NA	Dendrobium chrysotoxum Lindl
25	Kalikathko dana	NA	Myrsine semiserrata
26	Bayojadi	NA	Tanacetum macrophyllum
27	Paani Amala	Fishbone fern	Nephrolepis cordifolia
28	Ghodemacho	NA	*Thymus linearis*
29	Gadaino	NA	*Pleurospermum dentatum*
30	Dhupi	Black juniper	*Juniperus indica*
31	Chutro	Indian barberry	Berberis aristata
32	Attis	NA	Aconitum heterophyllum
33	Ban Lasun	NA	Allium wallichii

SN	Local name	Common name	Scientific name
34	Bikh	NA	Aconitum spicatum
35	Jhyaun	Lichens	Parmelia nepalensis
36	Titepati	Wormwood or sagebrush	Artemisia vulgaries
37	Guchche chyau	morel	Morchella conica
38	Lauthsalla	Yew tree	Taxus baccata
39	Meda/Khiraulo	King Solomon's seal	Polvgonatum verticillatum (L.)
40	Ban Aduwa	NA	Asarum himalaicum
41	Ban Aalu	NA	Rhizoma panacis majoris
42	Bhingiraj	False daisy	Eclipta prostrata
43	Jibanti	NA	Coelogyne cristata
44	Sungabha	NA	*Dendrobium densiflorum*
45	Majitho	NA	Rubia manjith
46	Shilajit (mineral)	NA	Asphaltum punjabianum
47	Yarshagumba	NA	Ophiocordyceps sinensis

Table 22: Forest management groups in the Tila Karnali watershed

Type of management group	Number	Area (km2)	Percent of forest managed
Community forest user group (CFUG)	97	85.35	20
Leasehold forest	16	4.21	1
National forest (District Forest Office)	-	340.23	79
Total	**113**	**429.79**	**100**

Annex 7: Fish

Table 23: Fish found in the Tila Karnali watershed

SN	Family	Local Name	English name	Species
1	Amblycipitidae	Bindhar, pichhi, baljung	Indian torrent catfish	Amblyceps mangois
2	Cyprinidae	Katle	Copper mahseer	Neolissocheilus hehexagonolepis
3	Cyprinidae	Asala, mada, dhawai	Indian carplet	Amblypharyngodon microlepis
4	Cyprinidae	Faketa, poti, chele, titer kane fageta	Barna baril	Barilius barna
5	Cyprinidae	Feketa, gudari, Jjhojha	Hamilton's barila	Barilius bendelisis
6	Cyprinidae	Tikahinia, fageta	Dwarf chamelion fish	Barilius tilea
7	Cyprinidae	Tilkhina, lam fageta	Vagra baril	Barilius vagra
8	Cyprinidae	Kachara, lohori	Gangetic latia	Crossoheilus latius
9	Cyprinidae	Darai, deduwa	Flying barb	Esomus danricus
10	Cyprinidae	Buduna, chuchche buduna	Annandale garra	Garra annanndalei
11	Cyprinidae	Patharchati	Lamta garra	Garra lamta
12	Cyprinidae	Budhuna, chepe	Gotyla	Garra gotyla
13	Cyprinidae	Bata, rohu	Bata labeo	Labeo bata
14	Cyprinidae	Pothi, sidhara, chandapothi, pate sidra	Spotfin swamp barb	Puntius sophore
15	Cyprinidae	Sidhara, pothi, potina, darahi, tite pothi	Two-spot barb	Puntius ticto
16	Cyprinidae	Thumree asala, buchche asala, dhumke asala	Alwan snowtrout	Schizothorax richardsonii
17	Cyprinidae	Buchhe asala	Blunt nosed snowtrout	Schizothorax molesworthi
18	Cyprinidae	Chuchche asala	Kunar snowtrout	Schizothorax labiatus
19	Cyprinidae	Chuchche asala	Dinnawah snowtrout	Schizothorax progastus
20	Cyprinidae	Sahar, mahseer, Chuchche sahar	Golden mahseer	Tor putitora
21	Cyprinidae	Phalame sahar	Tor mahseer	Tor tor
22	Cyprinidae	Sidre	Rosy barb	Pethia conchonius

SN	Family	Local Name	English name	Species
23	Cyprinidae	Rahu	Calabans	Bangana dero
24	Cyprinodontidae	Khurpe, chepti	Assamese Kingfish	Cyprinodon semiplotum
25	Nemacheilidae	Bhotee gadelo	Ticto barb, firefin barb	Schistura rupecula
26	Nemacheilidae	Baghe	Mottled loach, sand loach	Acanthocobitis botia
27	Sisoridae	Kavre, Marcha	Sulcatus catfish	Pseudecheneis sulcatus
28	Sisoridae		Torrent catfish	Parachiloglanis hodgarti
29	Sisoridae	Bhitte, capree, vendro, kalejunga, bhitte	River catfish	Glyptothorax cavia

Annex 8: Mammals

Table 24: List of mammals found in the Tila Karnali watershed

SN	Nepali Name	English Name	Scientific Name
1	Leopard	Common Leopard	Panthera pardus
2	Ghoral	Himalayan Goral	Naemorhedus goral
3	Ban Biralo	Jungle Cat	Felis chaus
4	Shyal	Golden Jackle	Canis aureus
5	Phyauro	Indian Fox	Vulpes bengalensis
6	Malsapro	Yellow Throated Marten	Martes flavigulia
7	Lokharke	Squirrel	Funambulus pennant
8	Dumsi	Indian Porcupine	Hystrix indica
9	Nyauri Musa	Common Mongoose	Herpestes edwardisii
10	Barking Deer	Barking Deer	Muntiacus muntjak
11	Bat	Bat	Pteropsus species
12	Hare	Hare	Lupus species
13	Monkay	Rhesus Macaque	Macaca mulatta
14	Langoor	Common Langur	Presbytes entellus
15	Pig	Wild boar	Sus scrofa
16	Blak bear	Himalayan black bear	Ursus thibetanus
17	Red Pand	Red Panda	Ailurus fulgens
18	Musk Deer	Himalayan Musk deer	Moschus leucogaster

Annex 9: Reptiles

Table 25: List of reptiles found in the Tila Karnali watershed, including preferred habitat

SN	Nepali name	Common name	Species	Occurrence	Habitat
1	Paha	European toad	Bufo bufo	Common	Open grass, agricultural fields, forest
2	Bhaguto	Indus Valley bullfrog	Rara tigrine	Common	Forests, open grass
3	Dhaman		Pryas mucosus	Common	Forests, bushes, open grass
4		Himalayan rock lizard	Laudakia tuberculate	Common	Open grass
5	Mausuli	Common house gecko	Hemidactylus frentus	Common	Open grass
6	Hareyu	White-lipped pit viper	Trimeresurus albolabris	Common	Forests
7	Gohoro	Bengal monitor	Varanus bengalensis	Common	Bushes, agricultural land, open grass

Annex 10: Birds

Table 26: List of birds found in the Tila Karnali watershed

SN	Nepali name	Common name	Species
1	Kali titra	Black partridge	Francolinus francolinus
2	Kaliz	Kalij pheasant	Lophura leucomelana
3	Ban khura	Red jungle Fowl	Gallus gallus
4	Nyauli	Great barbet	Megalaima virens
5	Kuthurke	Blue-throated barbet	Mjgalaima asiatica
6	Thople dhukur	Dove	Streptopelia chinensis
7	Kalo chil	Black kite	Milvus migrans
8	Himalayan gidhha	Himalayan griffon	Gyps himalensis
9	Chichilkote	The Great tit	Parus major
10	Baj	Eurasian hobby	Falco subbuteo
11	Lampuchhre	Magpie	Urocissa erthrorhyncha
12	Kokale	Grey treepie	Dendrocitta formosae
13	Kag	House crow	Carvus macrorhynchos
14	Dangre	Common myna	Acridotheres tristis
15	Julphe jureli	Bulbul	Pycnonotus leucogenys
16	Torigada	White-crested Laughingthrush	Garrulax leucolophus
17	Ghar bhangero	House sparrow	Passer domesticus
18	Chibe	Drango	Dicrurus spp
19	Rani charo	Scarlet minivet	Pricrocotus flammeus
20	Koili	Indian cuckoo	Cuculus micropterus
21	Lato koshero	Owl	Tyto alba
22	Kakakul	Crested serpent eagle	Spilornis cheela
23	Halesho	Yellow-footed green pigeon	Treron phoenicoptera
24	Fisto	Common tailor bird	Orthotomus sutorius
25	Huchil	Eurasian eagle owl	Bubo bubo

SN	Nepali name	Common name	Species
26	Seto parewa	White homing pigeon	Columba livia
27	Egypsian gidhha	Egyptian vulture	Neophron percnopterus

Annex 11: Hydropower

Table 27: List of hydropower schemes in the Tila Karnali watershed

SN	Name	Location	Capacity	Households benefited	Status
1	Narmagaad	Phoimahadev, Tilagufa	57 kW	686	Operating
2	Ghattegad	Chhapre, Tilagufa	18 kW	318	Operating
3	Sana	Daha, Khandachakra	15 kW	185	Operating
4	Samalgau	Kalika, Shubha Kalika	3 kW	35	Operating
5	Bhakunnegaad	Gela, Shubha Kalika	25 kW		Operating
6	Banchugaad	Chilkhaya, Mahabai	100 kW		Operating
7	Bhartagaad	Bharta, Shubha Kalika	47 kW	850	Operating
8	Haudigaad	Sukatiya, Shubha Kalika	30 kW	570	Operating
9	Odanaku	Odanaku Mahabai	30 kW	625	Operating
10	Tila-1	Pakha, Daha and Manma, Khandachakra	440 MW		Proposed
11	Tila-2	Shubha Kalika, Mahabai Khadachakra, Tilagufa	420 MW	4,570	Proposed
12	Rurubanchu	Banchugaad, Mahabai	13.5 MW		Proposed
13	Rurubanchu - 2	Banchugaad Mahabai	12 MW		Proposed
14	Gorukhola	Ghodemahadev, Tila	30 kW	371	Operating

Annex 12: Financial institutions

Table 28: Financial institutions in the Tila Karnali watershed

SN	Type	Name	GP or NP	Location
1	Cooperatives	Chuli Multi Propose Cooperatives L.Td.	Khadachakra NP	Daha
2	Cooperatives	Rachuli Agriculture Cooperative	Tilagufa NP	Rachuli
3	Cooperatives	Jharana Kalika Agricultural Cooperative L.td	Tilagufa NP	Chhapre
4	Cooperatives	Chuli Mahabu Users Cooperative L.td.	Khadachakra NP	Pakha
5	Cooperatives	Chuli Tila Agriculture Cooperative L.td.	Khadachakra NP	Daha
6	Cooperatives	Jharana Agricultural Cooperative L.td	Tilagufa NP	Chilkhaya
7	Cooperatives	Hatemalo Agriculture Cooperative L.td	Mahawai GP	Odanaku
8	Cooperatives	Rural Multi Propose Cooperative L.td.	Subhakalika GP	Sukatiya
9	Cooperatives	Tinchule Multi Propose Cooperative L.td.	Subhakalika GP	Bharta
10	Cooperatives	Tila Karnali Multi Propose Cooperative L.td.	Khadachakra NP	Manma
11	Cooperatives	Tila Karnali Agriculture Cooperative L.td.	Mahawai GP	Gela
12	Cooperatives	Kali Swabalamban Agriculture Cooperative L.td	Subhakalika GP	Mugraha
13	Cooperatives	Tila Agriculture Cooperative L.td.	Tilagufa NP	Jubitha
14	Cooperatives	Janachetana Multi Prpose Cooperative L.td.	Tilagufa NP	Phoimadev
15	Cooperatives	Pachaljharana Users' Cooperative	Khadachakra NP	Manma
16	Cooperatives	Triveni Multi Propose Cooperative	Tilagufa NP	Phoimadev
17	Cooperatives	Ruru Banchu Agriculture Cooperative L.td	Tilagufa NP	Chilkhaya
18	Cooperatives	Milijuli Agriculture cooperative L.td.	Khadachakra NP	Manma
19	Cooperatives	Pugeli Agriculture Cooperative L.td	Tilagufa NP	Phoimadev
20	Cooperatives	Bhaikhadev Agriculture Cooperative Ltd	Subhakalika GP	Bharta

SN	Type	Name	GP or NP	Location
21	Bank	Global IME Bank Ltd	Khadachakra NP	Manma
22	Bank	Sanima Bank Ltd	Khadachakra NP	Manma
23	Bank	Rastriya Banijya Bank Ltd	Khadachakra NP	Manma
24	Bank	Mega Bank Nepal Ltd	Khadachakra NP	Manma
25	Bank	NIC Asian Bank Ltd	Khadachakra NP	Manma
26	Bank	Agriculture Development Bank L.td	Khadachakra NP	Manma
27	Bank	Nirdhan Utthan Bank Ltd	Khadachakra NP	Manma
28	Bank	Nepal Investment Bank L.td	Tilagufa NP	Nagma
29	Bank	NABIL Bank L.td.	Tila GP	Ghodemahadev
30	Bank	Chhimek Laghu Bitta Bikas Bank	Khadachakra NP	Manma
31	Finance	Deprosc Laghubitta Bittiya Sanstha	Khadachakra NP	Manma

Annex 13: Irrigation

Table 29: List of irrigation schemes in the Tila Karnali watershed

SN	Name	GP/NP	Location
1	Ghattabadi - Phoijyula	Tilagufa NP	Phoimahdev
2	Kurmula to Dusa	Tilagufa NP	Chhapre
3	Majhkulo	Khadachkra NP	Pakha
4	Oada	Mahabai GP	Odanaku
5	Chauki Lek Chaukhola	Khadachkra NP	Pakha
6	Banchu	Tilagufa NP	Chilkhaya
7	Chalkhahat	Khadachkra NP	Manma
8	Bherekhola	SubhaKalika GP	Bharta
9	Nagma Mehalsera	Tilagufa NP	Phoimahdev
10	Ghodena	Khadachkra NP	Daha
11	Ramni	Mahabai GP	Gela
12	Gotikatiya Odal Kulo	Mahabai GP	Odanaku
13	Dhadar	Khadachkra NP	Daha
14	Mathillo Kilo	Khadachkra NP	Daha
15	Sukatiya Aandherkot	SubhaKalika GP	Sukatiya
16	Upiyadanda	Tilagufa NP	Phoimahdev
17	Ramni	Mahabai GP	Gela
18	Sukatiya	SubhaKalika GP	Sukatiya
19	Ghunkhaya Bhojkulo	Tilagufa NP	Ranchuli
20	Sukatiya	Tilagufa NP	Ranchuli
21	Chalne	Khadachkra NP	Daha
22	Bharta	SubhaKalika GP	Bharta
23	Majhkulo	Khadachkra NP	Pakha
24	Bhuwane	Tilagufa NP	Ranchuli
25	Ranauta	Tilagufa NP	Ranchuli
26	Oadkheni	Tilagufa NP	Ranchuli
27	Kalamuda Namthola	Tilagufa NP	Chilkhaya
28	Sirugada	Khadachkra NP	Manma
29	Khodamai	Khadachkra NP	Daha
30	Tallokhada	Tilagufa NP	Ranchuli
31	Manma Plegada	Khadachkra NP	Manma
32	Chhepade	Khadachkra NP	Manma
33	Udapokhari	Khadachkra NP	Manma

SN	Name	GP/NP	Location
34	Barapata	Khadachkra NP	Daha
35	Saprekhola	Mahabai GP	Odanaku
36	Lagna	Tilagufa NP	Ranchuli
37	Ritabari Chiura	Khadachkra NP	Manma
38	Ribari Chiura	Khadachkra NP	Manma
39	Hupi Rouli	Khadachkra NP	Daha
40	Phoimahadev	Tilagufa NP	Phoimahdev
41	Nagma Mehalsera	Tilagufa NP	Phoimahdev
42	Tusharemuhan	Khadachkra NP	Manma
43	Gatrugad	Tilagufa NP	Ranchuli
44	Nagma Mehelsera	Tilagufa NP	Phoimahdev
45	Sukatiya Aandherigad	SubhaKalika GP	Sukatiya
46	Gutrugad	Tilagufa NP	Ranchuli
47	Nayakhet	Mahabai GP	Odanaku
48	Kalekhola Ghamtapna	SubhaKalika GP	Sukatiya
49	Tusharemuhan Bahu Udeyasia	Khadachkra NP	Manma
50	Jamadar Danda Odar	SubhaKalika GP	Sukatiya
51	Pewarukh Chauthaikot	Mahabai GP	Gela
52	Aadherigad Samalgaukot Jiula	SubhaKalika GP	Kalika
53	Bherikhola Nainaldanda	SubhaKalika GP	Bharta
54	Saktekulo Chadargauda	Khadachkra NP	Pakha
55	Fayalkulo	Khadachkra NP	Daha
56	Jiuri Kulo	Khadachkra NP	Pakha
57	Chauki Lek	Khadachkra NP	Pakha
58	Sainekhola Bharata	SubhaKalika GP	Kalika
59	Kulibandh	SubhaKalika GP	Bharta
60	Sheri	Mahabai GP	Gela
61	Jor Jyula	SubhaKalika GP	Kalika
62	Takulla	Tilagufa NP	Chhapre
63	Garaimadu	Mahabai GP	Odanaku
64	Katgau Aarurukh	Tilagufa NP	Chhapre
65	Chautha Dekhi Piterimadu	Tilagufa NP	Chilkhaya
66	Thamkhet	Tilagufa NP	Chilkhaya
67	Lodkulo	Tilagufa NP	Ranchuli
68	Kuni	Mahabai GP	Gela

SN	Name	GP/NP	Location
69	Bhigma	Tilagufa NP	Phoimahdev
70	Jhyagad	Mahabai GP	Odanaku
71	Majhkulo	Khadachkra NP	Pakha
72	Dikekanda	SubhaKalika GP	Kalika
73	Chadakhan	Tilagufa NP	Chilkhaya
74	Khallagad	Tilagufa NP	Jubitha
75	Banchukhola	Tilagufa NP	Chilkhaya
76	Shanker	Tilagufa NP	Phoimahdev
77	Ridkedanda	SubhaKalika GP	Kalika
78	Bhiratkhola Bayale	Khadachkra NP	Pakha
79	Lamji	Mahabai GP	Gela
80	Latti Bhatadi Khola	Tilagufa NP	Ranchuli
81	Baidhunga Irrigation System	Tilagufa NP	Jubitha
82	Pariban Irrigation Kulo	Tila GP	Ghodemahdev
83	Bhitkhola	Tila GP	Ghodemahdev

Annex 14: Forest user groups

Table 30: List of CFUGs in the Tila Karnali watershed, including area coverage ad households

SN	District	GP/NP	Name	Area (ha)	Households	Area (km^2)
1	Kalikot	Tilagufa	Devi Mandu	29.78	107	0.30
2	Kalikot	Tilagufa	Gade Dhunga	16.88	79	0.17
3	Kalikot	Tilagufa	Mahabai Patal	134	93	1.34
4	Kalikot	Tilagufa	Mahavai Vitta Ban	190	68	1.90
5	Kalikot	Tilagufa	Devi Kandh	100	91	1.00
6	Kalikot	Tilagufa	Kalapatal	87.5	231	0.88
7	Kalikot	Tilagufa	Dudhesheela	77.44	231	0.77
8	Kalikot	Tilagufa	Lali Danphe	91.84	110	0.92
9	Kalikot	Tilagufa	Pugmalika	29	86	0.29
10	Kalikot	Tilagufa	Kalika	121.78	101	1.22
11	Kalikot	Tilagufa	Kalasa	161.35	138	1.61
12	Kalikot	Tilagufa	Kalika Mahadev	161.88	190	1.62
13	Kalikot	Khadachakra	Ghunghane Odar	40.24	160	0.40
14	Kalikot	Khadachakra	Chalne Chutada	51.52	262	0.52
15	Kalikot	Khadachakra	Kaulekhola Mota Kandh	35.2	115	0.35
16	Kalikot	Khadachakra	Panchadeval	75.25	160	0.75
17	Kalikot	Khadachakra	Kalika	17	31	0.17
18	Kalikot	Khadachakra	Kalika Mahabai	126	209	1.26
19	Kalikot	Khadachakra	Navadurga	86.75	122	0.87
20	Kalikot	Khadachakra	Mahabai	116.25	182	1.16
21	Kalikot	Khadachakra	Jaganatha	75.22	240	0.75
22	Kalikot	Khadachakra	Bhuyonigatha	436	422	4.36
23	Kalikot	Tilagufa	Kalika	17	31	0.17
24	Kalikot	Tilagufa	Mahadev	212	32	2.12
25	Kalikot	Tilagufa	Kalika	319	225	3.19
26	Kalikot	Tilagufa	Mastadev	110.68	96	1.11
27	Kalikot	Tilagufa	Shivalaya	162	99	1.62
28	Kalikot	Tilagufa	Mahadev	24.16	120	0.24
29	Kalikot	Tilagufa	Phurke Sallo	64	79	0.64
30	Kalikot	Tilagufa	Bishow Baba	105	76	1.05
31	Kalikot	Tilagufa	Malika	62	133	0.62
32	Kalikot	Mahabai	Mahabai Jaganath	191.05	144	1.91
33	Kalikot	Mahabai	Jilli Tribeni	58.02	40	0.58
34	Kalikot	Mahabai	Mahadev Mahabai Jaganath	48	144	0.48
35	Kalikot	Mahabai	Malu	17		0.17
36	Kalikot	Mahabai	Mahabai Patal	55.54	139	0.56

SN	District	GP/NP	Name	Area (ha)	Households	Area (km^2)
37	Kalikot	Mahabai	Kailash	151	93	1.51
38	Kalikot	Mahabai	Jalpadevi	54.72	100	0.55
39	Kalikot	Mahabai	Mahadev	11.36	142	0.11
40	Kalikot	Mahabai	Simkhet	16.6	27	0.17
41	Kalikot	Mahabai	Him Kalika	71.04	85	0.71
42	Kalikot	Mahabai	Gauri Kath	182	188	1.82
43	Kalikot	Mahabai	Thikot Shreekot	119.27	234	1.19
44	Kalikot	Mahabai	Nakumahabai Patal	66.41	111	0.66
45	Kalikot	Mahabai	Godrikhola	20.3	57	0.20
46	Kalikot	Khadachakra	Dudhesila	226.17	288	2.26
47	Kalikot	Khadachakra	Jankalyan	161.2	233	1.61
48	Kalikot	Khadachakra	Khare Patan	11.68	35	0.12
49	Kalikot	Khadachakra	Pani Dhara	56.25	52	0.56
50	Kalikot	Khadachakra	Jan Sanrakshan	33	69	0.33
51	Kalikot	Khadachakra	Bhayani	105	91	1.05
52	Kalikot	Khadachakra	Auladada	144.64		1.45
53	Kalikot	Khadachakra	Kalasa	148.83	165	1.49
54	Kalikot	Khadachakra	Palt Mahadevi	154	247	1.54
55	Kalikot	Khadachakra	Nainel Devi	160	103	1.60
56	Kalikot	Khadachakra	Sal Mela Kalapahad	48.18	112	0.48
57	Kalikot	Khadachakra	Masthamadu	140.2	161	1.40
58	Kalikot	Khadachakra	Nainalmadu	31.25	90	0.31
59	Kalikot	Khadachakra	Pancha Dev	123	204	1.23
60	Kalikot	Khadachakra	Puja Malika Jadibuti	72	44	0.72
61	Kalikot	Khadachakra	Mustadev Women	11.6	42	0.12
62	Kalikot	Khadachakra	Kot Darbar	32	95	0.32
63	Kalikot	Khadachakra	Tikhe Dhunga	35.54	110	0.36
64	Kalikot	Khadachakra	Jaljale Biryagada	15.06	71	0.15
65	Kalikot	Khadachakra	Chulimalika	97	310	0.97
66	Kalikot	Subhakalika	Kalika Chimate Patal	118	214	1.18
67	Kalikot	Subhakalika	Salghari	50	99	0.50
68	Kalikot	Subhakalika	Nainel Deb	23.36	112	0.23
69	Kalikot	Subhakalika	Danda Khola	179.2	130	1.79
70	Kalikot	Subhakalika	Tila	8.75	153	0.09
71	Kalikot	Subhakalika	Buki Malika	195	92	1.95
72	Kalikot	Subhakalika	Gaurachor Thado patal	70.76	95	0.71
73	Kalikot	Subhakalika	Kalika	109	158	1.09
74	Kalikot	Subhakalika	Mehele Thuni Gairapokhara	154.59	94	1.55
75	Kalikot	Subhakalika	Bauredhunga	34.72	55	0.35
76	Kalikot	Subhakalika	Ajammare Bhagyoti	151.75	118	1.52

SN	District	GP/NP	Name	Area (ha)	Households	Area (km^2)
77	Kalikot	Subhakalika	Kotdeutibajai	23.53	86	0.24
78	Kalikot	Subhakalika	Dada Patal	83.44	167	0.83
79	Kalikot	Subhakalika	Rew Patal	17.12	98	0.17
80	Kalikot	Mahabai	Chisapani	80	162	0.80
81	Kalikot	Subhakalika	Kuldev Raniban	130	117	1.30
82	Kalikot	Subhakalika	Mahadev Patal	41.84	159	0.42
83	Kalikot	Subhakalika	Bamnidir	41.76	103	0.42
84	Kalikot	Subhakalika	Dewrali	7.25	22	0.07
85	Kalikot	Subhakalika	Bohorapatal	2.44	31	0.02
86	Kalikot	Subhakalika	Dahal	67	64	0.67
87	Kalikot	Subhakalika	Masta Dev	75	62	0.75
88	Kalikot	Subhakalika	Jev Jaini	64	61	0.64
89	Kalikot	Subhakalika	Pragati	41	95	0.41
90	Kalikot	Subhakalika	Kalika	9.79	48	0.10
91	Kalikot	Subhakalika	Ghattekhet	29.67	24	0.30
92	Kalikot	Subhakalika	Bhabani Women	30.47	95	0.30
93	Kalikot	Subhakalika	Mahadev	38.49	45	0.38
94	Jumla	Tila	Kumedi Majh	148	82	1.48
95	Jumla	Tila	Sudi Patal	92.8	110	0.93
96	Jumla	Tila	Kalapatal	106.4	81	1.06
97	Jumla	Tila	Kalika	103.8	54	1.04
			Total	**8,534.6**	**11,527**	**85.35**

Table 31: Leasehold forests user groups in the Tila Karnali watershed

SN	District	GP/NP	Name	Area (ha)	Area (km^2)
1	Kalikot	Subhakalika	Tila Karnali	1.43	0.01
2	Kalikot	Subhakalika	Koiralpani	3.28	0.03
3	Kalikot	Tilagufa	Ratimata	2	0.02
4	Kalikot	Khadachakra	Kuldev	6.32	0.06
5	Kalikot	Khadachakra	Mahadev	5.25	0.05
6	Kalikot	Mahabai	Nawasirjana	3	0.03
7	Kalikot	Khadachakra	Tila Karnali Bhulu	6	0.06
8	Kalikot	Subhakalika	Dahal	5	0.05
9	Kalikot	Subhakalika	Nawajyoti	3	0.03
10	Jumla	Tila GP	Motyojhula	21.25	0.21

SN	District	GP/NP	Name	Area (ha)	Area (km^2)
11	Jumla	Tila GP	Titemela	21.5	0.22
12	Jumla	Tila GP	Bhadkholi	15	0.15
13	Jumla	Tila GP	Ubobadadun	15.5	0.16
14	Jumla	Tila GP	Uboban	17	0.17
15	Jumla	Tila GP	Darina	25	0.25
16	Jumla	Tila GP	Tilchaur	25	0.25
Total				**561.12**	**5.61**

Annex 15: Key stakeholders

Table 32: Key stakeholders in the Tila Karnali watershed and relevant contact information

SN	Organization	Contact Person	Position	Phone
1	DWO/Kalikot	Dan Bahadur B.K	Chair	9848306556
2	VDSEF /VC/Kalikot	Rajendra Kumar Shahi	Vice Chair	9848301587
3	NNDSWO/Kalikot	Gorakh Nepali	District Officer	9848119027
4	HURENDEC/Kalikot	Dilip Kumar Shahi	Treasurer	9848394918
5	Agricuture Knowledge Centre (AKC)	Tek Bahadur Khatri		9848317664
6	Nepal Red Cross Society, Kalikot	Bal Pd. Sanjyal	President	9758900139
7	KIRDARC/Kalikot	Suman Kumar Bam	Supervisor	9868302414
8	District Cordination Centre	Netra Raj Shahi	Member	9858320022
9	SAHAS Nepal, Kalikot	Gorkha Bahadur Khadka	Member	9858071002
10	S.C. Hydropower	Darba Bahadur Shahi	Sub-Engineer	9848301626
11	Division Forest Office, Kalikot	Ram Chandra Kandel	DFO	9851034390
12	Malika FM	Pushparaj Bhattarai	News Chief	9868258657
13	Nepali Aawaj FM	Rukum Kumar Yogi	Station Manager	9864706945
14	Feminist Dalit Organization (FEDO), Kalikot	Haja Sunar	Chair	9848301187
15	Khadchkra NP, Ward-4	Dhansingh B.K	Chair	9848305743
16	Khadchkra NP, Ward-2	Birkha Singh B.K	Chair	9848306617
18	Mahabai GP	Nanda Bahadur Singh	Chair	9886302367
19	Tilagufa NP	Danta Nepali	Vice mayor	9843027330
20	Dalit NGO Federation (DNF) Kalikot	Raj Kumar Pariyar	Member	9848375360
21	Shubha Kalika GP	Pampha Kumari Shahi	Vice-chair	9748019465
22	Federation of Nepal Chamber of Commerce and Industry	Tila Bahadur Shahi	General secretary	9848329693
23	Civil Society	Lila Neupane	Chair	9858320036
24	Federation of Nepal Jouranalist Jumla	DB Budha	Secretary	9868398500
25	FECOFUN	Kala Bahadur Malla	Chair	9868305054
26	FEDWASUN	Chitrasingh Gaule	Chair	9858321144
27	Small and Cottage Industry Development Office	Bishnu Prasad Regmi	Cottage and Industry Development Officer	087-440010
28	Tila Hydropower Limited	Darba Bahadur Shahi	Sub-engineer	9848301626
29	HCRDC	Kul Prasad Pandey	Treasurer	9848301560
30	Nepal Red Cross Society	Dharma Bahadur Shahi	Vice-President	9858320372

SN	Organization	Contact Person	Position	Phone
31	District Adminstration Office (DAO)	Raj Kumar Dulal	Assistant District Administration Officer	9851254554
32	Mahawai GP	Mana Raj Shahi	Vice-chair	9848381055
33	Khadchkra NP	Pushparaj Giri	Ward chair	9848307074
34	Tila Rural Municipality, Jumla	Bishnu Maya Budha	Vice-chair	9758901286
35	Suva Kalika GP	Pampha Kumari Shahi	Vice-chair rson	9748019465
36	Khadhakra NP	Bijaya Bista	Vice-chair	9848301522
37	Federation of Non-government Organization	Birendra Bahadur Budha	Chair	9848314376
38	Federation of Nepal Journalist Association, Kalikot	Tularam Pandey	Chair	9848301462

Annex 16: Vision building framework