MIDDLE KARNALI WATERSHED HEALTH REPORT

Community Vision - "Integrated watershed management with sustainable social, economic and environmental prosperity supported by appropriate policies and effective implementation that leads to conservation of aquatic biodiversity and multiple uses of water."

USAID
FROM THE AMERICAN PEOPLE

USAID PAANI PROGRAM
युएसएड पानी परियोजना

What is a watershed?

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

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

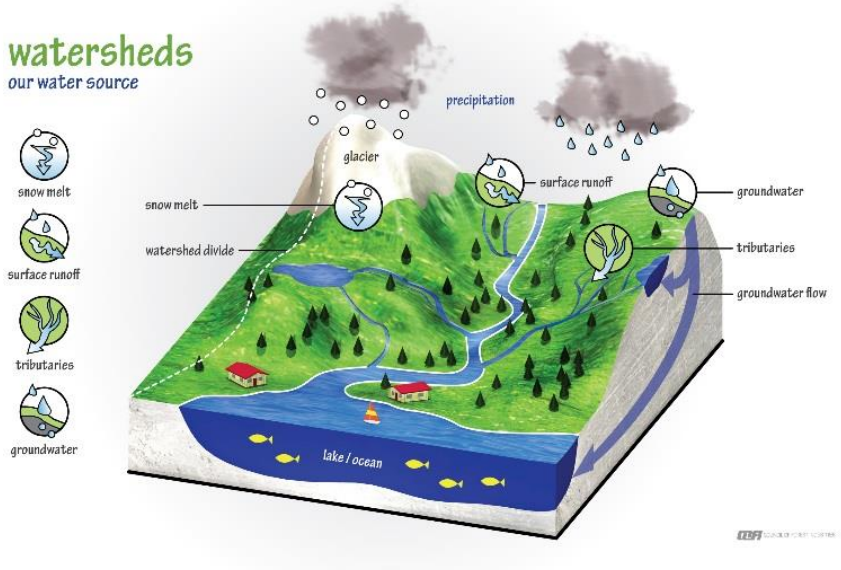

Figure 1: Diagram of a typical watershed

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

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

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

River Basin	Karnali
Provinces	Numbers 6 and 7
Total watershed area	903.66 $km^{2,}$
Number of streams	160
Major rivers	Gunat Khola, Barale Khola, Belkhet Khola, Chinne Khola, Ramghat Khola, Khidkijyula Khola, Rakam Karnali, Dogade Khola, Paduka Khola, Ghatte Khola, Pulletala Khola, Lodegaad
Lakes and wetlands	None
Landcover	Forest, 52%; agriculture, 30%; grazing land, 13%; rivers and streams, 3%; scrub land, 1%; and other, 1%.
Municipalities	Aathbish, Chamunda Bindrasaini, Dullu, Kamalbazar and Panchadeval Binayak
Rural Municipalities	Thantikandh, Bhairabi, Naraharinath and Turmakhad
Population	171,856 (49% male; 51% female) (CBS, 2015)
Ethnic Groups	Brahmin/Chhetri/Thakuri 59%; Janajati 10% (Tharu, 71%); Dalit 30% (57% Kami), Others 1%

The Middle Karnali watershed (Figure 2) stretches across the Achham, Kalikot, and Dailekh districts in mid- and far-western Nepal. The Kalikot portion lies to the north, the Achham part in the west, and Dailekh to the east and south. The vast majority of the watershed is characterized as mid- and high hills. In Nepal's federal system, this watershed lies within provinces 6 (Kalikot and Dailekh) and 7 (Achham).

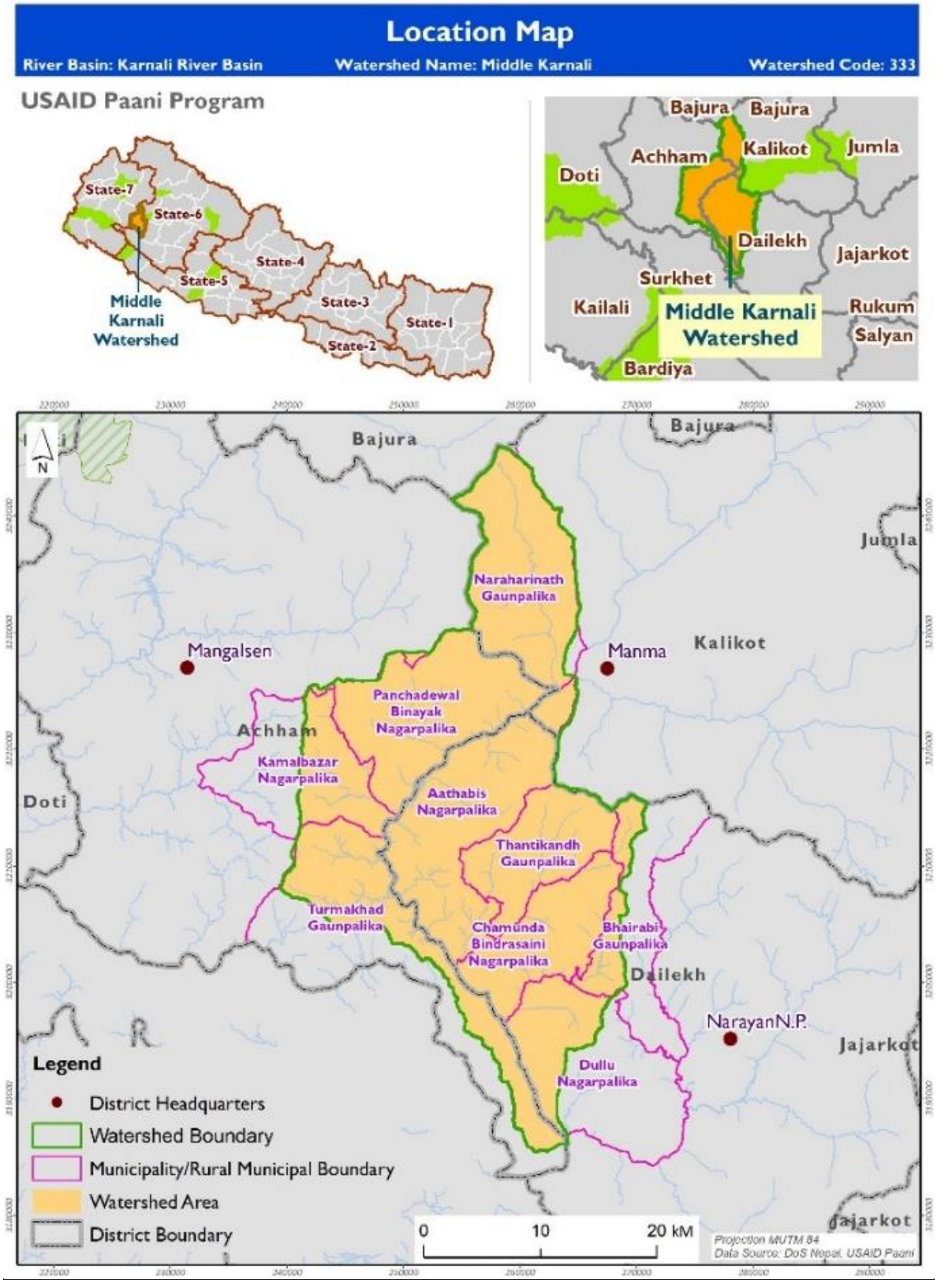

Figure 2. Map of the Middle Karnali watershed

The Karnali River originates at 3,962 m (12,999) on the southern slopes of the Himalaya, running down from Tibet to the Middle Karnali watershed. The total population of the watershed is estimated at 171,856 (CBS 2015). A majority of the population relies on agriculture and wage labor for livelihoods. Major ethnic groups include Brahmin, Chhetri, Thakuri, Dalits, and an assortment of Janajati people (indigenous). A major hydroelectric project (Upper Karnali, 900 MW) has been planned for the middle of the watershed.

Nature

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

Water

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

Rainfall

Long-term rainfall data in the Middle Karnali watershed was obtained from rainfall stations at Asaraghat (206) and Balebudha (410), which lie in the lower part of the watershed. In the hilly region in the north, topographic variation has a profound impact on the spatial distribution of rainfall. While no stations are located in the northern stretches of the watershed, data from Dailekh (402), Serighat (305), Raskot (309), and Mangalsen (217) was used to estimate rainfall average for this area.

The average annual dry season rain fall (Nov – Apr) is 34 mm, while the average annual wet season rainfall comes to 237 mm. The average annual recorded rainfall is 1,293 mm.

Water availability and accessibility

The Karnali River is fed by rain, glaciers, and snow melt, and its tributaries (Figure 3) are the main source of water for domestic, agricultural, and industrial uses. Household survey results showed that piped water, surface water, springs, stone taps, wells, and waterfalls are used for community drinking. In spite of this array of water sources, 97% of households reported difficulty in obtaining enough water for their daily needs.

More than 90% of households use surface water for their daily needs, while 52% also draw from piped water systems. Forty-nine percent of households reported needing more than 30 minutes per day to collect daily water, while 30% said they needed between 15 and 30 minutes per day.

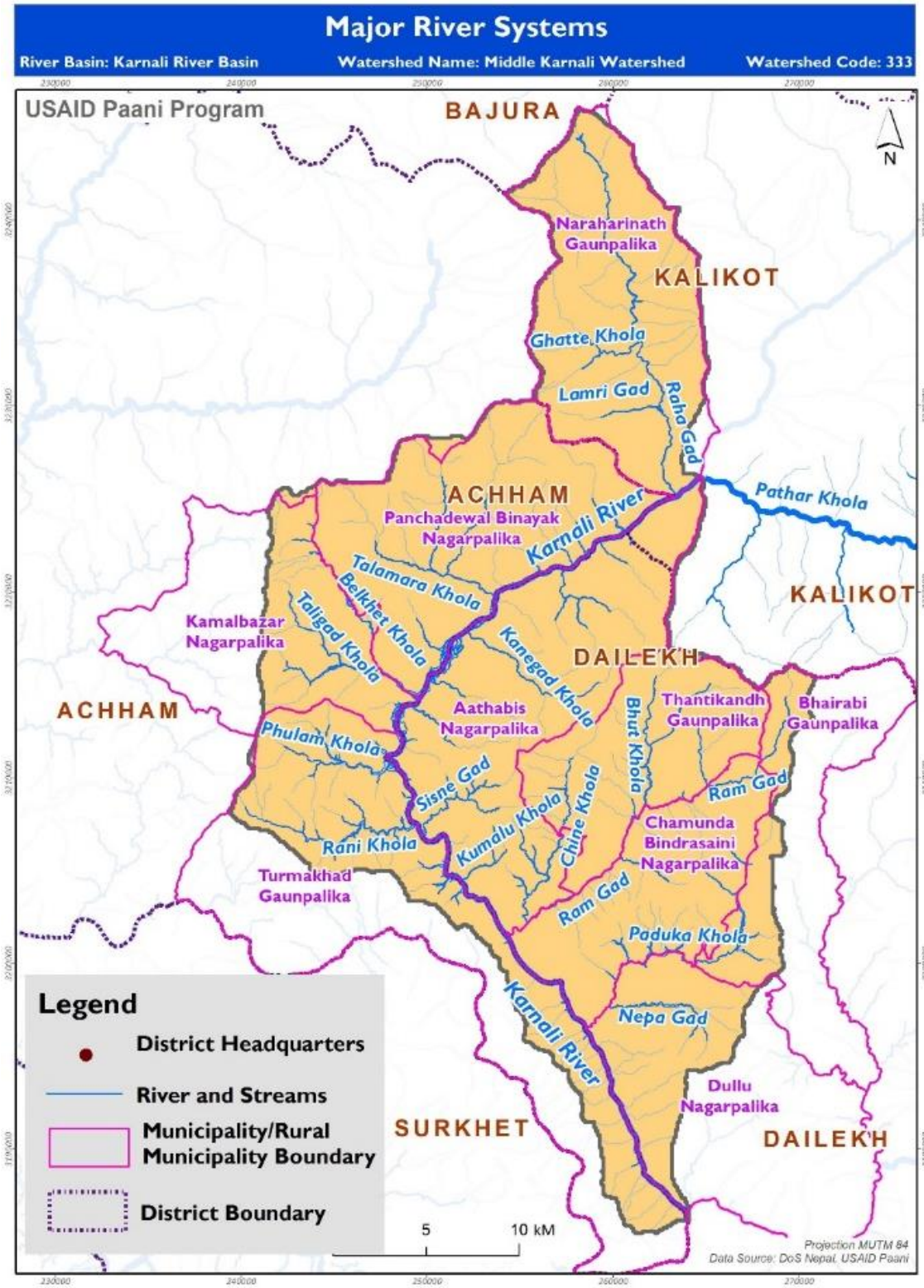

Figure 3: River and stream networks in the Middle Karnali watershed

50%
Households within <30 minutes to bring water sources

97%
Households experience difficulty obtaining water due to drying water sources.

Water accessibility refers to 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. Twenty-two percent of respondents said they did not have equal access to water. Of that 22%, 82% cited water scarcity as a primary obstacle, while 24% reported long distances to water, and 16% noted cultural barriers (e.g., certain water sources reserved for particular castes).

River and lake water quality

Water quality monitoring was conducted at 14 sites in the Middle Karnali watershed (Figure 4). Water samples were collected and tested for pH, iron, nitrite-nitrogen, ammonium, phosphate, and temperature. Generally, water quality within the watershed fell within accepted ranges for drinking, agriculture, irrigation, and aquatic life. Ammonium levels were slightly elevated in a few sites, while phosphate levels were found to be higher than average in a majority of sites.

Eleven percent of residents reported the quality of their drinking water as poor, and 42% said they were unaware of the quality of the local drinking water.

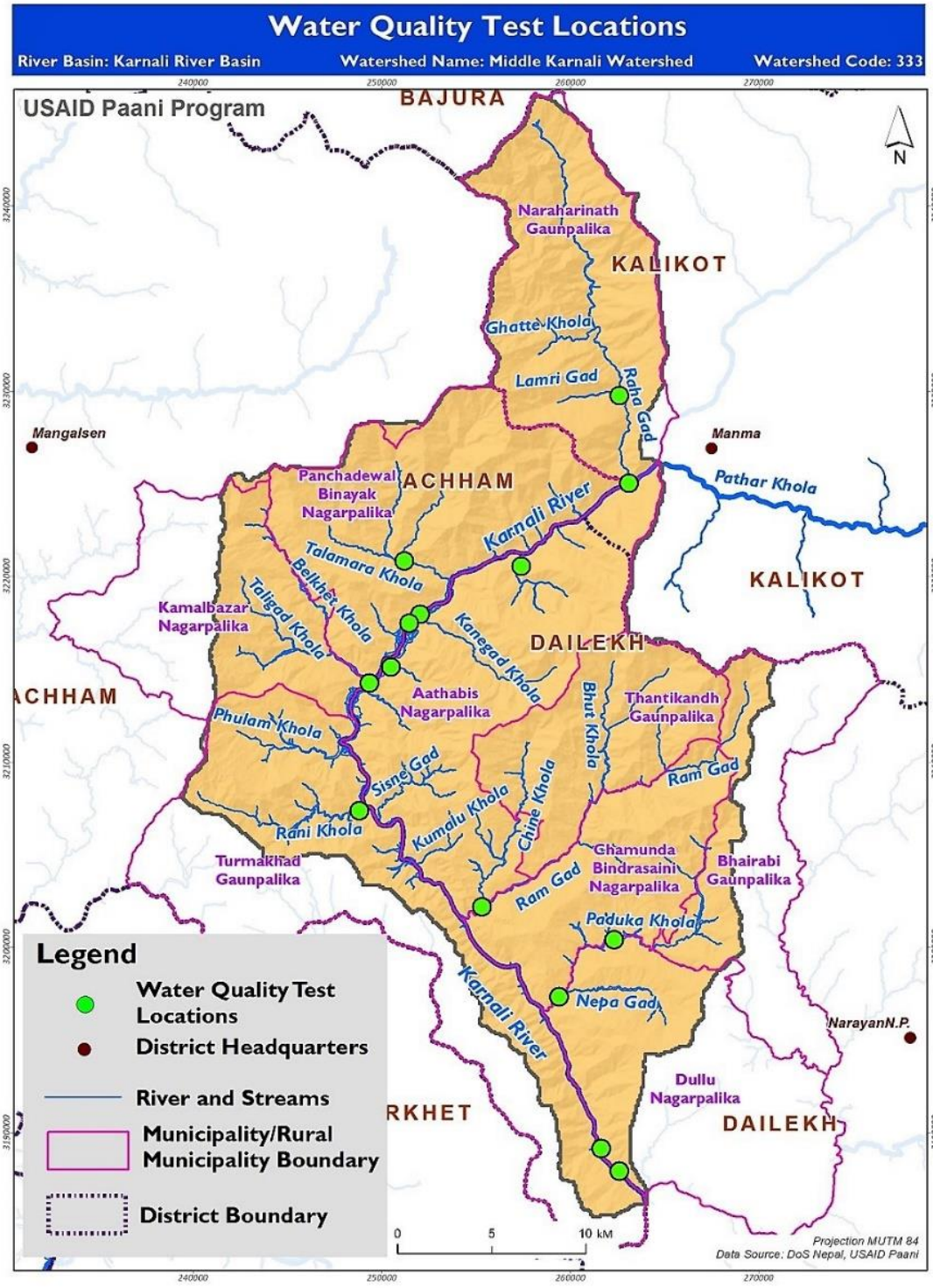

Figure 4: Water quality survey points in the Middle Karnali watershed

Biodiversity & habitat

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

Land use and land cover

Most of the land in the Middle Karnali watershed is either forest (52%) or cultivated for agriculture (30%). Three percent of the area is covered by rivers, streams and other water bodies. Except for the Karnali River, many of the tributaries dry up during the winter season, which make them unsuitable for fish and other aquatic life. The remaining area consists of grazing land – grass, shrub and bushes in patches, and may have few trees scattered throughout (13%).

The watershed maintains a rich aquatic and terrestrial biodiversity from 540 m in the southern area to 3,000 m in the north. Because of the steep gradients in this watershed, tributaries from the hills have a fast water flow, which makes fish migration difficult in this area. The watershed maintains a rich aquatic and terrestrial biodiversity from 540 m in the southern area to 3,000 m in the north.

The forests of the watershed are primarily Sal forest at lower elevations and mixed with Chir pine at higher elevations. Other common tree species include Alder, Rhododendron, Quercus, Kharsyu, and Katu.

The significant forestation in the watershed provides ample control over soil erosion, however, land satellite data from Global Forest Watch between 2000 and 2016 shows the watershed has lost 353 hectares of forest over that time, while gaining 110 hectares in other parts (Figure 5).

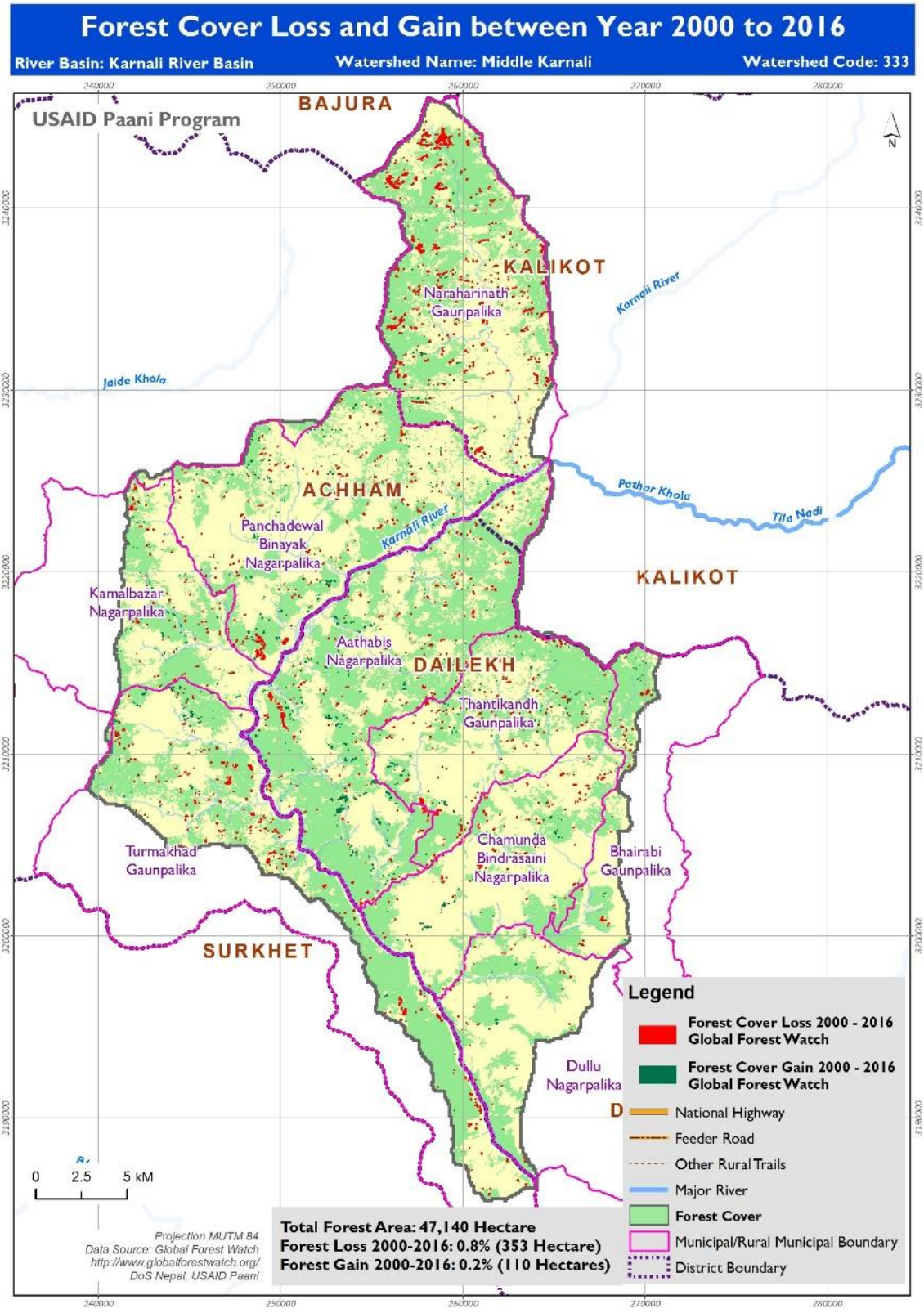

Figure 5: Forest cover loss and gain in the Middle Karnali watershed, 2000-2016

Fish diversity

The Middle Karnali is an especially important location for cold water fish because the lower current and large number of tributaries flowing at low gradients is suitable for breeding these species. An EIA report prepared by NESS reported 46 species of fish in the Middle Karnali watershed/Upper Karnali Hydro Power, including large numbers of species such as Sahar, Asala, Rajbam, Jalkapoor, Goz, and Katle (NESS 2012). However, indigenous fish stocks have been declining due to overfishing and harmful fishing practices, including poison, gill nets, dynamite, and electric current. Hydropower development in the area also threatens fish species as well as aquatic flora in the watershed.

Figure 6: Aquatic biodiversity hotspots in the Middle Karnali watershed

Wealth

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

Agriculture is the primary source of income (70%), followed by livestock rearing (12%). Service-based occupations (4%), remittance (3.5%) and wage employment (3%) are also significant sources of livelihood in the watershed. The remaining 8% of income sources are scattered among fishing, poultry framing and dairy farming.

Infrastructure and extractives

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

Capture fishery practices

In the Middle Karnali watershed, both traditional and non-traditional fishing groups rely on aquatic life to support their livelihoods. Seven traditional fishing communities live in the area, including the Majhi, Badi, Kumal, Tharu, Rajbhar, Nuniya, and Sunar. Together, they comprise nearly 1,600 fishers in the watershed.

Fish farming ponds are becoming increasingly common in the watershed. In Rakam, 32 fish ponds now operate, cultivating Mangur fish primarily.

The Karnali highway provides important markets for selling fish, and the growth of this market has inspired more and more households to fish as a means to diversify their income sources. However, as mentioned above, the growing interest in fish harvesting has also driven a rise in destructive fishing practices. Forty-eight percent of households reported that fish stocks had declined in recent years.

Irrigation and sustainable agriculture

Eighty-four percent of households rely on agriculture as the main source of income. Within the watershed, numerous crops can grow, including staples (e.g., rice, wheat, millet, lentils) and specialty crops (e.g., sugar cane, potatoes, chili, onions, and garlic). A network of small-scale irrigation canals supports farming in the area.

Almost all the households (99%) reported that soil productivity has decreased in recent years.

Gravel mining

Gravel mining has great potential for revenue generation in the watershed (particularly in Tallo Dungeswor and Rakam Karnali) due to the high quantities of sand, gravel and boulders in the area that can be used for infrastructure development projects.

Concerns about over extraction and exploitation have already been voiced as many households fear aggressive mining will negatively impact aquatic life and degrade ecosystem services from the river.

Hydropower

When completed, the Upper Karnali Hydroelectric Project will stand 64 meters tall and 207 meters long, displacing numerous families and impacting thousands of hectares of forest and riverine habitat. By diverting water flow in the Karnali river, fish migration will be affected as well. Many respondents in the household survey complained that information about the project and its potential effects on the watershed was not freely available nor disseminated.

There are numerous micro-hydropower plants also operating and/or planned inside the watershed, including projects at Baralagadh, Moriyali Khola, Kuika Khola, and Malkot.

Roads

Road construction in the watershed has been continuous since 1990, as since that time significant portions of VDC budgets have been dedicated to these projects. However, many of these roads were ultimately poorly constructed and the excavated material was disposed along roadsides without supervision. Approximately 220 km of road have been built in rural areas of the watershed with another 116 km currently planned and/or under construction.

Road construction is considered the primary driver of human-induced sedimentation and the loss of top soil through surface erosion and landslides.

Irrigation

In Middle Karnali, households draw from a variety of sources for irrigation, including rivers (17%), lakes and ponds (32%), springs (13%), ponds (18%), collection tanks (2%) and rainwater harvesting (75%).[1]

Of the households surveyed, only 6% said they could obtain sufficient water to irrigate their land throughout the year. Ten percent of households own no agricultural land.

Climate resilience and disaster risk reduction

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

[1] These numbers add up to more than 100% because many families use multiple sources to provide water for irrigation.

Based on focus group discussions and secondary data, the Middle Karnali watershed was assessed for disaster risks. Twenty VDCs (49%) were rated as highly vulnerable, while 16 VDCs were rated medium risk, and the remaining 5 VDCs as low risk.

Local bodies at the watershed level have developed Local Adaptation Plans of Action (LAPAs) and Water Use Master Plans (WUMPs), which seek to provide blueprints for anticipating, mitigating and responding to natural hazards and climate change impacts. Currently, there are 20 LAPAs and 23 WUMPs operational in the watershed. Fifteen VDCs have both a LAPA and WUMP. No VDCs reported having formed a Community Adaptation Plan of Action (CAPAs).

Some watershed residents were observed adopting climate resilient practices, such as planting different types of fruit trees in areas where temperature has risen.

Early warning systems

There are no operational early warning systems in the Middle Karnali watershed.

Power

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

Local institutions and inclusiveness

Local government offices for Achham are located in Panchadewal Binayak, Kamalbazar and Turmakhand. In Dailekh, local government offices are located in Aathabis, Chamunda Bindrasaini, Dullu, Bhairabi, and Thantikandh. In Kalikot, the local government office is Naraharinath.

In addition to the sites of local district governance, there are many community-based organizations, federations and line agencies in the watershed responsible for various aspects of management. These groups include community forest user groups (CFUG), District Drinking Water Supply (DDWS), the Department of Irrigation, and the District Coordination Committee, among others. The District Soil Conservation Office, District Forest Office, and District Agriculture Development Office are also active in relevant watershed matters.

Currently, 186 CFUGs are active in the Middle Karnali, collectively managing 19,274 hectares of forest. Of the 1,786 individuals belong to CFUGs in the region, 623 are women. Community forestry has contributed significantly to restoring forest resources, which has generated cascading positive effects on water resources and soil conservation.

While CFUG work has been impressive, we find that general participation in community groups is low: only 22% of residents claim membership in a natural resource management (NRM) organizations. Looking at this number by caste and ethnicity, only 13% of Janajatis, 17% of Dalits, and 25% of Brahmin/Chettri/Thakuri belong to NRM groups. Women and persons from marginalized castes are underrepresented in leadership positions, as only 23% of key positions were occupied by members from these groups.

Awareness about government planning in the watershed is low: only 20% claimed knowledge of local level planning processes, such as Local Adaptation Plan of Action (LAPA) and Community Adaptation Plans of Action (CAPA).

Policies, frameworks and regulations

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

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

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

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

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

Watershed health assessment – Summary

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

We are concerned with initial assessment *and* on-going monitoring. We use the following rating system.

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

Based on the designated indicators for assessment, we rate the health status of the Middle Karnali watershed as ***fair*** (Table 1)**.** High difficulty obtaining water and low levels of drinking and irrigation infrastructure are current threats to the future sustainability of the watershed. Declining soil fertility and unregulated rural road construction also pose significant challenges in the area. However, rising awareness of the need for LAPAs and CAPAs to improve watershed health and sustainability offer some hope for generating effective planning in the coming years.

Table 1: Summary of health indicators for the Middle Karnali watershed

Thematic area	Watershed health indicator	Rating	Rationale
WATER	Water availability		– 97% of households report difficultly obtaining sufficient water – Low levels of drinking water and irrigation infrastructure
	Water accessibility		– 49% percent of households report needing 30 or more minutes to collect daily water – 22% percent of households report unequal access to water
	Water quality		– Tested parameters fell within the normal range – 11% of respondents reported quality of drinking water as poor – Concerns about increasing use of agro chemicals in the watershed
	Household sanitation		– 27% percent of households do not properly manage solid household waste – 92% percent of households have a personal toilet
	Solid waste disposal		– Solid waste from urban areas and settlements are often discarded in streams, rivers and open space – 29% percent of respondents throw wastewater directly into the river
BIODIVERSITY & HABITAT	Quantity of fish		– Increasing demand for fish in the market place has inspired rise in use of destructive fishing practices – 48% percent of respondents say native fish populations have declined
	Fishing practices		– Poison, gill nets, and electric current are used for fishing – Fewer than 1% of households report fishing as their primary livelihood option

Thematic area	Watershed health indicator	Rating	Rationale
	Invasive species		– Households report that catfish have migrated from private fish farms into fresh water rivers
	Species diversity		– Use of destructive fishing practices is threatening species diversity – 46 types of fish reported in the watershed
	Land use and land cover		– Majority of watershed is forest cover (52%), followed by agriculture (30%) and grazing land (13%) – Net forest density has decreased due to forest fires and changes in land use
SUSTAINABLE INFRASTRUC-TURE & MINING	Sustainability of hydropower		– Large hydropower project under construction on the Karnali River – Several micro-hydropower plants operate primarily in the wet season
	Sustainability of gravel mining		– Gravel mining is limited at the moment but concerns voiced about the need to regulate as infrastructure projects increase
	Sustainability of rural roads		– Most rural roads have been constructed without supervision, leading to poor roads with high negative environmental impact: siltation and landslides
	Sustainability of irrigation		– 94% percent of households with irrigation report the water flow is only seasonal, due to drying water sources and low dry season flow – Irrigation user groups function poorly – Poor maintenance of existing irrigation canals
CLIMATE RESILIENCE AND DISASTER	Areas vulnerable to landslides, floods and landslides		– Haphazard rural road construction and high levels of open grazing accelerate landslides and contribute to forest degradation

Thematic area	Watershed health indicator	Rating	Rationale
RISK REDUCTION 	Use of climate resilience adaptation practices		– Some evidence of climate smart technologies in use in the watershed, such as rain water harvesting and recharge ponds – 20 LAPAs and 23 WUMPs are operational in the watershed – No CAPAs have been developed
	Households with access to early warning systems		– No early warning system available in the watershed
GOVERNANCE AND EQUALITY 	Household member engagement/participation in local planning processes		– Low general participation of residents in NRM groups – Only 20% of respondents were aware of local planning processes such as LAPA and CAPA
	Community members are active in NRM groups [Biodiversity, disaster, climate change, water, agriculture, forest, irrigation, farmers]		– Only 22% of respondents claimed affiliation with a local NRM groups – Only 15% of women respondents were affiliated with a CFUG – No women reported affiliation with a water user group
	Women, marginalized castes and ethnic groups hold key positions in NRM groups		– Few women and marginalized persons (23%) hold key positions in NRM groups
	People comply with laws and policy provisions and local norms and standards		– Low compliance with existing regulations regarding solid waste disposal and fishing practices, among others

Thematic area	Watershed health indicator	Rating	Rationale
	Government enforces laws and regulations		– Low enforcement of existing regulations regarding solid waste disposal and fishing practices, among others
	Conflicts over NRM [Water/benefit sharing, watershed issues, sand mining, irrigation, hydropower]; issues are resolved		– Lack of knowledge and some disputes about proposed Upper Karnali Hydroelectric Project – Reports of lack of transparency about benefit sharing and accountability in local NRM groups
	Good coordination between the, municipalities/rural municipalities, and provinces including government line agencies in the watershed		– Lack of role of clarity between local bodies and DCC Low coordination among municipalities for governance; awaiting formation of province-level government for establishing guidelines for collaboration – Coordination mechanism among municipalities and rural municipalities – including province level government yet to be formed; – Guideline for coordination collaboration not exist at this stage.
	Equitable access and benefit sharing arising from use of natural resources (ecosystems services and products)		– Only 6% of households said they received enough water to irrigate year-round – Only 22% of households reported having equal access to water – A majority of respondents complained of inequitable benefit sharing among natural resources

References

Central Bureau of Statistics, Nepal (CBS). *2015 Statistical Year Book Nepal*. Kathmandu: Government of Nepal. Accessed January 11, 2018. (http://cbs.gov.np/image/data/2017/Statistical%20Year%20Book%202015.pdf).

NESS (Nepal Environmental and Scientific Services). *Environmental Impact Assessment (EIA) Study of Upper Karnali Hydropower Project (UKHP) 900 MW*. NESS: Kathmandu, 2012.

Shrestha, T.K. *Introduction to Fish Culture.* Tribhuvan University: Kathmandu, 1990.