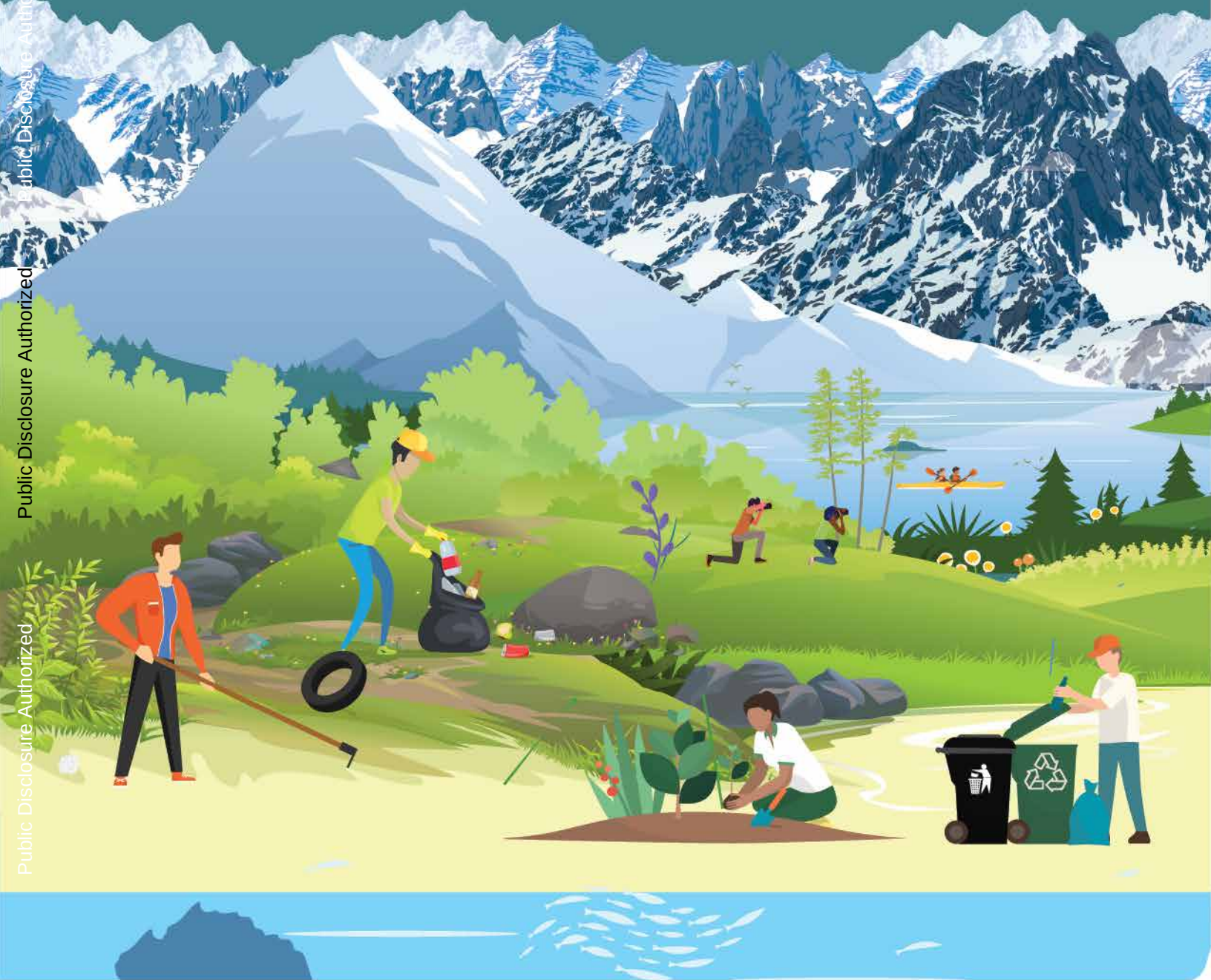


Pakistan: Sustainable Solid Waste Management in Mountain Areas



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Publications part of this study

India: Sustainable Solid Waste Management in Mountain Areas

Nepal: Sustainable Solid Waste Management in Mountain Areas

Pakistan: Sustainable Solid Waste Management in Mountain Areas

Technical Guidance Report: Sustainable Solid Waste Management in Mountain Areas of India, Nepal, and Pakistan

Good Practice Options for Sustainable Solid Waste Management in Mountain Areas of India, Nepal, and Pakistan

Pakistan: Sustainable Solid Waste Management in Mountain Areas

January, 2021

*Supporting the Development of Sustainable Solid Waste Management Strategies for the
Mountainous Regions of India, Nepal and Pakistan*

Pakistan: Sustainable Solid Waste Management in Mountain Areas
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SAR ENB



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Foreword

Waste management has become a major challenge all over the world, particularly in low- and middle-income countries. In this context, governments and communities are increasingly recognizing that, outside of large cities, waste management is also clearly a fast growing critical issue in environmentally-fragile areas. Mountains—a prime example of environmentally-fragile areas—face competing challenges of high poverty as well as, in specific locations, increasing impacts from tourism-related development. Geographical remoteness, limited access to civic infrastructure, lack of capacity, and topographical and temperature variations due to altitude differences complicate waste management. These mountain features make the provision of actions and services to address growing volumes of unmanaged waste even more challenging in mountain areas of India, Nepal, and Pakistan.

The impacts of growing volumes and evolving composition of unmanaged waste in mountain areas are increasing rapidly. Uncollected solid waste contributes to flooding, open burning leads to air pollution and causes respiratory ailments, and haphazardly dumped waste creates eyesores that may eventually have a negative impact on tourism. Poor waste management practices also affect areas downstream. Litter, in particular plastic, is carried in streams and rivers from mountains to the plains, and eventually to the oceans.

Addressing these challenges come with tremendous opportunities. Cleaner areas help provide a more attractive environment for tourism. Waste, if treated as a potential resource, can create jobs and new business opportunities for local entrepreneurs, in addition to being used as an energy source and fertilizer substitute. Adopting a landscape approach in management practices in mountain areas can increase coordination, awareness, and lead to behavior change around waste generation and segregation.

This study represents a first attempt to examine solid waste management in unique and ecologically-sensitive mountain areas. For this, I want to congratulate and thank the World Bank team behind this endeavor, especially the Country Management Units (CMUs) who led the team, as well as the clients and the stakeholders who contributed towards this study. The Korea Green Growth Trust Fund (KGGTF) deserves a special mention here.

The report is tailored to Pakistan, but the recommendations and related actions are designed to guide discussions and actions in other mountain areas in the region and elsewhere. Recommendations have been developed using an integrated waste management framework, and related implementable actions are presented in order to overcome solid waste management challenges faced in mountain areas. A phased approach has been suggested to allow for flexibility, as implementation may follow different time frames and recommendations may be adopted concurrently.

We hope this report will contribute to furthering dialogue that can lead to much-needed action, including improving analytics and tools, engaging with stakeholders, and contributing to policy and institutional development to support local development.

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Abbreviations

3 Rs	Reduce, Reuse, Recycle
ANP	Ayubia National Park
ASA	Advisory Services and Analytics
C&D	Construction and demolition
CBO	Community-based organization
CDD	Community Development Department
CDLD	Community-Driven Local Development
CSR	Corporate social responsibility
DDA	District development authority
ENB	Environment, Natural Resources, and Blue Economy
ENCORE	Enhancing Coastal Ocean Resource Efficiency
EPA	Environmental Protection Agency
EPR	Extended producer responsibility
GDA	Galiyat Development Authority
GDP	Gross Domestic Product
HHTIT	Hazara Hill Tract Improvement Trust
ICT	Islamabad Capital Territory
ILM	Integrated landscape management
ISWM	Integrated solid waste management
IUCN	International Union for Conservation of Nature and Natural Resources
K-eco	Korea Environment Corporation
kg	Kilograms
KGCTF	Korea Green Growth Trust Fund
KITE	Khyber Pakhtunkhwa Integrated Tourism and Enterprise Development
KP-EPA	Khyber Pakhtunkhwa Environmental Protection Act
KP-LGA	Khyber Pakhtunkhwa Local Government Act
LDPE	Low-density polyethylene
LG	Local government

LGA	Local government acts
LNG	Liquefied natural gas
MoCC	Ministry of Climate Change
MoE	Ministry of Environment
MSW	Municipal solid waste
NCS	National Conservation Strategy
NEAP	National Environmental Action Plan
NEP	National Environmental Policy
NEQS	National Environmental Quality Standards
NGO	Non-governmental organization
Pak-EPA	Pakistan Environmental Protection Agency
PBS	Pakistan Bureau of Statistics
PEPA	Pakistan Environmental Protection Act
PEPC	Pakistan Environment Protection Council
PEPO	Pakistan Environment Protection Ordinance
PET	Polyethylene terephthalate
PforR	Program-for-results
PLEASE	Plastic Free Rivers and Seas for South Asia
RDF	Refuse-derived fuel
SAR	South Asia Region
SAWI	South Asia Water Initiative
SHG	Self-help group
sq. km.	Square kilometer
SRF	Solid recovered fuel
SWM	Solid waste management
TMA	Tehsil municipal administration
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
WCS	World Conservation Strategy
WMC	Waste management company

Currency Units & Exchanges Rates

Currency Units	Exchange Rates (Effective as of December 27, 2020)	
Pakistan Rupee (PRs)	\$1 = PRs 160.31	PRs 1 = \$0.006
All dollar amounts are US dollars unless otherwise indicated.		



Executive Summary

Pakistan has a rich mountain landscape, boasting some of the highest peaks and longest glaciers in the world. The Karakoram, Hindu Kush, and Himalayas are all part of the country. Melting snow and meltwater from glaciers in the mountains also feed the country's rivers, including the Indus, which is a key resource for Pakistan's agricultural and industrial sectors, as well as for the country's potable water requirements. Therefore, the importance of mountainous regions to Pakistan's economic and environmental sustainability cannot be ignored.

Overview of Solid Waste Management in Pakistan

There are many challenges to the ecology and environment of Pakistan, one of them being the growing volume of solid waste due to increasing population, urbanization, and industrialization. In 2017, Pakistan generated approximately 30 million tonnes of municipal solid waste (MSW), equivalent to roughly 82,000 tonnes per day.

Tehsil municipal administrations (TMAs) are responsible for solid waste disposal, as well as sewage handling and treatment. However, TMAs are struggling to cope with increasing quantities of MSW in the face of inadequate funds, a lack of rules, regulations and standards, a dearth of technical know-how, and inadequate collection vehicles and equipment.

Solid Waste Management in Mountain Areas of Pakistan

The mountainous regions of Pakistan offer some of the most spectacular and fascinating landscapes and ecology in the world, attracting many domestic and foreign tourists; they, thereby, offer these regions an opportunity to develop their local economies. However, solid waste management (SWM) in these areas is even more challenging and sporadic compared to the plains. Tourism in these areas is placing increasing stress on the local environment, leading to increased pollution, natural habitat loss, and pressure on endangered species. These effects can gradually destroy the environmental resources on which tourism itself depends.

Reliable estimates on the quantity and characteristics of waste are not readily available in mountain areas, as these vary significantly depending on tourist influx, regional characteristics, and seasonal factors. Additionally, mountain areas present unique challenges such as sudden spikes in the quantity of waste generated during tourist season, widely varying waste characteristics including large volumes of plastic and other special wastes (for example, mountaineering equipment), and constraints of land availability for waste treatment and disposal.

While all settlements—whether mountainous or not—face SWM challenges, mountain areas tend to face additional ones. These challenges are by virtue of their location, characterized by remoteness, topography, scattered settlements, sensitive and fragile ecosystems, lack of infrastructure and road networks, and poor institutional and financial capacity. This makes service provision in mountain areas all the more demanding compared to the plains.

Ecologically-sensitive areas as well as mountainous regions face some similar challenges when it comes to SWM. Table ES.1 summarizes the challenges faced by all areas regardless of location, as well as the challenges unique to mountain areas and eco-sensitive areas. Moreover, not all mountain areas are the same, and vary by many localized factors, such as topography, climate, access, seasonality, waste volumes and types, and the impact of tourism. It is clear then that mountain areas require a suite of bespoke waste management solutions.

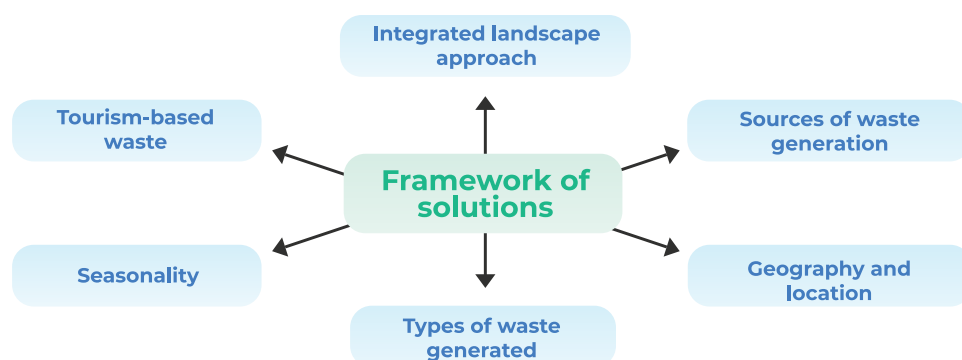
Table ES.1: Comparison of SWM challenges in mountain, non-mountain, and eco-sensitive areas

SWM in all Areas	SWM in Mountain Areas	SWM in Eco-Sensitive Areas
Poor awareness and adoption of SWM practices	Topography and geology (e.g., steepness, ruggedness, soil stability)	Remoteness of settlements
Lack of waste segregation	Remoteness of settlements	Distance to developed infrastructure make waste collection and transport challenging
Inadequate collection and storage facilities	Scattered and low-density areas generating low volumes of waste	Tend to attract tourists
Poor or obsolete transportation options	Diverse temperature and weather conditions	Depending on the area, tourists may visit all-year long
Lack of or poorly functioning treatment facilities	Sensitive environmental and ecological conditions	Sensitive environmental and ecological conditions
Improper waste disposal techniques	Vulnerability from seismic activity and landscape	Space constraints for waste treatment and disposal
Competing priorities for local governments	Lack of road networks making access difficult	
Lack of skilled and technical capacity	Special types of waste generated (e.g., mountaineering waste), which require treatment and disposal	
Lack of institutional coordination	Waste transport requires vehicles suitable to mountain regions	
Lack of funding and poor cost recovery	Limitations of space for waste treatment and disposal	
	Poor socio-economic conditions in general	
	High variability of waste generation due to tourist seasons	

Recommendations

This study recommends that solutions need to be steadily built on a framework in order to successfully and sustainably manage mountain waste. The framework consists of various, and related, factors shown in Figure ES.1.

Figure ES.1: Framework of solutions for mountain waste management



This report presents various recommendations and implementable actions that may be adopted in a phased manner in order to overcome SWM challenges faced in mountain areas. A phased approach has been suggested to allow for flexibility, as implementation may follow different time frames, and recommendations may be adopted concurrently. Actions are applicable to all mountain settlement types (mountain cities/towns, rural villages with road access, remote areas that are not connected by road, and high-altitude regions for trekking and mountaineering). Hence, actions would need to be selected based on the appropriate local scenario.

The proposed recommendations to manage solid waste in mountain areas are generally aligned with the integrated solid waste management (ISWM) framework and are summarized in Figure ES.2.

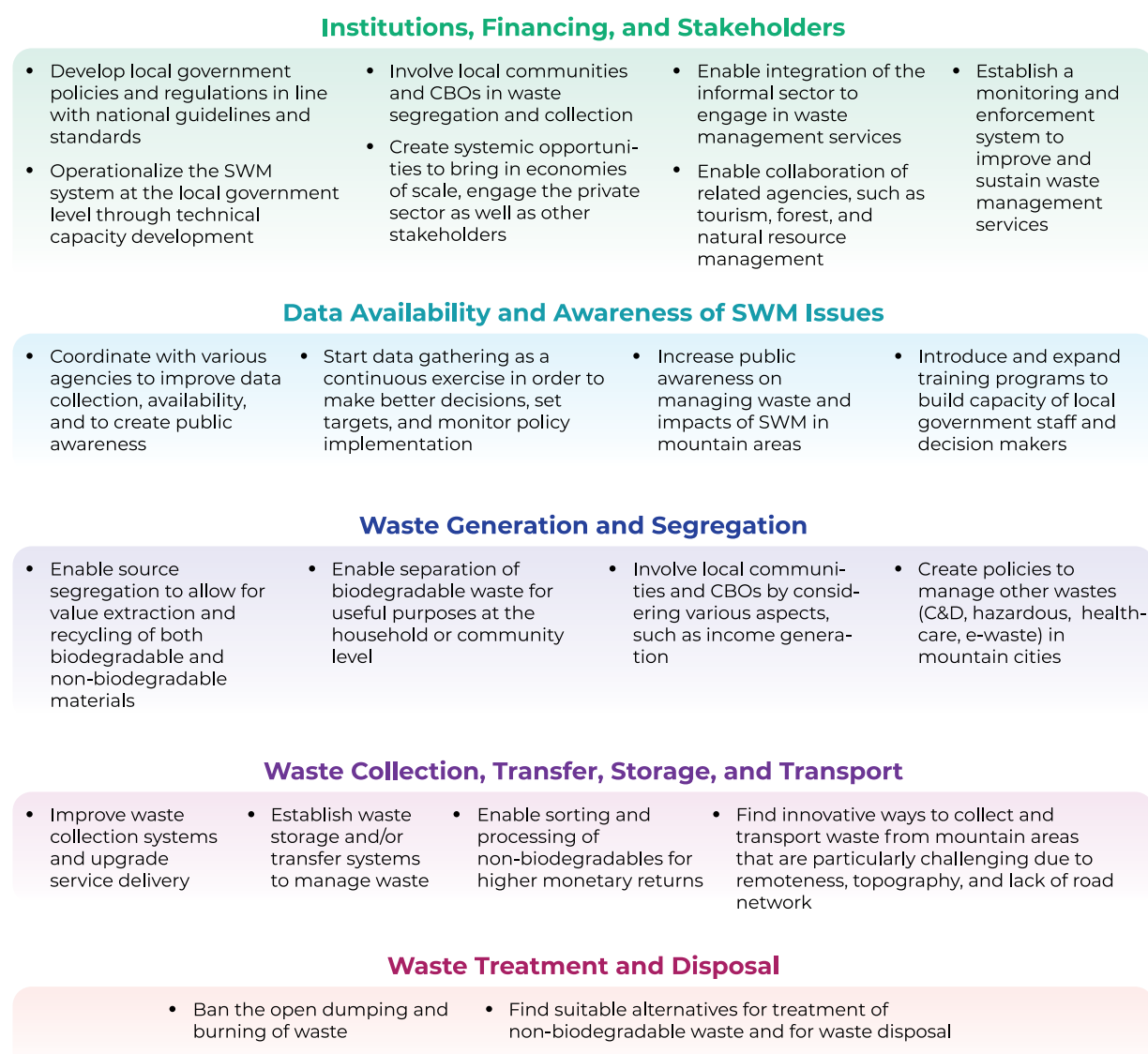
Background of this Regional Study on Sustainable SWM in Mountain Areas

This study represents the first attempt of the World Bank to examine SWM issues in these unique, ecologically-fragile areas that face concurrent challenges of high poverty and increasing pressures from tourism development. The World Bank, with funding from the Korea Green Growth Trust Fund, initiated a study—*Supporting the Development of Sustainable Solid Waste Management Strategies for the Mountainous Regions of India, Nepal and Pakistan*—with the following objectives:

- Analyze the current situation regarding SWM in the mountainous regions of India, Nepal, and Pakistan; and
- Provide data regarding region-specific models and technical recommendations that can be used by the World Bank in sectoral dialogues with country representatives to promote sustainable SWM in the mountainous regions of these three countries.

A field study was undertaken due to a lack of quantitative data available in mountainous regions. Khyber Pakhtunkhwa Province was chosen for the field study in Pakistan, focusing on Abbottabad and Swat districts within the province. The technical team selected these districts as they are not only mountain cities and tourist hubs in themselves, but also serve as tourism corridors to more remote locations. The field study can be considered to provide a snapshot of the current SWM scenario as well as confirmation of waste trends that one would expect to see in mountain areas.

Figure ES.2: Summary of recommendations for sustainable SWM in mountainous regions



The data collected during the course of the field study was collected via a two-pronged approach. One, waste sampling was undertaken to identify the types of waste being generated, as well as quantity and other factors. Two, qualitative surveys were carried out to understand the mindset and awareness level of residents, commercial establishments, and tourists in these areas.

The key findings from the field study are summarized in Figure ES.3.

Figure ES.3: Key findings from Pakistan field study

-  Readily biodegradable waste makes up the largest fraction of total waste generated
-  Plastic waste is the main constituent in mixed waste at places frequented by tourists
-  Far more non-recyclable plastic is generated compared to recyclable plastic
-  Segregation is not commonly practiced; although households are willing to segregate their waste if asked to
-  Residents acknowledged that waste is thrown in nearby areas or in open drains, burned, or disposed of in rivers
-  Heavily-frequented tourist establishments such as restaurants and hotels in mountain regions generate more waste on average than shops in the valley/non-tourist areas
-  Collection coverage is lacking in most mountain areas, resulting in waste strewn around and left in the open
-  Willingness to pay for SWM services is common
-  Litter and garbage on trails are environmental issues commonly cited by tourists
-  Almost all respondents said they believe environmental degradation has had a negative effect on their families

Publications in this Study

Five reports make up the set of publications for this study, which together serve to inform positive change in the SWM sector in mountain areas in the South Asia Region.

Three country-specific reports on India, Nepal, and this one on Pakistan—***Pakistan: Sustainable Solid Waste Management in Mountain Areas***—provide overviews of the MSW management scenario in each country. Furthermore, the reports investigate the impacts and challenges of mountain waste, including a detailed analysis of the data collected from the field study undertaken for this project. The reports present recommendations and specific actions—tailored to mountain areas—to improve SWM systems and practices. In conclusion, suggestions for further World Bank and donor engagement are provided.

The ***Technical Guidance Report: Sustainable Solid Waste Management in Mountain Areas of India, Nepal, and Pakistan*** summarizes the key findings and current understanding of mountain waste in the three countries. It provides an overview of the unique issues faced in the Himalayan region through a comparative analysis of SWM issues faced by each country. Based on the field study conducted for this project, as well as on experience and observations, recommendations are presented as a framework of overarching approaches with specific, implementable actions not only to improve current SWM practices, but also to mitigate the

negative impact of solid waste in mountainous regions. The actions are presented in a phased manner, considering that implementation of a mountain waste plan or policy may progress according to different time frames in different countries. The report concludes with suggested areas of World Bank and donor engagement to promote sustainable SWM in mountainous regions.

The ***Good Practice Options for Sustainable Solid Waste Management in Mountain Areas of India, Nepal, and Pakistan*** document offers examples of successful implementation and coordination of SWM plans that have led to positive change in SWM practice in India, Pakistan, Nepal, and other countries, including the Republic of Korea, Mexico, and Georgia. It includes examples of successful SWM policies and practices that have led to improvements in the SWM sector. It thereby offers examples that could be implemented, scaled-up, or adapted to mountain areas in these three countries, not only in the Himalayan region but elsewhere as well. These practices may also be applicable to mountain areas in other countries.



1. Introduction

The Islamic Republic of Pakistan boasts unique mountain ecology and a landscape that is home to some of the world's highest mountain peaks and glaciers. The northern highlands of the country include parts of the Hindu Kush, Karakoram, and the Himalayan mountain ranges. Pakistan also has more glaciers than anywhere in the world, with the exception of the polar regions (Al Jazeera 2020). The Indus River flows the entire length of Pakistan and is fed with glaciers and rivers in the high-peaked ranges in the north of the country. The Indus supports various ecosystems, and is a key water resource for Pakistan's agricultural and industrial economies, as well as for the country's potable water requirements (see Box 1.1 on pollution of the Indus River). The importance of mountainous regions to Pakistan's economic and environmental sustainability, therefore, cannot be minimized.

Box 1.1: Indus River: Pakistan's lifeline is the second most plastic-polluted river in the world

The Indus River is the one of the longest rivers in Asia, and also the longest river in Pakistan. It has supported civilizations for millennia and is culturally important in the region. Its tributaries are large rivers in itself, making the Indus one of the largest rivers in the world in terms of annual flow. Today the river is key to Pakistan's economy and supports the country's breadbasket, especially Punjab and Sindh provinces. It is also an important source of hydropower generation and potable water for the country. Unfortunately, it is now also a source of pollution, carrying waste, plastic, and other debris from the highlands of Pakistan down to the mouth of the river, where it discharges into the Arabian Sea.

A 2018 article published in *Environmental Science & Technology* identified the Indus as one of the top ten polluted rivers in the world. In fact, it is listed as second, behind only the Yangtze River in China. The authors developed this ranking based on researching published data on plastic concentration—including bottles, bags, microscopic fibers, and beads—in 57 rivers around the world. These concentrations were then multiplied by the rivers' water discharge to calculate the total weight of plastic flowing into the sea/ocean. The article concluded that 90 percent of plastic waste in the oceans comes from these ten rivers across the world. What was common to all these rivers was large populations—even hundreds of millions—living in the surrounding area, coupled with inadequate waste management systems.

The Pakistan Plastic Manufacturers' Association estimates that 55 billion plastic bags are used each year in Pakistan. According to Karachi University, the Indus contributes over 160,000 tonnes of plastic waste to the sea annually. Although Pakistan is one of over 120 countries in the world to ban some form of single-use plastic, there is no cohesive national policy or regional effort, outreach and education to the public, or enforcement to require shops to switch to biodegradable or reusable bags.

Sources: Fioriti 2019, Dawn 2019, Gray 2018, Lodrick and Ahmad 2019, Patel 2018

This unique mountain ecology offers Pakistan an opportunity to build an economy that leverages these natural assets for economic growth. Mountain ecosystems are fragile and must be managed to ensure their ecological integrity and environmental sustainability. Solid waste management (SWM) is a challenge that impacts ecological resources, socio-economic wellbeing, and tourist-sourced economic growth potential in these regions.

Reliable estimates on the quantity and characteristics of waste are not readily available in mountain areas, as these vary significantly depending on tourist influx, regional characteristics, and seasonal factors. In addition, mountain areas present unique challenges such as sudden spikes in the quantity of waste generated during tourist season, widely varying waste characteristics including large volumes of plastic and other special wastes (for example, mountaineering equipment), and constraints of land availability for waste treatment and disposal, especially due to a number of environmental sensitivities in these areas. All of these factors require specific strategies and models of SWM specifically for mountainous regions.

1.1 Key Solid Waste Management Challenges in Pakistan

Pakistan faces a number of challenges to its environment and ecology. One of the primary issues is the growing volume of municipal solid waste (MSW) due to increasing population, urbanization, and industrialization in the country. A number of factors contribute to this. Lack of coordination among the public and municipal service providers, lack of national environmental quality standards for SWM, fragmented governance, insufficient collection vehicles and equipment, lack of proper landfill sites, and designated dumps being overfull and exceeding capacity are some of these factors. Other factors include scarce funding for waste management, a dearth of expertise on the subject, inadequate checks and balances of waste collection and disposal at the ground level, policies created without research and evidence-based analysis, and low priority of the sector at all tiers of government.

Around three-fifths of Pakistan's land area consists of mountain terrain and plateaus and the remaining two-fifths constitutes the plains (Burki and Ziring 2020). Mountain areas in Pakistan are popular hubs for tourism, and therefore are an important economic factor for the country. However, one of the most significant impacts of tourism is the amount of waste it generates; one of the far-reaching implications of unmanaged waste in mountain areas is that it might not always stay in the mountains. For instance, plastic waste can find its way into rivers, lakes, or wetlands after it enters sewage systems, is washed down by rainwater, or blown away by wind. It is rivers that are the key pathways to the plains and coastal areas—for water, sediments, pollutants, and plastic waste. Once rivers have discharged their non-biodegradable waste into the ocean (primarily plastic), it becomes 'marine litter'. Marine litter is increasingly being recognized as one of the key environmental problems in our lifetime.

Another important point to note is that openly dumped waste diminishes the value of tourist sights and negatively impacts the ecosystem in the area. There is tremendous opportunity for growth in the tourism industry in the mountainous regions of Pakistan. The negative impact of large quantities of open waste may, however, cut short the potential for this industry to flourish, and for the local communities that depend on it. Given the importance of the tourism sector in Pakistan, particularly domestic tourists, it is imperative that policies are implemented in order to bring about positive change and to prevent the waste situation from worsening. Improving SWM conditions protects not only the environment and human health, but also provides livelihood opportunities to many in the region.

Poverty is generally more widespread in mountainous regions than in the plains (FAO 2007). Many mountain communities have multiple, pressing concerns, such as economic development and food security, and as a result waste management is not given as much importance (Wilson 2007). In mountain areas of developing countries, 39 percent of people are food insecure, compared to an average of 12.5 percent in the plains (FAO 2015). Table 1.2 presents a poverty profile of Pakistan, comparing population below the poverty line in the country as a whole to the population living in Khyber Pakhtunkhwa Province, which is home to the country's mountainous region and the location of the field work conducted for this study. In Pakistan, 24.3 percent of the total population in the country lives below the poverty line, compared to 18 percent in the province.

Table 1.1: Poverty profile of Pakistan and Khyber Pakhtunkhwa Province (2015-16)

Total population (millions)		Population below the poverty line (millions)		Population below the poverty line (%)	
Countrywide	Khyber Pakhtunkhwa	Countrywide	Khyber Pakhtunkhwa	Countrywide	Khyber Pakhtunkhwa
200.8	27.9	48.8	5.0	24.3	18.0

Source: World Bank 2021b, calculations based on HIES microdata published by PBS

1.2 Background

The World Bank, along with generous support from the World Bank Group's Korea Green Growth Trust Fund (KGGTF), initiated a study on solid waste in mountain areas in India, Nepal, and Pakistan. This study represents the first attempt of the World Bank to examine SWM issues in these unique, ecologically-fragile areas that face concurrent challenges of high poverty and increasing pressures from tourism development.

The study—*Supporting the Development of Sustainable Solid Waste Management Strategies for the Mountainous Regions of India, Nepal and Pakistan*—was aimed at analyzing the current situation of solid waste management in mountain areas and providing recommendations for sustainable SWM to reduce negative impacts from the lack of collection, lack of treatment, and improper disposal methods in these countries. Specifically, the project has the following objectives:

- Analyze the current situation regarding SWM in the mountainous regions of India, Nepal, and Pakistan; and
- Provide data regarding region-specific models and technical recommendations that can be used by the World Bank in sectoral dialogues with country representatives to promote sustainable SWM in the mountainous regions of these three countries.

A field study was undertaken due to the lack of quantitative data available in mountainous regions of all three countries. It was informed by two main components: waste sampling and a qualitative survey. Waste sampling was carried out primarily at households, commercial establishments, and hotels in order to understand waste generation and composition in mountain areas. Moreover, given the importance of public awareness and individual behavior to improve SWM, qualitative surveys were conducted among residents as well as foreign and domestic visitors. The field study's waste sampling data and the qualitative survey analysis form the basis for the three country-specific reports in this study.

The target areas for this project were Himachal Pradesh state in India, the Annapurna Conservation Area in Nepal, and Khyber Pakhtunkhwa Province in Pakistan. Field studies were conducted between May and September 2019. A summary of the field studies conducted in the three countries is provided in Figure 1.1.

Figure 1.1: Overview of field studies in India, Nepal, and Pakistan

	 India	 Nepal	 Pakistan
State/province/area	Himachal Pradesh	Annapurna Conservation Area	Khyber Pakhtunkhwa
Districts	Kullu and Kangra districts	Kaski	Abbottabad and Swat districts
Locations	Kullu, Manali, Dharamshala, McLeod Ganj, and Triund	Ghandruk, Chhomrong, Kimche, and Syauli	Abbottabad city, Nathia Gali, and Mingora
Time frame (2019)	June	May and September	July
Individual samples	85	388	75

1.3 Publications in this Study

Five reports make up the set of publications in this study, which together serve to inform positive change in the SWM sector in mountain areas in the South Asia Region. Three country-specific reports on India, Nepal, and this one on Pakistan—*Pakistan: Sustainable Solid Waste Management in Mountain Areas*—provide overviews of the MSW management scenario in each country. Furthermore, the reports investigate the impacts and challenges of mountain waste, including a detailed analysis of the data collected from the field study undertaken for this project. The reports present recommendations and specific actions—tailored to mountain areas—to improve SWM systems and practices. In conclusion, suggestions for further World Bank and donor engagement are provided.

The *Technical Guidance Report: Sustainable Solid Waste Management in Mountain Areas of India, Nepal, and Pakistan* summarizes the key findings and current understanding of mountain waste in the three countries. It provides an overview of the unique issues faced in the Himalayan region through a comparative analysis of solid waste management issues faced by each country. Based on the field study conducted for this project, as well as on experience and observations, recommendations are presented as a framework of overarching approaches with specific, implementable actions not only to improve current SWM practices, but also to mitigate the negative impact of solid waste in mountainous regions. The actions are presented in a phased manner, considering that implementation of a mountain waste plan or policy may progress according to different time frames in different countries. The report concludes with suggested areas of World Bank and donor engagement to promote sustainable SWM in mountainous regions.

The *Good Practice Options for Sustainable Solid Waste Management in Mountain Areas of India, Nepal, and Pakistan* report offers examples of successful implementation and coordination of SWM plans that have led to positive change in SWM practice in India, Pakistan, Nepal, and other countries, including the Republic of Korea, Mexico, and Georgia. It includes examples of successful SWM policies and practices that have led to improvements in the SWM sector. It thereby offers examples that could be implemented, scaled-up, or adapted to mountain areas in these three countries, not only in the Himalayan region but elsewhere as well. These practices may also be applicable to mountain areas in other countries.

1.4 Overview of this Report

Chapter 2 of this report discusses the current landscape of the SWM sector in Pakistan. It explores key solid waste data in Pakistan, such as MSW generation rates, composition, collection efficiencies, and treatment and disposal options. This chapter also features comparisons of these key indicators between Pakistan and the South Asia Region, as well as globally. Furthermore, it provides an overview of key policies and laws and institutions relating to SWM. Lastly, the chapter discusses the role of the informal sector in Pakistan and how SWM is currently funded in the country.

In Chapter 3, the report investigates the current situation regarding SWM in the mountain areas of Pakistan. Further information regarding the parameters of the field study, such as which areas were chosen and why, are also discussed. The analysis of the quantitative data gathered from the waste sampling and a summary of the qualitative information gained from the survey are presented for further analysis.

Chapter 4 looks at the complexity of managing solid waste in mountain areas as well as the various challenges and opportunities that arise. It presents why mountain areas face unique challenges in managing solid waste. It also discusses how mountain areas relate more commonly to other eco-sensitive areas, such as protected areas, small islands, and polar regions, compared to urban and rural areas in non-mountain regions. The chapter concludes with the various SWM challenges common in Pakistan's mountain areas.

Based on the SWM challenges specific to mountain areas described in the previous chapter, Chapter 5 proposes a framework or foundation on which solutions can be steadily built. It also presents recommendations and related implementable actions along a phased approach. A phased approach is suggested as it allows for flexibility by respective national, provincial/state, or local governments. The recommendations are suggested based on an integrated solid waste management (ISWM) approach.

In conclusion, Chapter 6 briefly summarizes the role of the World Bank in the SWM sector and how it can provide support to clients to improve SWM services and practices in mountain areas in the South Asia Region and elsewhere.



2. Overview of the Solid Waste Management Sector in Pakistan

The South Asia Region, of which Pakistan is a part, generated 334 million tonnes of waste in 2016, including both urban and rural waste (Kaza et al. 2018). In the region, Pakistan ranks second after India in terms of both land area and population compared to the other seven countries in the region. In terms of regional waste generation, Pakistan ranks fifth in per capita municipal solid waste (MSW) generation, and second by total generation (Kaza et al. 2018). A rapidly increasing population, coupled with sustained economic growth, industrialization, and urbanization has led to an uncontrolled increase in waste generation in the country. Current waste management systems, as described in further detail in this chapter, are lacking due to poor levels of public awareness, inefficient institutions and technical capacity, outdated and inadequate infrastructure, and a shortage of financing.

The data presented in this chapter outline the MSW crisis faced by Pakistan's current approach to solid waste management (SWM). From generation to the collection, treatment, and disposal of MSW in the country, it is apparent that more needs to be done to protect against severe environmental and health-related threats to the country, its economy, and its people.

2.1 Municipal Solid Waste Generation

From 2005 to 2016, the total MSW generated in Pakistan increased from about 20 million tonnes to about 30 million tonnes, the latter being equivalent to roughly 82,000 tonnes per day (State Bank of Pakistan, 2009; Kaza et al. 2018). Solid waste generated from the urban areas amounted to 18.3 million tonnes and 12.5 million tonnes in rural areas in 2016 (Safar et al. 2017).

An analysis of the data available on MSW generation between 2009 and 2014 in ten cities in Pakistan shows that the annual growth rate of waste generation (5 percent) is higher than the population growth rate of the same period (2.1 percent) (Pakistan, PBS 2010; Pakistan, PBS 2015). The World Bank estimates that MSW in Pakistan will increase to 42 million tonnes in 2030 and over 66 million tonnes in 2050, based on current urbanization and population growth rates (Kaza et al. 2018).

Pakistan's waste generation of 0.43 kg per person per day is currently below the global (0.74 kg per person per day) and the South Asia regional (0.52 kg per person per day) averages (Kaza et al. 2018). Table 2.1 shows the MSW generation figures for Pakistan, compared to both the global and regional averages, along with forecasted MSW generation values for 2030 and 2050. The table also provides current and estimated population trends for the country.

Table 2.1: Comparison of Pakistan's MSW generation and population to global and regional averages

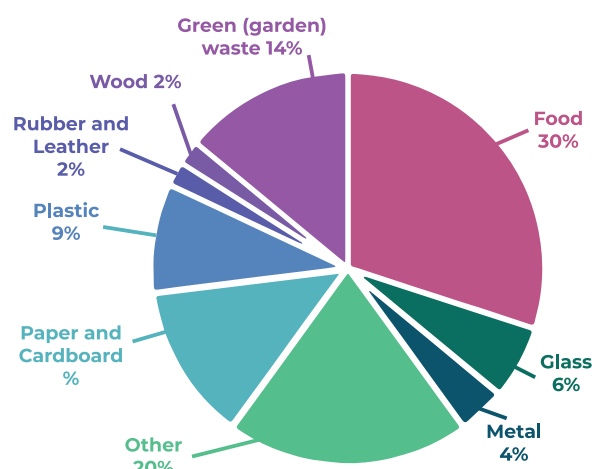
Indicator	Global	South Asia	Pakistan
Waste generation, 2016 (million tonnes/year)	2,010	334.23	30.35
Waste generation per capita, 2016 (kg/person/year)	0.74	0.52	0.43
Waste generation, 2030 projected (million tonnes/year)	2,590	466.24	42.43
Waste generation, 2050 projected (million tonnes/year)	3,400	661.18	66.38
Total population, 2016 (millions)	7,424	1,771	204
Urban population, 2016 (millions)	4,036	587.08	73.78
Urban population growth (annual rate %)	2.02	2.51	2.66
Rural population, 2016 (millions)	3,387	1,184	129.84
Rural population growth (annual rate %)	0.16	0.63	1.76
Total population, 2030 projected (millions)	8,548	285	263
Total population, 2050 projected (millions)	9,733	2,293	338

Sources: Kaza et al. 2018; UNDESA 2019; World Bank 2020

2.2 Municipal Solid Waste Composition

The composition of MSW in Pakistan is shown in Figure 2.1. Pakistan is similar to other countries in the region in that MSW primarily consists of biodegradable (organic) waste. Forty-four percent of Pakistan's waste comprises biodegradable waste (that is, kitchen and garden/green waste). Miscellaneous waste falls under 'Other', which is the second largest category. Plastic waste makes up one-tenth of the total waste generated (Kaza et al. 2018).

Figure 2.1: MSW composition in Pakistan



Source: Kaza et al. 2018

2.3 Municipal Solid Waste Collection and Transport

Similar to most low- to middle-income countries, Pakistan has a rudimentary waste collection system and very poor waste collection rates in its urban areas. According to the Pakistan Bureau of Statistics, waste collection services in Pakistan are not widely available. Even in urban centers, 43 percent of areas have no waste collection service. Meanwhile, more than 95 percent of rural areas in Pakistan have no waste collection system at all (Pakistan, PBS 2015). The MSW collection rates for Pakistan for 2014 are shown in Table 2.2. This is much lower than the regional collection average of 77 percent and 40 percent for urban and rural areas in 2016, respectively (Kaza et al. 2018).

Table 2.2: Average MSW collection rates in Pakistan

Collection agency	Urban (%)	Rural (%)
Collected by municipality	43	2
Private collection	14	3
<i>Pakistan collection efficiency</i>	<i>57</i>	<i>5</i>
<i>South Asia Region collection efficiency</i>	<i>77</i>	<i>40</i>

Sources: Pakistan, PBS 2015; Kaza et al. 2018

MSW collection goes hand-in-hand with transport. If collection systems are poor, the same can generally be said for transport, and vice versa. Although national data for MSW transport is not currently available, a snapshot of a city in a mountain area can shed light on the situation prevalent in the country. Bannu is a city at the foothills of the mountains in Khyber Pakhtunkhwa Province. In 2014, this city had only 14 vehicles to serve a population of around 50,000 people (City Population 2018b; Pakistan, PBS 2015). Table 2.3 shows the types and number of vehicles used for SWM in Bannu.

Table 2.3: Types and number of vehicles used for SWM in Bannu, Khyber Pakhtunkhwa (2014)

Dumper – 2	Pick-up – 1	Tractor trolleys – 6	Mechanical loader - 1
Truck – 1	Compactor – 1	Water lorries - 2	

Source: Pakistan, PBS 2015

2.4 Municipal Solid Waste Treatment and Disposal

In addition to the poor waste collection averages in Pakistan, most of the collected waste in the country is either burned or dumped within or outside municipal limits in low-lying areas. A study by the Government of Pakistan in 2015 listed disposal sites in only a handful of cities. It should be noted that none of these listed sites are sanitary landfills. In Bannu, Khyber Pakhtunkhwa, for instance, there is only one 4-acre dump (Pakistan, PBS 2015).

This is not limited only to smaller cities. Large urban agglomerations, such as Lahore, which has a population of over 11 million residents (2017) and generates 2.4 million tonnes of MSW per year has 330 dumps spread across 52 hectares (World Bank 2018; Pakistan, PBS 2015). As a matter of perspective, compare this with Mumbai, a city with a population of over 12 million (2011) that generates approximately 2.5 million tonnes of MSW per year and has dumping grounds spread over 249 hectares (World Bank 2018; India, MoHA 2011).

Open dumping and the burning of waste pose long-term threats to the environment and to human health. Open dumping often results in odor issues as well as leachate leaking into, and thus contaminating, soil and groundwater. It also serves as a breeding ground for vector diseases such as malaria and dengue. Furthermore, unstable piles of waste material often result in landslides, not to mention the negative effect on surrounding property values.

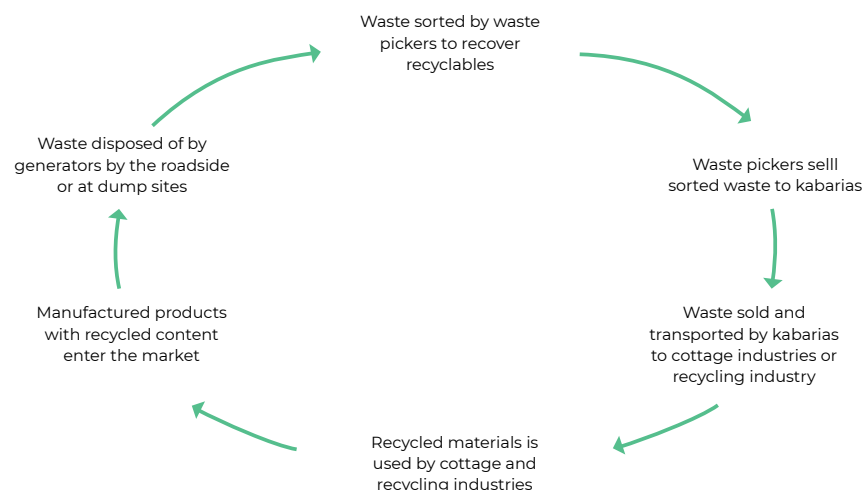
Uncontrolled burning of waste in open areas is a significant source of carcinogens such as dioxins, furans, and black carbon, a short-lived climate pollutant that contributes to climate change (CCAC n.d.). Waste is often deliberately burned to recover recyclables or may start out on its own due to chemical reactions of combustible materials. As such, it contributes to air pollution and exacerbates health issues like respiratory diseases for the nearby population.

2.5 The Informal Sector in Pakistan

As is common in similar developing countries, the informal sector in Pakistan plays an important role in the collection and sorting of recyclable materials. Recyclables are collected from waste that is dumped by the roadside or in dumping areas, and then sold to middlemen. While there is no official definition of an informal sector, it is broadly understood to be individuals or small businesses working in waste collection, trading, and recycling. These workers typically lack proper wages and benefits and work under poor conditions. Given the nature of their job, they are often considered unsanitary and are not respected for their roles in keeping cities free of trash, enabling recycling, and protecting the environment. This is in sharp contrast to the formal sector, represented by government sanitation workers or those who work in the private sector in solid waste collection, handling, or disposal. These workers are recognized by the public as playing a key role in keeping their cities clean and receive fixed salaries and benefits, and have defined work hours.

The informal sector in SWM in Pakistan is primitive but well entrenched, given that the system has not changed in decades. The process begins at primary collection storage points and waste dumps, and involves the sorting and collection of recyclable materials. This recyclable waste is sold to local junk shops (also known as *kabarias*). The *kabarias* purchase what they deem usable by informal cottage industries and other industries, and facilitate the distribution of reusable/resalable waste through local distribution channels that supply the informal cottage industries in the country. The recycled products manufactured by these industries then enter the market once again. This process is summarized in Figure 2.3.

Figure 2.2: Schematic representation of the informal sector in Pakistan



2.6 Governance and Policy

In 2010, the 18th Constitutional Amendment was approved by the National Assembly of Pakistan. This resulted in a number of new features being introduced in the Constitution and the devolution of multiple ministries at the federal level to the provincial governments. Under the Amendment, environmental functions in the federal capital territory of Islamabad were delegated to the Pakistan Environmental Protection Agency (Pak-EPA), and Provincial Environmental Protection Agencies were delegated the environmental management functions for provinces. In 2012, the federal government converted the Ministry of Environment (MoE) to the Ministry of Climate Change (MoCC). The MoCC is primarily responsible for managing national-level environmental issues, such as climate change, and implementation of international conventions that Pakistan becomes a party to. Key legal instruments and policies related to SWM in Pakistan are summarized in Table 2.4 and described in further detail below.

Table 2.4: Key legal instruments governing SWM in Pakistan

1983	Pakistan Environment Protection Ordinance (PEPO) marked the beginning of environmental legislation in Pakistan. Its main objective was to establish institutions (e.g., PEPC).
1992	National Conservation Strategy (NCS) emerged after almost a decade of discussion and analysis, and provides a broad framework for addressing environmental concerns in the country.
1993	National Environmental Quality Standards (NEQS) controlled industrial pollution by creating limits for industrial effluents and emissions, as well as municipal discharges from wastewater systems, but did not take into account pollution caused by improper disposal of MSW.
1997	Pakistan Environmental Protection Act (PEPA) replaced the earlier PEPO, in an effort to bridge gaps in the law.
2001	National Environmental Action Plan (NEAP) was approved to follow the strategy of the NCS, which narrows the government's policy focus on the environment to four core programs: clean air, clean water, waste management, and ecosystem management.
2005	National Environmental Policy (NEP) aimed to protect, conserve, and restore Pakistan's environment in order to improve quality of life of citizens through sustainable development, and addressed different sectoral issues, including waste management.
2013	Local Government Acts (LGAs) , passed by each province; these Acts contain provisions for integrated solid waste management (ISWM) systems and other municipal services that district councils will review.

Sources: Khyber Pakhtunkhwa, LGERDD 2013, Pakistan, MoE 2005, SACEP, n.d., Sohail et al. 2014, ZA LLP 2020

A National Conservation Strategy (NCS) was developed in response to the World Conservation Strategy (WCS) launched by the International Union for Conservation of Nature and Natural Resources (IUCN) in 1980 and was formulated in 1992. The NCS emerged after almost a decade of discussion and analysis, and has served as the environmental policy body of Pakistan. It recommends actions in order to redress environmental degradation and to facilitate sustainable utilization of natural resources.

The National Environmental Quality Standards (NEQS) came into being in August 1993 and were applicable to all new industrial units to adopt more environmental-friendly inputs and machinery in industrial processes. The aim of the NEQS is to regulate the discharge of municipal and industrial liquid effluent by specifying upper and lower permissible limits for industrial effluent and emissions. They are also applicable to municipal discharges of wastewater. The NEQS cover a wide range of toxic or harmful substances including smoke, particulate matter, carbon monoxide, arsenic, lead, and mercury, but do not take into account pollution caused by the improper disposal of ordinary municipal waste.

The Pakistan Environmental Protection Act 1997 (PEPA) is the basic legislative tool empowering the Government of Pakistan to frame regulations for the protection of the environment. This legislation is comprehensive and provides the basic legal framework for protection, conservation, rehabilitation, and improvement of the environment. The Act is applicable to a wide range of issues and extends to air, water, soil, marine, and noise pollution, and to the handling of hazardous wastes. PEPA regulates various forms of pollution, including the improper discharge of waste.

In 2001, the National Environmental Action Plan (NEAP) was approved to follow the strategy of the NCS, which narrows the government's policy focus on the environment to four core programs: clean air, clean water, waste management, and ecosystem management. A comprehensive program has been launched to support implementation of NEAP.

The National Environmental Policy 2005 (NEP) provides an overarching framework to address environmental issues facing Pakistan, particularly pollution of fresh water bodies and coastal waters, air quality, lack of proper

waste management, deforestation, loss of biodiversity, desertification, natural disasters, and climate change. It also gives direction for addressing cross-sectoral issues as well as the underlying causes of environmental degradation and meeting international obligations.

Recommended policy measures are to: (1) Enact the National Clean Air Act; (2) Ensure reduction and control of harmful emissions through regulatory programs; (3) Establish cleaner production centers and promote cleaner production technologies and practices; (4) Introduce discharge licensing systems for industry; (5) Encourage reduction, reuse, and recycling of municipal and industrial solid and liquid wastes; and (6) Provide financial and other incentives (reduction/elimination of tariffs, low interest loans, appreciation certificates, and awards) for technology upgradation, adoption of cleaner technology, implementation of pollution control measures, and compliance with environmental standards.

Since the field study for this project was conducted in the Khyber Pakhtunkhwa Province, the remainder of this section focuses on environmental legislation and institutions in the province.

Khyber Pakhtunkhwa Environmental Protection Act 2014

The Khyber Pakhtunkhwa Environmental Protection Act 2014 (KP-EPA 2014) addresses the prohibition of discharges and emissions of wastewater and air emissions, noise control, requirements of initial environmental examinations, and environmental impact assessments for new development projects, as well as hazardous substances and waste.

Under the KP-EPA 2014, no person is allowed to discharge or emit any effluent, air pollutant, waste, or noise in an amount, concentration, or level in excess of the provincial Environmental Quality Standards (PAKP 2020a).

Khyber Pakhtunkhwa Local Government Act 2013 (Amended 2018, Second Amendment 2019)

The Khyber Pakhtunkhwa Local Government Act 2013 (KP-LGA 2013) disallows discharge of any dangerous chemical, inflammable, hazardous, or offensive material in drains or sewers, public water courses, or on public land; dumping of solid waste and refuse by any person or entity at a place other than landfills or dump sites, notified or designated by the concerned local government. It also prevents damage to or polluting the physical environment, inside or outside private or public premises, in a manner that endangers public health (PAKP 2020b).

2.7 Institutions Related to Solid Waste Management

Pakistan's SWM has traditionally been handled by local governments. However, following the increasing rate of solid waste generation, the growing awareness on waste reduction at source, recycling, recovery, and overall waste management practices have pushed other institutions, such as the city mayor's office, departments for environment protection, housing and urban development, and the Ministry of Climate Change to deal with one or more aspects along the SWM chain.¹

¹ The various steps involved in the management of solid waste—starting from generation to storage, collection, transport, transfer, treatment (including recycling), and finally disposal—are collectively referred to as the SWM chain.

Table 2.5: Pakistan's institutional framework for SWM

1975	Ministry of Climate Change (earlier Ministry of Environment) established. Following the Stockholm Declaration of 1972, it proposed and drafted the first consolidated environmental law in Pakistan.
1983	Pakistan Environmental Protection Agency (Pak-EPA) administers and implements the provisions of PEPO at the federal level; it also provides technical support to the Ministry of Climate Change.
1984	Pakistan Environment Protection Council (PEPC) is the main environmental policy-making body in the country, responsible for pollution control and preservation of the living environment.
1987	Four Provincial Environmental Protection Agencies (EPAs) at the provincial level, planned in 1984 but established three years later, to administer and implement the provisions of PEPO.
2001	Local Government Acts (LGAs) , passed individually by each province, based on the premise that locally-managed basic services would improve responsiveness to local needs and facilitate improved service delivery.

Source: SACEP, n.d.

The types of services that these institutions provide can be categorized into direct waste management-related services and ancillary services. For instance, waste management companies (WMCs) are government-owned bodies that are run independently but are funded by local government. While Pakistan has an institutional framework at the federal, provincial, and local levels with regard to SWM (summarized in Table 2.5), there appears to be no functional arrangements for coordination amongst federal, provincial, and local levels of government.

2.7.1 Institutions at the Federal Level

In 1983, the Pakistan Environment Protection Council (PEPC) and Pakistan Environmental Protection Agency (Pak-EPA) were established. The PEPC was responsible for pollution control and preservation of the living environment. Since then, many institutional policy and regulatory developments have taken place at the federal and provincial levels, including the creation of the Ministry of Environment.

2.7.2 Institutions at the Provincial Level

Pakistan is divided into four administrative provinces—Balochistan, Khyber Pakhtunkhwa, Punjab, and Sindh; two autonomous territories; and the federal territory of Islamabad, which is the capital of the country. All four administrative provinces are at different stages of environmental management with varying financial resources.

The provincial institutions are concerned primarily with trying to make SWM more effective via resource augmentation and conservation. The major natural resource management and protection responsibilities for forests, agriculture, and water lie at the provincial level, even though these authorities are often overwhelmed by federal projects. Provincial Environmental Protection Agencies (EPAs) have also been established in all four provinces, which focus on industrial and urban pollution problems, including solid waste. The EPAs, which have the functional responsibility to implement laws and regulations, look toward the national political leadership for direction.

2.7.3 Institutions at the Local Level

Municipal governments in Khyber Pakhtunkhwa are governed under KP-LGA 2013 and are responsible for solid waste disposal and for sewage management and treatment. The Municipal Committees in districts and *tehsils* that previously provided municipal services to the urban population are now required—with little increase in staffing or resources—to deliver these services to a much wider jurisdiction, including sizable rural areas not previously part of their mandate.² Furthermore, according to the data collected in the field study, these independent and free standing *tehsils* do not share financial or other resources as their distribution is primarily dependent upon political will rather than *tehsil* requirements. There are no mechanisms for prioritizing resources within a district to ensure that the relatively deprived rural areas begin to build services equal to those of the formal municipalities. In this situation, *tehsil* municipal administrations (TMAs) are unable to cope with ever-increasing volumes of MSW. Some factors include inadequate funds, a lack of regulations and standards, and a lack of technical knowledge and expertise, as well as equipment.

In addition, efforts are made at the district level to solve problems related to expanding cities and towns, such as the establishment of various departments, hiring the services of skilled professionals, and preparing developmental plans. District development authorities (DDAs) and district administrative advisory committees are examples of such efforts. In Khyber Pakhtunkhwa Province, a number of DDAs are responsible for managing solid waste. For instance, the Galiyat Development Authority (GDA) was established with the basic aim to provide infrastructural and civic facilities for waste management, among others, and to develop tourism infrastructure (Khyber Pakhtunkhwa, GDA 2016). In Swat, the DDA has been established to launch a new township to mitigate the housing problem and will provide basic facilities including SWM (Khyber Pakhtunkhwa, SDDA 2014). In Dir, the Area Development Organization, an NGO, has been working to raise awareness and build capacity to help beneficiaries develop their own networks of support (Devex 2020).

At the divisional level, the Government of Khyber Pakhtunkhwa implemented the Community-Driven Local Development (CDLD) policy in Malakand, which includes six districts: Malakand, Shangla, Swat, Upper Dir, Lower Dir, and Chitral. The main aim of the CDLD is to restore the community's trust in the local government, build the local government's responsiveness by helping local authorities achieve disbursement targets, and to build local governance capacity and community development (Human Dynamics n.d.).

Administratively, there appear to be no functional arrangements for coordination between federal and provincial management teams. In addition, there are practically no institutional arrangements at the local/district levels. Evidently, there is a great need for the MoCC, provincial environment departments, EPAs, district and *tehsil* governments, and other relevant government and non-government institutions and organizations at all levels to be strengthened through the provision of adequate human resources, equipment, infrastructure, and financial resources.

2.8 Solid Waste Management Stakeholders

Tables 2.6 and 2.7 outline the various stakeholders and service providers involved in SWM in Pakistan and their current roles and responsibilities. Table 2.6 focuses on direct waste management services provided by the government, quasi-government bodies, private sector, NGOs, and others (including community-based organizations, households, or establishments managing the waste themselves). Direct SWM services

² In Pakistan, a *tehsil* is an administrative sub-division of a district.

include collection, transportation, and disposal of MSW. No data is available on waste sorting, and recovery of recyclable materials takes place primarily at the informal level with the assistance of NGOs. Recyclables are sold to the private sector. In certain areas like Bani Gala, a suburb of Islamabad, NGOs are becoming more active in providing waste management services to their communities. The *Good Practice Options for Sustainable Solid Waste Management in Mountain Areas of India, Nepal, and Pakistan* report, published as part of this study, illustrates how Amal, an NGO, is working to improve waste management services in Bani Gala. Not only does Table 2.6 provide a detailed understanding of the current structure of the waste management sector in Pakistan but also shows the lack of services provided along the SWM chain, as well as the lack of information available to make well-informed decisions.

Table 2.7 shows the various stakeholders in Pakistan that provide ancillary services in the SWM sector. Services such as awareness campaigns and knowledge sharing, data collection and research, and technical expertise are provided by academia, consultants and experts, the government and quasi-government bodies, and NGOs.

Table 2.6: Stakeholders providing direct solid waste management services

Waste Service	Government	Quasi-government	Private Sector	NGOs	Others (e.g., CBOs, informal sector)
Collection	Yes	Yes	Yes	Yes	Yes
Transportation	Yes	Yes	Yes	Yes	Yes
Sorting	No data available	No data available	No data available	No data available	No data available
Recycling/Recovery	No data available	No data available	Yes	Yes	Yes
Disposal	Yes	Yes	Yes	Yes	No
Financing	Yes	Yes	Yes	No	Yes

Table 2.7: Stakeholders providing ancillary solid waste management services

Service	Government	Quasi-government	Consultants/ Expert Institutions	NGOs	Academia
Awareness campaigns, knowledge sharing	Yes	Yes	Yes	Yes	Yes
Data collection and research	Yes	Yes	Yes	Yes	Yes
Technical expertise	No	No	Yes	No	Yes

2.9 Solid Waste Management Financing in Pakistan

Both the government and private sectors in Pakistan provide SWM services. Broadly speaking, financing for SWM services can be categorized as follows:

1. Areas governed and managed by provincial governments: After the 18th Amendment to the Constitution was passed in 2010, the responsibility of providing basic services was delegated to the provincial governments. Provincial governments provide funds through Local Government (LG) and Community Development Departments (CDD) to relevant agencies at the city/TMA level. The agencies are required to provide these services either by themselves or through the private sector. The distribution of the budget is based on factors such as population, area type (urban/rural), areas with political/bureaucratic importance, and public demand. For example, in Punjab province the maximum share of the budget is spent on the five largest cities (Lahore, Gujranwala, Faisalabad, Multan, and Rawalpindi), whereas in the case of Sindh province, the maximum budget is allocated to Karachi.

2. Areas governed and managed by the armed forces (cantonments, defense housing societies, and military lands): The government subsidizes SWM services in armed forces areas. In the case of cantonment areas under armed forces control, the local Cantonment Board deals with waste management services. Cantonment Boards are funded by relevant station headquarters and some cantonments, such as in Lahore and Karachi, also collect SWM service charges from residents.

3. Areas managed by private entities (private housing societies in big cities): Private housing societies are typically gated communities that offer a higher-than-average living standard. A committee of elected resident members manages each society. These committees collect fees (monthly or quarterly) decided by the mutual consent of residents, and hire private contractors for waste management services. Private contractors collect the waste through door-to-door service from housing societies and transport it to designated dump sites.



3. Solid Waste Management in Mountain Areas of Pakistan

A key element of this report is the discussion on the state of solid waste management (SWM) in mountain areas of Pakistan. SWM in the mountain provinces of Punjab and Khyber Pakhtunkhwa, as well as the autonomous territories, is far behind Pakistan's urban centers in terms of collection, management, and disposal. Information about SWM in the province of Khyber Pakhtunkhwa, the location for the field study presented in this chapter, is available in Section 3.1. Inaccessible and rough terrain makes waste management operations extremely challenging, and often results in the open dumping of waste in open areas and rivers as well as the burning of waste. This proves hazardous to communities of millions living in these areas, as well as those communities downstream who rely on rivers originating in the mountains and glacial melt for drinking and agriculture. This situation is further compounded by the impact of tourists, trekkers, and mountaineering expeditions that contribute to increased volumes of solid waste in remote and high-mountain areas.

Mountain tourism in Pakistan is gaining importance and has the potential to be an important part of the economy in these regions, but a polluted landscape will hinder that opportunity. Furthermore, SWM in the mountains can provide job opportunities through collection, segregation, and decentralized approaches. However, if not done correctly, it may have long-lasting negative impacts on the environment, human health, and the local economy.

Based on regional knowledge and confirmed during the field study, SWM in Pakistan's mountain areas is often characterized by the absence of adequate systems to collect and manage waste. Looking particularly at the extreme northern regions of Khyber Pakhtunkhwa and Gilgit-Baltistan, wherever collection services are unavailable, waste is frequently dumped in open spaces or in rivers or burned. When collection services are available, there is no segregation of waste, and most of the waste is dumped in rivers, lakes, and freshwater streams, along mountainsides, or left along trails and campsites. While open dumping is by no means unique to mountainous regions, mountain environments pose additional risks if these sites are located near waterways, with the potential to pollute water that is used by large populations downstream. In turn, it also negatively impacts river ecology and fish stock.

One may imagine that these mountain areas are remote and rural. However, several large cities with populations of close to half a million or more inhabitants exist in the mountain areas of Pakistan. There is, therefore, a considerable amount of waste being generated even in these mountain cities. For instance, the mountain city of Quetta, capital of Balochistan Province, has an urban population of over 1 million, and generates more than 450,000 tonnes of municipal solid waste (MSW) annually (City Population 2018d; Pakistan, PBS 2015). A similar situation exists in other large mountain cities such as Mingora, Dir, Chitral, Abbottabad, and Mansehra in Khyber Pakhtunkhwa Province, and Gilgit and Skardu in Gilgit-Baltistan Province. In addition to MSW being generated by households and commercial establishments in these areas, waste from tourism and trekking/mountaineering activities also adds to the problem.

Historically not much attention has been paid to waste management and disposal in these areas. However, there is increasing realization that it can no longer be ignored. There are a few examples where local governments are working towards improving the sector. For instance, the Government of Khyber Pakhtunkhwa

has established a water and sanitation service company to manage MSW in Swat and Abbottabad. In Murree Hills, a hill station in the province of Punjab, the government has outsourced waste services to the private sector in an attempt to improve services.

3.1 Solid Waste Management in Khyber Pakhtunkhwa Province

This section of the report focuses on SWM in Khyber Pakhtunkhwa, in particular, as this province was the location of the field study presented later in this chapter. Therefore, a closer look is warranted at the SWM challenges faced by mountainous regions in Khyber Pakhtunkhwa.

3.1.1 Municipal Solid Waste Generation

No province-wide figures are available for MSW generation in Khyber Pakhtunkhwa Province. Peshawar, the capital and largest city of the province, generates 600-700 tonnes per day of MSW, which is equivalent to 219,000-255,000 tonnes per year (Hussain 2020). Bannu, with a population of around 50,000 people generates 13,870 tonnes per year (2014) (City Population 2018b; Pakistan, PBS 2010).

3.1.2 Municipal Solid Waste Collection

Statistics for MSW collection in Khyber Pakhtunkhwa are summarized in Table 3.1. In 2013/14, approximately 68 percent of households in urban areas received waste collection services, compared to only one percent in rural areas (Pakistan, PBS 2015). The majority of services were provided by the municipality, and only a very small portion by the private sector, as shown in Table 3.1.

Table 3.1: Percentage of households receiving MSW collection services in Khyber Pakhtunkhwa (2013/14)

Service provider	Urban (%)	Rural (%)	Average (%)
Municipality	66	1	34
Private	2	0	1
Total collected	68	1	35

Source: Pakistan, PBS 2015

3.1.3 Municipal Solid Waste Disposal

There is a lack of data on MSW disposal at the national as well as provincial level. Given this lack of information, it can be assumed that most of the waste is dumped or burned. In Peshawar, a city of 1.97 million people (2017), there is only one 60-acre dump that is listed in the official statistics of the country (City Population 2018b; Pakistan, PBS 2015).

3.2 Field Study Overview

A key element of the World Bank's *Supporting the Development of Sustainable Solid Waste Management Strategies for the Mountainous Regions of India, Nepal and Pakistan* study, funded by the Korea Green Growth Trust Fund (KGGTF), was to enhance the quality of data, given its insufficient availability in mountain areas of the three countries.

The field study had two components: waste sampling and a qualitative survey. The aim of this study was to present current trends, identify challenges, and make recommendations that may be applied widely to mountain areas in all three countries under this study.

Due to time limitations and other constraints, the sample size for the field study was small so the results (provided in Appendix 1) should not be considered statistically significant and caution must be used when citing this data. The field study can thus be considered to provide a snapshot of the current solid waste scenario as well as confirmation of waste trends that one would expect to see in mountain areas in these three countries.

The field study in Pakistan was conducted between May and July 2019 by Korean consultants, Korea Environment Corporation (K-eco), in cooperation with local partners, including the Khyber Pakhtunkhwa Integrated Tourism and Enterprise Development (KITE) Project officials and the Green Growth Initiative committee.

3.3 Location and Geography

Khyber Pakhtunkhwa Province was chosen for the field study in Pakistan, focusing on Abbottabad and Swat districts within the province. The technical team selected these districts, based on consultations with relevant stakeholders, as they are not only mountain cities and tourist hubs in themselves, but also serve as corridors for tourism to more remote locations. For instance, Abbottabad is a gateway to the stunning northern areas through the Karakoram Highway, while Mingora, the largest city in Swat, is the entrance to the beautiful valleys of Upper Swat, Kumrat, Chitral, and beyond. See Box 3.1 for a description of the challenging waste management scenario in Chitral.

Located in northwest Pakistan, Khyber Pakhtunkhwa is a preferred destination for both domestic and international tourists. Tourism serves as the primary source of income for people living in and around these locations, as well as those living in the districts of Swat, Chitral, Abbottabad, and Mansehra.

Administratively, Khyber Pakhtunkhwa is split into seven divisions (Bannu, Dera Ismail Khan, Hazara, Kohat, Malakand, Mardan, and Peshawar), and each division is further split into districts. There are 35 districts in the province. Some key facts about the province are provided in Table 3.2.

Table 3.2: Important facts about Khyber Pakhtunkhwa

Average elevation: 5,000 meters
Population (2017): 30.52 million (approximately 15% of Pakistan's total population)
Formerly known as: North-West Frontier Province
Share of national GDP: 10.5%
Key sectors: Agriculture, mining, tourism

Sources: Khyber Pakhtunkhwa, KPEZDMC 2020; Mock and O'Neil 2002; Pakistan, PBS 2018

Box 3.1: Chitral City: Solid waste (mis)management

Chitral is one of Pakistan's most northern districts, surrounded by the tallest mountains in the world. Chitral city, capital of Chitral District in Khyber Pakhtunkhwa Province, is bounded on all sides by the Hindu Kush, Karakoram, and Hindu Raj mountain ranges. Chitral city itself is at an elevation of 1,494 meters. The most recent population data for the district dates back to 1998, at roughly 320,000 people. One of the poorest districts in the country, approximately 90 percent of its inhabitants live in rural areas. Chitral city is the only urban settlement in the district, with a population of over 20,000. Once the only district in Pakistan to be cut off from the rest of the country during winter months, it is now connected to the rest of the country year-round due to the construction of the Lowari Tunnel.

The topography and haphazard development of settlements exacerbate the solid waste management (SWM) problems in the area. Not only are settlements widely scattered, but dwellings are also squeezed in narrow valleys since even small patches of level land are used for agriculture. All of these issues put together hamper waste collection. With a growing population, the scale of the problem is rapidly expanding.

The Chitral *tehsil* municipal administration (TMA) collects approximately only two out of the nine tonnes of waste generated daily, mostly from commercial areas. Most of the municipal solid waste (MSW), whether collected by the SWM department, disposed of by individuals, or picked up by private waste collector, ends up in ravines, river banks, or in vacant lots and side streets. Almost all bridges, creeks, and areas behind hotels and shops are filled with garbage.

In the absence of disposal sites, individual households and the TMA routinely burn the waste along river banks. There is an illegal dump site in Danin town, about 14 kilometers from Chitral, but no complaints or demands for corrective measures have been lodged by citizens or members of civil society. The disposal site in Chitral, which is rented by the TMA, lies very close to the river and is even submerged when the river is high.

All these factors combined have resulted in what one report calls sanitation and solid waste disposal facilities in the area "deplorable" (IUCN 2004b). Ecotourism is a valuable potential asset for Chitral, bringing improvements in multiple sectors. But with that comes its own challenges of upgrading and delivering services for waste management, sewage and wastewater, and so on. Whether Chitral city is able to overcome these issues remains to be seen.

Sources: AHKRC 2012; ANC 2020; IUCN 2004b

3.4 Field Study Site Descriptions

District: Abbottabad, **Province:** Khyber Pakhtunkhwa

Total Population: 1.3 million

Site locations: Abbottabad and Nathia Gali

Abbottabad District is part of the Hazara Division. A city by the same name is the capital of the district. Located in the eastern part of the Khyber Pakhtunkhwa Province, the district covers an area of 1,967 sq. km. (Pakistan, PBS 2020a). Abbottabad district is located in a predominantly mountainous terrain, and the average elevation of peaks in the district ranges from 2,500 to 2,700 meters. These mountains form part of the lesser Himalayas and dominate the landscape. Population statistics for Abbottabad district based on the 2017 Census are summarized in Table 3.3. A summary of tourism in Abbottabad District is provided in Box 3.2.

Table 3.3: Population statistics, Abbottabad District, Khyber Pakhtunkhwa Province (2017)

Total population	1.3 million
Urban population	1,039,775
Rural population	293,137
Urban fraction (% of total)	78
Rural fraction (% of total)	22
Population growth rate (%)	2.2
Population density	678/sq. km.

Source: City Population 2018a

Box 3.2: Snapshot of tourism in Abbottabad District

Abbottabad District has historically been the focus of resort tourism since the 1880s, when the British colonial administration established summer camps for its troops in the Galiyat area, and Dunga Gali, Nathia Gali, and Thandiani were primarily used by civil servants. Following independence, the cantonments in the area were abandoned until 1961, when the Hazara Hill Tract Improvement Trust (HHTIT) was created to reduce excessive tourist pressure on Murree by redeveloping these abandoned cantonments. In 1999, the Galiyat Development Authority (GDA) was established to promote tourism, taking over from the HHTIT.

While accurate data on tourism in the district is not available, a survey conducted by the federal government's tourism division shows that 99 percent of visitors to Abbottabad District are domestic visitors traveling within the country and that tourists spend an average of 1.5 nights in the area. Abbottabad city, Ayubia, Dunga Gali, Nathia Gali, and Thandiani are the district's most favored tourist destinations.

According to the same survey, a total of 38,400 visitors stayed in Abbottabad city, of whom only 1.3 percent were foreign nationals. Although the district is traversed by an extensive road network, is easily accessible, and enjoys well-established telephone links, few tourists choose to reside in the district itself. Rather, Abbottabad is better known as a transit point for more popular tourist hotspots, such as Gilgit, Hunza, the Kaghan valley, and Swat. Day visitors prefer Murree Hills to Abbottabad.

The Galiyat area, which comprises the hill stations of Nathia Gali, Dunga Gali, Thandiani, Ayubia, Khanaspur, and Changla Gali, to name a few, is one of the most popular domestic tourism regions of the district. Galiyat (also *galyat* and *galliat*) refers to a narrow strip of land extending on both sides of the Khyber Pakhtunkhwa-Punjab provincial borders, between Abbottabad and Murree. Literally, *gali* means an alley or valley between two mountains. Box 3.3 describes the influence of tourism on solid waste management in Ayubia National Park. According to the Khyber Pakhtunkhwa Tourism Sector Analysis in 2019, the area of Galiyat receives 2.5 million visitors annually and the annual economic contribution of tourism from the region is \$310 million. 43 percent of households in the region are dependent on tourism for their livelihood.

There exists tremendous potential to develop pro-poor ecotourism in the Galiyat region of Abbottabad District. If properly developed, these areas could serve to attract nature tourists, ornithologists, hikers, and trekkers, thus creating even more employment opportunities for local communities.

Sources: AMA 2020, IUCN

Box 3.3: Ayubia National Park: Boom in tourists = Boom in plastic waste

Ayubia National Park (ANP) is a 33 sq. km. national park located in the Galiyat region of Abbottabad district, Khyber Pakhtunkhwa Province. At an elevation of 2,400 m, the park has been developed as a protected area surrounded by tourist towns in Galiyat. According to the Galiyat Development Authority, there are 420 households, 100 shops, 50 hotels, two hospitals and three schools in the surrounding area of ANP area.

UNESCO, in partnership with the World Wide Fund for Nature-Pakistan, initiated a baseline study on plastic waste for Islamabad Capital Territory (ICT) and ANP in 2019. Similar to this World Bank study on solid waste in mountain areas undertaken for Pakistan, India, and Nepal, the UNESCO-WWF project undertook a quantitative baseline study to establish the magnitude of the plastics waste problem in these two areas. The study covered all types of plastic waste generated, identified opportunities for future actions, and provided a framework for further work in other cities in Pakistan.

The study found that approximately 195 tonnes of waste were generated monthly in ANP, of which it is estimated that almost 95 tonnes was plastic waste. This is equivalent to almost 50 percent of total waste generated. Comparatively, ICT, had a much lower proportion of plastic waste, at 14 percent. This is attributed to the high volume of tourists all year around, coupled with a higher volume of single-use plastic generated. Moreover, plastic waste on the weekends increased significantly compared to during the week, which also points to an influx of tourists.

LDPE and PET were the most frequently found plastic waste types in ANP, which are common types of plastic expected to be found in high tourist areas, given the reliance on single-use plastic. Common LDPE materials consist of shopping bags, thin plastic packaging, wrappers, and cling film. PET commonly is used in water and beverage bottles, jars, clothing, rope, etc. On the contrary, the types of waste found in ICT were more suited towards a stable, permanent population, such as biodegradable and construction wastes.

An interesting point to note is that—similar to this World Bank qualitative survey—the UNESCO-WWF study also found that most respondents do not segregate their waste; in fact, it is an “alien concept” to them.

Sources: Khyber Pakhtunkhwa, GDA 2020; Pakistan, WWF 2019; Q4A 2020

District: Swat, **Province:** Khyber Pakhtunkhwa

Population: 2.3 million

Site location: Mingora

Swat, a valley locally known as “Pakistan’s Switzerland”, is in the Malakand Division in the north of Khyber Pakhtunkhwa Province. Swat District covers an area of 5,337 sq. km. (Pakistan, PBS 2020b). The district is enclosed by high mountains, which are offshoots of the Hindu Kush range. Chitral and Gilgit, prominent tourist areas in the region, are situated in the north of the district. Swat’s average elevation is 975 meters, resulting in a considerably cooler and wetter climate compared to most of Pakistan (Moihuddin 2007). Swat is also home to rare Buddhist ruins and stupas, adding to the draw for tourism in the area.

While the capital of Swat is Saidu Sharif, Mingora—the site of the field study in Swat District—is the largest city and also the hub for social, cultural, and economic activity in the Malakand region. Mingora is the third-largest city in Khyber Pakhtunkhwa Province after Peshawar and Mardan. It enjoys a central position in trans-Hindu Kush-Himalayan development activities. Mingora, with a large number of hotels, is a main transit point for the major tourist destinations of Swat Valley. See Box 3.4 for a snapshot of tourism in Swat District. Population statistics for Swat District based on the 2017 Census are summarized in Table 3.4.

Table 3.4: Population statistics, Swat District, Khyber Pakhtunkhwa Province (2017)

Total population	2.3 million
Urban population	695,900
Rural population	1,613,670
Urban fraction (% of total)	30
Rural fraction (% of total)	70
Population density	430/sq. km.

Source: City Population 2018e

Box 3.4: A Snapshot of tourism in Swat District

Approximately 38 percent of the economy of Swat depends on tourism. The Swat River plays a significant role in the local economy, as it is the source of attraction for tourists and recreation for local residents. The river also provides water for irrigation and domestic use. That said, the river is under threat from a number of factors, such as waste pollution, deforestation, unplanned urbanization encroachments, illegal fishing, and lack of a proper sanitation system for most residential areas and hotels along the river.

According to local consultants, tourism department officials in the area have stated that no reliable data regarding tourist numbers is available; however, the number of tourists who visited Swat Valley in 2018 was estimated to be about 1 million.

Having been recently cleansed of militant presence, this restive mountainous region enjoys a peace and tranquility that has attracted an increasing number of visitors every year. The rise in tourist numbers has also boosted the local hotel industry by 10 percent in recent years.

Source: MAM 2020

3.5 Methodology of the Field Study

The data assimilated during the course of the field study was collected via a two-pronged approach: the use of waste sampling in order to identify the kinds of waste being generated as well as quantity and other factors, and a qualitative survey undertaken in specific key areas in order to better understand the mindset and awareness level of residents in these areas. Further details on the components of the study include:

- *Waste sampling:* This was done at source to determine the amount and composition of generated and discarded waste by different sources. Sources included households from low-, middle-, and high-income backgrounds and tourist establishments (hotels and restaurants).
- *Qualitative survey:* Interviews were conducted with residents and commercial establishments in order to better understand their behavior and habits with respect to SWM. The interviews also helped understand the respondents' level of awareness of waste management in mountainous regions.

In general, the targets of the qualitative surveys were local residents, domestic and foreign tourists, and hotel staff. For the qualitative survey in Pakistan, only households and tourist establishments (hotels) were interviewed; tourists were excluded. In contrast, the surveys in India and Nepal targeted local residents, hotel staff, and both domestic as well as foreign tourists. The data gathered from the qualitative survey are summarized in Table 3.5.

Table 3.5: Qualitative survey summary

Household survey	Hotel survey
• Socio-economic information • Waste generation, types of waste, segregation, and management • Waste collection services • Environmental awareness • Effort and willingness to better manage solid waste	• Waste generation, segregation, and management practices • Waste collection services • Waste management in the area • Waste related to tourists • Staff training

3.6 Respondents and Sample Size

Waste sampling was conducted at households and commercial establishments (hotels and restaurants) in Abbottabad city and Nathia Gali, both in Abbottabad District, as well as in Mingora, Swat District. Qualitative surveys of households and hotels were conducted in Mingora only. Tables 3.6 and 3.7 provide summaries of the field study in terms of types of respondents, sample size, samples collected, and qualitative surveys conducted.

Table 3.6: Pakistan field study: Waste sampling summary

District	Abbottabad		Swat
Field study site	Abbottabad	Nathia Gali	Mingora
Waste sampling conducted	30 households 5 hotels	5 commercial establishments (Hotels and restaurants)	30 households 5 hotels
Types of information gathered in waste sampling	Waste generation	Composition	Waste generation
	Composition		Composition
Total number of samples by location	147	38	280
Survey period (number of days)	5	8	8

Table 3.7: Pakistan field study: Qualitative survey summary

Field study site	Mingora
Survey size	30 households surveyed, 21 responded
	5 hotels
Number of interviews by location	26

3.7 Key Findings from the Field Study

The key findings from the waste sampling and qualitative surveys and observations from the study are summarized in this section. Please note that due to small sample sizes, as shown in Tables 3.6 and 3.7, these values should not be considered representative and are only meant to provide a snapshot of solid waste practices in the sample locations. It is suggested that further corroborative research be done prior to any decisions being taken based on the data at hand. The data collected during the field study are summarized in Appendix 1.

3.7.1 Results of Waste Sampling Conducted in Abbottabad and Swat Districts

Waste Generation:

- Waste generation in remote mountain communities is much lower than in mountain cities.
- In Swat District, readily biodegradable waste (RBW) makes up the largest fraction of waste generated by sampled households, as shown in Figure A1.1, whereas in Abbottabad District, non-biodegradable, non-recyclable (NB-NR) waste makes up the largest fraction of household generated waste, as shown in Table A1.3.³
- Overall, RBW makes up almost half of sampled household waste generated, followed by NB-NR waste, as summarized in Figure 3.1.
- Diapers and hazardous household waste are generated equally across all socio-economic groups (Mingora, Swat).
- At places frequented by tourists, plastic waste is the main constituent in mixed waste.
- The highest fraction of waste from commercial establishments, such as hotels and restaurants, is RBW, followed by NB-NR waste, as shown in Figure 3.2.
- Far more non-recyclable plastic is generated compared to recyclable plastic (Mingora, Swat).

³ For the purposes of this study, the following definitions have been used: Readily biodegradable waste includes kitchen (for example, vegetable peel, food scraps, bones) and garden (for example, grass cuttings, leaves and twigs, wood) waste. Biodegradable waste includes recyclable paper, hair/fur, textiles, leather and rubber. Non-biodegradable, non-recyclable waste consists of the non-recyclable fractions of plastic, paper, metal, and glass, domestic hazardous waste, Tetra Paks, diapers, and inert waste (for example, rocks and soil). Non-biodegradable, recyclable waste comprises the recyclable fraction of plastic, paper, metal, and glass.

Figure 3.1: Average composition of sampled household waste in Abbottabad and Swat Districts

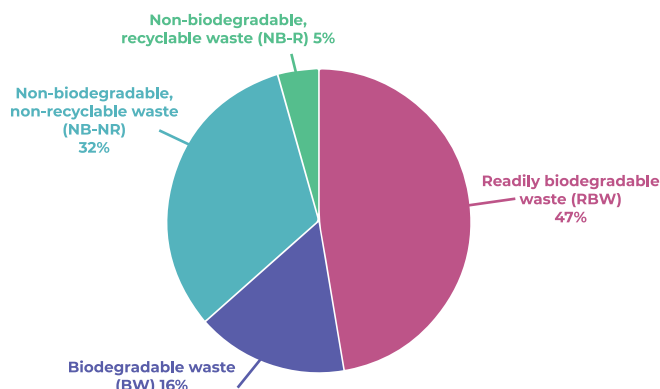
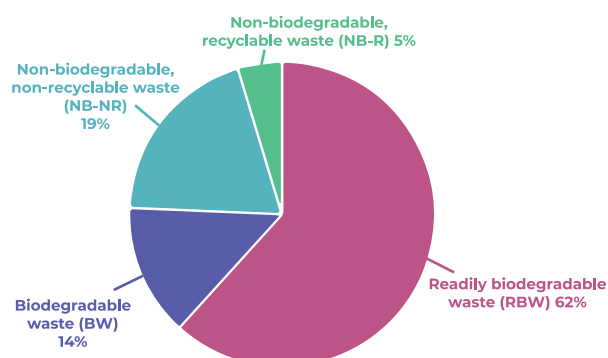


Figure 3.2: Average composition of sampled commercial waste in Abbottabad and Swat Districts



High Income vs. Low Income:

- High-income households generate more waste overall than low- and middle-income households.
- High-income households have the highest percentage of recyclables.
- There is considerably more variance in the amount of the grass/wood portion of RBW between high- and low-income households. This is probably due to high- and middle-income households having more green space/gardens compared to low-income households, and perhaps because low-income households use branches/wood as a fuel source.

Commercial vs. Household:

- Commercial establishments (hotels/restaurants) generate significantly more waste than households.
- Households generate a higher proportion of non-biodegradable waste than hotels, as shown in Figures 3.1 and 3.2.
- Heavily-frequented tourist establishments such as restaurants and hotels in mountainous regions generate more waste on average than commercial establishments in the valley/non-tourist areas.
- Waste composition of households and commercial entities are similar to other developing countries.

Swat vs. Abbottabad:

- In Swat, all households irrespective of socio-economic conditions generate similar amounts of biodegradable waste, while in Abbottabad, low-income households generate less biodegradable waste than middle- and high-income households.
- In Swat, even the non-biodegradable waste is evenly distributed across all three socio-economic groups, while in Abbottabad, low-income households generate a much higher proportion of NB-NR waste compared to others.
- There is considerable variation in the waste composition of tourist establishments in all places.

3.7.2 Results of Qualitative Survey Conducted in Households in Swat District

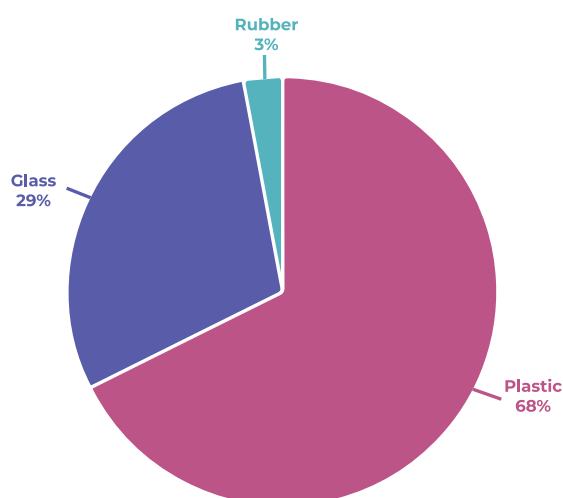
High Income vs. Low Income:

- All income groups generate plastic waste.
- Waste disposal in open drains is a common practice among all income groups.
- Low-income groups generate more plastic waste in the form of plastic bags, etc. than other groups.
- Only high-income areas have access to large community bins and the availability of community bins gradually decreases as incomes decline.

Waste Composition:

- Kitchen waste is the biggest fraction of waste generated in households.
- When asked what kind of non-biodegradable waste is generated, surveyed households primarily reported plastic and glass. Other fractions, such as metal and paper and cardboard, were not included, as shown in Figure 3.3.

Figure 3.3: Types of non-biodegradable waste generated according to surveyed households



Waste Storage, Collection, Segregation and Disposal:

- Almost no households segregate their waste; all wastes are mixed together in the bin/bag/box. This is significantly different compared to the other two countries in the study, as shown in Figure 3.4.
- The majority of households dispose of their biodegradable waste by providing it to the service provider or by throwing it away.
- Non-biodegradable waste is mostly disposed of by throwing it in community bins, followed by providing it to a service provider.
- However, the majority of respondents said there are no large bins for community disposal nor is there regular waste collection service.
- Since the majority of waste is not segregated, it is commonly disposed of in the following ways, from most to least common: by dumping or throwing in drains, disposing in community bins, providing it to waste collector, or burning the waste, as shown in Figure 3.5.

- Few households have access to waste collection services provided by the local public authority.
- Although the waste collection charge is approximately PRs 100 per month, those who receive the service are not satisfied due to improper collection and unreliability.
- The main complaint of residents regarding the current SWM system is that waste is left lying around, followed by odor.
- In areas where there is no collection service, residents collect the waste themselves every few days and either throw it in nearby areas, burn it, or dispose of the waste in the Swat River.

Figure 3.4: Percent of surveyed households segregating waste in the three countries

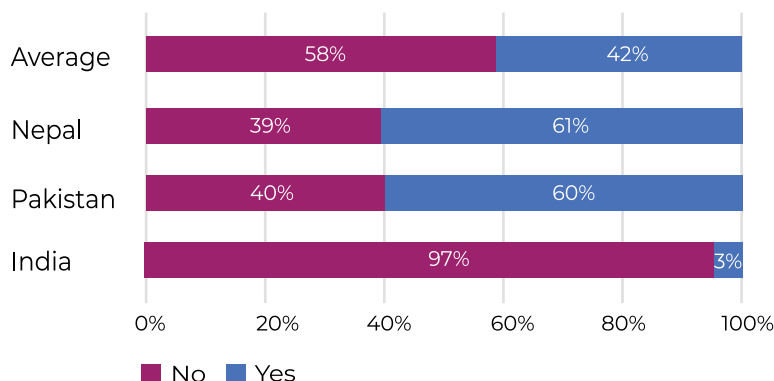
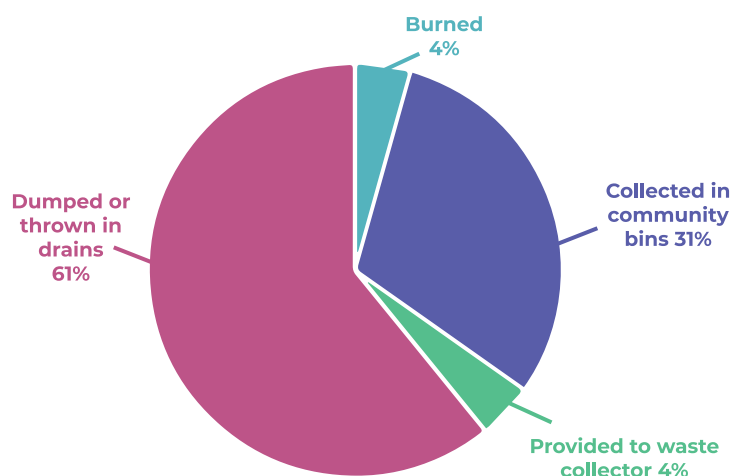


Figure 3.5: Disposal methods of unsegregated waste by surveyed households



Environment and Awareness:

- Waste was commonly found strewn around the community, uncollected, and left in the open.
- Odor from waste is one of the prevailing issues affecting residents in these areas.
- Some households had participated in clean-up activities in the surrounding areas.

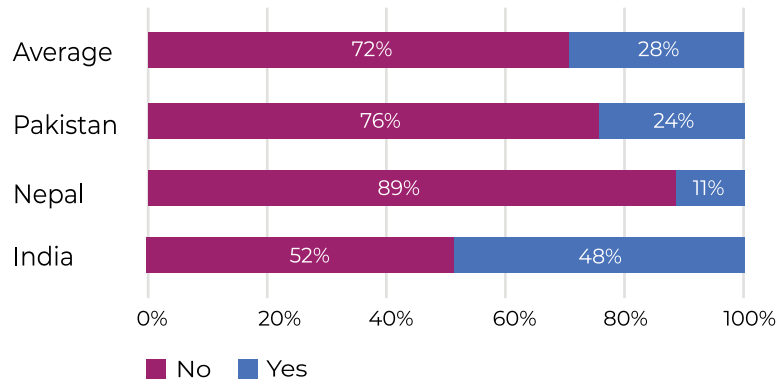
Willingness to Pay:

- A majority of surveyed households show a willingness to pay for services. This is not unusual and is seen in many other low-income country cities around the world. Residents are willing to pay for services if

they perceive that the standard of service is efficient. Figure 3.6 shows the willingness to pay for SWM services among sampled households in all three countries.

- Respondents claimed they are willing to pay anywhere between PRs 100-1,000 per month for waste collection services, with the majority willing to pay PRs 300 or less per month.

Figure 3.6: Willingness to pay for SWM services among sampled households



Environmental Awareness of SWM:

- Although most surveyed households think that waste management is an environmental problem, they are unaware of how the service provider disposes of their waste. Half of respondents say they are unconcerned about the disposal methods used, as shown in Figure 3.7.
- Almost all respondents said they believe environmental degradation has had a negative effect on their families.
- The most effective way of raising awareness according to surveyed households, from most to least preferred as summarized in Figure 3.8, is television, followed by social media, door-to-door campaigning, and newspapers.
- Households are willing to segregate their waste if the service provider provides a reliable service and requests that waste be segregated at source.

Figure 3.7: Summary of environmental awareness of surveyed households

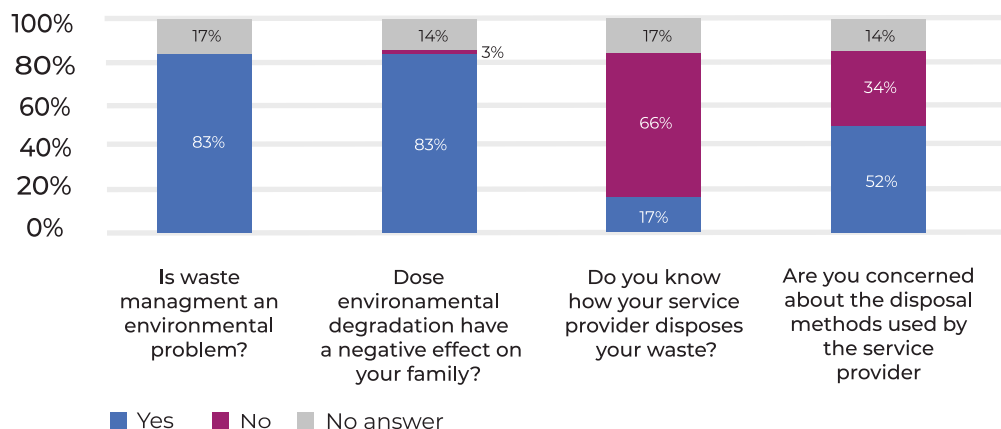
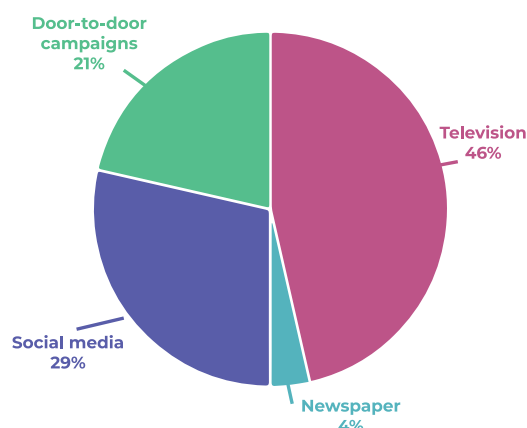


Figure 3.8: Awareness-raising methods according to surveyed households



3.7.3 Results of Qualitative Survey Conducted at Hotels in Swat District

- Just under half of the hotels surveyed segregate their waste into biodegradable and non-biodegradable fractions. The non-biodegradable waste is not further separated into various fractions.
- Most hotels supply their non-biodegradable waste to service providers; however, they also sell their non-biodegradable waste to waste-pickers and *kabarias*.
- More than half of the hotels surveyed pay service providers for SWM collection (PRs 5,000-6,000 per month)
- The majority of respondents said waste is collected daily by the service provider, but also said that they are dissatisfied by the type of service provided due to poor cleaning, infrequent collection, and poor performance.
- Some hotel staff are aware that the waste is disposed of in the Swat River.
- Just under half of the respondents are willing to pay more for SWM services, depending on the service provided, but all are willing to pay for SWM services.
- Just over half of the respondents said tourists to their hotel complain about poor SWM in the area.



4. Solid Waste Management Challenges in Mountain Areas of Pakistan

Regardless of location, type of habitation, or elevation, the solid waste management (SWM) sector is complex and requires multiple aspects to work in synergy in order to provide efficient services, protect public health, and conserve the environment. In low- and middle-income countries, it is all the more challenging because SWM requires significant prerequisites such as local government capacity, institutional coordination, stakeholder cooperation, and sustainable funding mechanisms. Other prerequisites include infrastructure, technical knowledge, public awareness, behavioral change, monitoring and enforcement, data collection and analysis, and relevant laws and policies.

The uniqueness of mountain areas adds to the challenges of managing solid waste in high-altitude areas. While SWM challenges may be shared by many types of locations, mountain areas relate to challenges more commonly associated with other eco-sensitive areas rather than their counterparts in the plains. These points are further elaborated in the following sections.

4.1 What Makes Mountain Areas Unique?

Mountain areas are unique for the following reasons: type of settlement, altitude and climate, topography and land availability, remoteness and connectivity, and accessibility by road, all of which have a combined effect on the range of SWM services that are needed and that can be provided. Each of these issues is explained below, in the context of how mountain areas are distinguishable from settlements in the plains.

- *Settlement type:* One might assume that mountain areas are dotted with small settlements in remote areas, where waste quantities generated are negligible compared to larger cities in the plains. However, mountain settlements—especially in the three countries that are the focus of this report—range from large mountain cities that are home to hundreds of thousands of people, to small towns and rural villages that are connected to larger cities by a road or train network, and to remote villages and tourist spots that can only be reached by foot and consist of few to no inhabitants. There are settlements that are tourist hotspots (for example, the “hill stations” in India and Pakistan established during colonial times), which see waves of population increases during peak season times, and others that are not popular tourist destinations. In Pakistan, at least one-quarter of the total population lives in hilly or mountain areas, based on available statistics. Table 4.1 lists the largest cities in Pakistan that are located in mountain areas.

Table 4.1: Top five mountain cities in Pakistan by population⁴

City	Population, 2017 (millions)	Elevation (meters)
Quetta, Balochistan	1.00	1,679
Chitral, Khyber Pakhtunkhwa	0.45	1,494
Mardan, Khyber Pakhtunkhwa	0.36	310
Mingora, Khyber Pakhtunkhwa	0.33	984
Kohat, Khyber Pakhtunkhwa	0.23	489
Abbottabad, Khyber Pakhtunkhwa	0.21	1,256

Source: City Population 2018c

- *Altitude and climate:* Mountain settlements in India, Nepal, and Pakistan span the gamut from low- to mid-altitude hills and plateaus offering a temperate climate to the largest concentrations of the highest peaks in the world that are characterized by extreme climate throughout the year.
- *Topography and land availability for SWM:* These are inter-related issues, where the topography may be suitable to establish SWM facilities but there is a lack of land, to where there may be ample land available but the topography may not be suitable for infrastructure such as sorting, processing, and treatment centers and landfills.
- *Seismic activity:* The Himalayan region is vulnerable to earthquakes, with major earthquakes affecting all three countries. While earthquakes also occur in non-mountain areas, development of waste infrastructure, particularly landfills, needs to be carefully considered. Landfill liners may tear, landfill gas and leachate collection systems may shift, and landfill covers may crack following an earthquake. These outcomes can cause severe pollution to groundwater aquifers, streams, and alpine lakes that are sources of freshwater not only for mountain communities but also for settlements downstream that support millions of people.
- *Remoteness and connectivity:* The importance of road or train connectivity to mountain settlements cannot be minimized with regard to SWM. Many aspects, such as types of bins, storage containers and facilities, frequency and efficiency of collection services, and availability of treatment options, are directly related to whether mountain settlements can transport their wastes. Even in large mountain cities, neighborhoods and localities would need waste collection services to collect and transport the waste to nearby facilities. The more remote a mountain settlement is, the more difficult and costly it is to provide SWM services.
- *Accessibility by road:* Mountain areas may or may not be connected by road to larger towns nearby and to cities in the plains. Moreover, those that have road networks may not have all-weather roads and may be cut off during the monsoon and winter seasons. This adds an additional layer of complexity to SWM services as storage facilities and transfer stations may need to be developed.

4.2 Shared and Diverse Challenges

One may assume that mountain cities face the same SWM challenges as cities in the plains, and that mountain villages and remote areas face the same issues as villages and remote locations in non-mountain areas. A closer look at the issue reveals that this assumption is both true as well as untrue. While all settlements

⁴ It is difficult to develop a standard definition of a mountain due to a range of different conditions, but generally a mountain can be said to be higher than 300 meters (UNEP 2007).

face certain SWM challenges, mountain areas tend to face additional ones by virtue of their location. This makes improving service provision in mountain areas all the more demanding compared to the plains. Table 4.2 summarizes the challenges faced by all areas regardless of location as well as the challenges unique to mountain areas.

Moreover, not all mountain areas are the same and vary by many localized factors, such as topography, climate, access, seasonality, waste volumes and types, and the impact of tourism. It is clear, then, that mountain areas require a suite of bespoke waste management solutions. Recommendations and options for mountain areas are discussed in Chapter 5.

Table 4.2: Comparison of SWM challenges in mountain and non-mountain areas

SWM in all Areas	SWM in Mountain Areas
• Poor awareness and adoption of SWM practices • Lack of waste segregation • Inadequate collection and storage facilities • Poor or obsolete transportation options • Lack of or poorly functioning treatment facilities • Improper waste disposal techniques • Competing priorities for local governments • Lack of institutional coordination • Lack of skilled and technical capacity • Lack of funding and poor cost recovery	• Topography and geology (e.g., steepness, ruggedness, soil stability) • Remoteness of settlements • Scattered and low-density areas generating low volumes of waste • Diverse temperature and weather conditions • Sensitive environmental and ecological conditions • Vulnerability from seismic activity • Lack of road networks making access difficult • Special types of waste generated (e.g., mountaineering waste), which require treatment and disposal • Waste transport requires vehicles suitable to mountainous regions • Limitations of space for waste treatment and disposal • Poor socio-economic conditions in general • High variability of waste generation due to tourist seasons

4.3 Shared Challenges with Other Eco-Sensitive Areas

Mountain areas face many SWM challenges that are similar to other eco-sensitive areas, such as protected areas (for example, conservation parks, sanctuaries), small island states, remote villages in Arctic regions, and so on. These areas have the following in common:

- Remoteness and distance to developed infrastructure for waste treatment and disposal make waste collection and transport challenging.
- They are scenic or have a unique landscape that tends to attract tourists. While this brings important revenue to these areas, it also adds to the waste build-up.
- Depending on the area, tourists may visit regardless of season, adding considerably to the year-round waste generated in the area.

- They often have space constraints so allocating space for treatment and disposal is not always an option.
- Decentralized waste management solutions may be better suited to these areas.

These commonalities are worth mentioning because SWM practices that have been established in other eco-sensitive areas may also be suitable to mountain areas. The *Good Practice Options for Sustainable Solid Waste Management in Mountain Areas of India, Nepal, and Pakistan* report of this study highlights examples of solid waste practices in small island states such as the Maldives, and the impact of tourism fees on islands in Indonesia.

4.4 Challenges Specific to Mountain Areas of Pakistan

Mountain areas are, therefore, quite complex and require considerable coordination, planning, and financing. One cannot address mountain waste in Pakistan without addressing the specific challenges related to the SWM chain in mountain areas. From the lack of coordination and financing, to the poor infrastructure in place to deal with treatment and disposal, a detailed look at the current system is necessary in order to overhaul and amend it. Figure 4.1 summarizes the various SWM challenges in Pakistan's mountain areas.

Figure 4.1: Summary of SWM challenges specific to mountain areas of Pakistan

Institutional coordination and financing	Availability of data and Awareness	Waste generation and segregation	Waste collection and transport	Waste treatment and disposal
• Lack of institutions (government or private sector) to deal with solid waste • Lack of enforcement of rules and regulations • Lack of government funding for the solid waste sector • Lack of incentives to encourage private sector participation • Lack of financing available to initiate projects • Lack of mechanisms to collect user fees to improve service delivery	• Basic data is not collected, hence difficult to develop formal SWM plans • Insufficient data on solid waste generated from tourism/mountaineering expeditions • Low environmental awareness of officials, residents, and tourists • Citizens' lack of respect and disregard for the law	• Waste quantities vary significantly based on settlement type • No formal system of waste segregation exists • Waste quantities and characteristics vary significantly between places that are tourist hotspots and those that are not, and also by season • Large amounts of plastic waste are generated in tourist destinations	• Topography, such as steepness, and remote access to certain places makes movement of waste difficult • Infrequent or no collection services exist in remote mountain areas • Most households do not have collection services • No proper storage bins/areas allocated by the government • Few vehicles available, if at all, for transport; lack of financial resources/funding to purchase more	• Most waste is commonly dumped along roadsides, drains, ravines, and in waterways • Open burning is common and also a major pollutant in the area • No treatment options available for non-biodegradable wastes • Mountain areas lack appropriate disposal systems



5. Recommendations and Actions for Solid Waste Management in Mountain Areas of Pakistan

Based on the issues identified in the course of analysis of the field study as provided in Chapter 3 and the solid waste management (SWM) challenges specific to mountain areas described in Chapter 4, it is clear that there can be no one-size-fits-all approach to mountain waste.

Nevertheless, taking a regional perspective of the three countries in the study, it is useful to think about the range of solutions that are warranted. Any proposed recommendation would require an understanding of the following factors and their inter-linkages. Proposed recommendations and related implementable actions along a phased approach are then presented in this chapter.

5.1 The Framework to Build Solutions

When thinking specifically about mountain waste and what is needed to overcome the relevant challenges, it is important to consider a framework or foundation on which solutions can steadily be built. The following factors need to be considered: landscape management approach, sources of waste, geography and location, types of waste, seasonality, and tourism-based waste.

5.1.1 Landscape Management Approach

An integrated landscape management (ILM) approach recognizes the inextricable links between forests, natural resources, and the value chains that depend on them, such as agriculture, timber, and tourism. This approach aims to ensure both an equitable as well as sustainable use of renewable natural resources such as forests, wildlife, water resources, and land, to improve livelihoods for the most vulnerable rural communities, while at the same time strengthening the health and resilience of surrounding landscapes.

Any long-term solution on mountain waste should be considered in the context of integrated landscape management. By doing so, it would help conserve, restore, valorize, and promote the sustainable use of natural resources in mountain habitats, such as forests and waterbodies (for example, streams and lakes). The approach also brings various stakeholders together around a common vision to manage trade-offs across different land use sectors within a given area (World Bank 2021a). See Box 5.1 for more information on the landscape management approach.

5.1.2 Sources of Waste Generation

Solid waste in mountain areas comes from two primary sources: settlements and tourism. Settlements include communities that live in these areas, many tracing back their heritage to ancient times. Tourism denotes outsiders who are temporarily visiting one or more locations either for leisure, pilgrimage, or for adventure tourism.

In India, Nepal, and Pakistan, settlements can be classified as (1) mountain cities or urban areas, (2) mountain villages or rural areas that are generally connected by some form of road network, and (3) remote areas that are not connected by road and can only be reached by foot. SWM practices will vary depending on the type of settlement. For example, mountain cities in India, Nepal, and Pakistan have hundreds of thousands of inhabitants, all contributing to year-round waste generation, which needs to be constantly managed in terms of collection, treatment, and disposal. On the other hand, small villages and remote locations may require decentralized approaches such as household or community composting to manage their wastes.

The second source of waste generation in these areas is from tourism. Tourists contribute significantly to the amount of municipal solid waste (MSW) generated in mountain areas, be they large cities or smaller isolated hamlets. In some places, tourism is a year-round industry and, therefore, the additional waste generated requires funding and coordination with tourism service providers, among other interventions. Tourism-related waste is described in further detail in Section 5.1.6.

Box 5.1: Understanding the Integrated Landscape Management Approach

The idea behind integrated landscape management (ILM) is to sustainably manage landscapes by bringing together multiple stakeholders with different land-use objectives. Instead of a sector-focused approach where sectors work in isolation, the ILM approach aims at simultaneously focusing on natural resource management, development, climate change, livelihoods, and food security, as well as other socio-economic and governance issues for a defined landscape or place. In this way, the landscape-based approach is increasingly recognized as an effective means to address challenges in food security, ecosystem conservation, and climate change.

Defining the Concept

The overarching objective of ILM is to maintain social, economic, and ecological functions in a balanced manner, and to contribute to sustainable development and the reduction of negative external impacts in a region. While there are multiple ways of approaching ILM, they all share some common salient points including (1) broad stakeholder participation, (2) negotiation around multiple objectives and strategies to develop shared understanding of multi-functional landscape, (3) adaptive management, based on shared learning, and (4) place-based and decentralized processes, emphasizing the role of local actors and their empowerment. Even defining the boundary of a landscape is done through the lens of what is locally feasible and spatially informed.

Since an ILM approach includes several sectors, actors, and may even have a variety of objectives, it is important that all related institutions, even informal bodies, and stakeholders have an established, integrated framework on which to collaborate and build upon in order to achieve their common goals. It is essential that stakeholders understand the workings and dynamics of a place and use locally-appropriate mechanisms as the basis for their actions.

In the context of ILM, landscapes can include multiple, interlinked functions and can provide a variety of services (for example, food, water, shelter, livelihood, economic growth, biodiversity, climate change regulation, and human well-being). The landscape, thus, becomes an ideal unit for planning and decision-making, allowing various sector plans and programs to be integrated into a single spatial context.

Source: World Bank 2021a

5.1.3 Geography and Location

While the sources of waste can provide indications of the quantity and types of waste generated, geography and location help in determining the infrastructure, equipment and vehicles, man power, and, therefore, funding required to manage the generated waste. For instance, steepness and remoteness of settlements would hamper certain types of waste collection services.

Mountain cities are more likely to be connected by road and rail networks to cities in the plains, thus enabling sorting and processing of waste before the waste is shipped to a large processor or recycler. On the contrary, waste transport vehicles would not be able to reach remote locations, and thus these areas would require different solutions from those in urban mountain areas.

5.1.4 Types of Waste Generated

The next consideration is the types of waste generated by these sources. Based on the type of settlement or by activity (in this case, tourism), it is possible to infer the types of waste generated. For instance, in mountain cities there is likely to be a mix of biodegradable and non-biodegradable waste, as well as special wastes such as construction and demolition (C&D) waste, healthcare waste, electronic waste, and inert/non-recyclable waste. In rural areas and remote communities, the primary type of waste would be biodegradable. In both these areas, biodegradable waste is higher in volume and weight compared to other wastes, and could be segregated and mostly managed at source.

Understanding the types of waste generated in different communities would enable planning or pre-planning for storage and collection systems, transportation vehicle requirements, and probable treatment and disposal options. For instance, in mountain cities, biodegradable waste may be better suited to community or centralized facilities due to the lack of space. However, in rural and remote areas, composting could easily be done at the household level.

5.1.5 Seasonality

When planning appropriate SWM systems in mountain areas, it is important to consider whether waste generation follows a pattern based on tourism, employment, or some other factor. Any popular tourist area, be it a mountain city or remote village, or even a base camp, will show fluctuations in waste quantities generated based on tourist seasons. For instance, in Pakistan, the peak tourist season is from May to September, while Nepal has two tourist seasons: from March to May and from September to November.

Waste management infrastructure and services need to accommodate variations in waste amounts for collection, transport, treatment, and disposal. However, seasonality is complicated, and may change over time. For instance, in many hill stations across India the concept of peak tourist season is fading away as more families are able to afford weekend getaways. Conversely, in other countries like Nepal, not only do peak leisure tourism times vary from adventure tourism, but the climbing season happens within a very short window of a few weeks every year, depending on the weather.

5.1.6 Tourism-based Waste

Mountain areas are magnets for tourism, and this brings with it an additional set of unique challenges related to SWM. Tourism is an interesting aspect of life in mountain areas because it has the potential to simultaneously be both economically lucrative and detrimental to the environment.

Leisure and adventure tourism—both domestic as well as international—are bringing growing numbers of visitors to mountain areas in the three countries in this study. Tourism-related activities (and the resulting waste generated) take place in mountain cities and towns, villages that act as transit points for trekking and climbing expeditions, and in uninhabited areas (high-altitude areas for mountaineering). Specific challenges associated with tourism waste include seasonality and the fact that tourists may care less about engaging in environmentally- friendly behavior while on holiday. The seasonality aspect is described in Section 5.1.5.

With regard to tourists engaging in sustainable behavior, research from the University of Queensland in Australia shows that even typically environmentally-conscious travelers do not necessarily make environmentally-friendly choices while on holiday. Reasons for this include:

- That it is the responsibility of the government or industry to manage waste
- A lack of information and awareness on prevalent waste practices
- Comparisons to other tourists' behavior
- While on holiday, tourists do not want to think about their environmental responsibilities (Dolnicar 2015).

An important aspect of tourism in mountain areas is associated with adventure tourism in uninhabited areas, such as high-altitude areas where mountaineering and trekking expeditions take place. In this case, no waste management services exist. Moreover, in high-altitude areas like the Himalayas, waste—whether solid waste, human excrement, or the remains of climbers—does not decompose easily due to the low temperatures. The only appropriate waste management strategy under these conditions is Leave No Trace, and specifically for solid waste, “Pack it in, Pack it out” (LNTCOE 2020).⁵

It has been observed that when areas become popular with tourists, the non-biodegradable waste fraction generated in these areas, such as plastic packaging, Tetra Paks, and glass, tends to increase. In addition, adventure tourism generates specific types of waste associated with climbing equipment and supplies such as tin cans, oxygen bottles, batteries, ropes, and tents. When this happens, waste systems must adapt to changing waste compositions. In this way, tourism affects the types of waste generated, and thus will have a cascading effect on how this waste is collected, where it is transported to, and how it is treated and disposed of.

5.2 Recommendations and Actions

Understanding that solutions for SWM in mountain areas need to be devised in a framework considering waste sources, geography and location, types of waste generated, seasonality, and tourism-based waste, it is recommended that an action plan or policy specific to mountain waste be created at the national level. An action plan or policy would detail the current waste situation in mountain areas in the country, set targets for the sector (on collection, treatment, recycling, and disposal), and create guidelines on financial sustainability, public awareness, promotion of a green economy, and rehabilitation of contaminated sites.

In support of this suggestion for a specific mountain waste plan or policy, this report presents various recommendations that are supported with implementable actions. These actions have been elaborated

in a phased manner, rather than in a time-bound fashion, taking into consideration that implementation of a mountain waste plan or policy may progress according to different time frames in different countries. A phased approach allows for flexibility by respective national, provincial/state, or local governments. The recommendations presented in this section are suggested taking into account an integrated approach of SWM. The concept of integrated solid waste management (ISWM) is described in Box 5.2. Box 5.3 provides a note on how to use Tables 5.1-5.5 presenting the suggested actions.

⁵ Leave No Trace is a set of seven ethics principles designed to promote conservation in nature while participating in outdoor recreational activities. One of the principles is to dispose of waste properly. “Pack it in, Pack it out” essentially means taking back unused materials and waste to be disposed of in waste bins or back home and not leave them in the outdoors.

A number of the suggested actions may be initiated simultaneously, regardless of the phase they are in, and may work concurrently with one another. For example, open dumping should be banned only once waste storage sites are opened, otherwise the ban is likely to be ineffectual. Similarly, fines for littering should ideally run simultaneously with awareness campaigns so that residents and tourists alike are aware of the new regulations.

It should be noted that these recommendations and various implementable actions have been developed primarily with mountain areas in mind; however, the recommendations listed here may work for non-mountain areas as well, as a number of challenges are the same (as given in Table 4.2). While individual communities can manage certain aspects of solid waste management by themselves, such as household composting for small villages or remote hamlets, that may not be enough. In addition, integrating measures by connecting sub-areas in order to provide centralized services, such as regional treatment facilities, is also needed. This will depend on local conditions, geography, and location of settlements, and hence needs to be developed at an intrinsically local level.

At each stage constant monitoring is required to see how effective programs have been:

- If something has worked, it is important to track what made it successful and how can it be scaled-up or expanded in a way that benefits the rest of the region or even the country.
- If something did not work, it is important to identify the factors behind the failure as well as the barriers to implementation so that changes can be made to support future implementation.

It is important to note that the recommendations and implementable actions provided in the remainder of this chapter are meant to propose ideas for the way forward, and should not be considered unalterable. It is expected that respective governments, should they wish with assistance from the World Bank, would develop a mountain waste plan or policy based on the specific scenario regarding mountain waste in their countries.

Box 5.2: Integrated solid waste management

Integrated solid waste management (ISWM) is a comprehensive framework for solid waste management (SWM), pictorially depicted in Figure B5.2.1. It includes all aspects of running an efficient, coordinated waste system, including the waste hierarchy, stakeholders, policy and legal, technological, financial, economic, environmental, and institutional aspects. The ultimate aim of ISWM is to manage an SWM system in a way that is environmentally, financially, and socially sustainable.

ISWM is based on four basic principles:

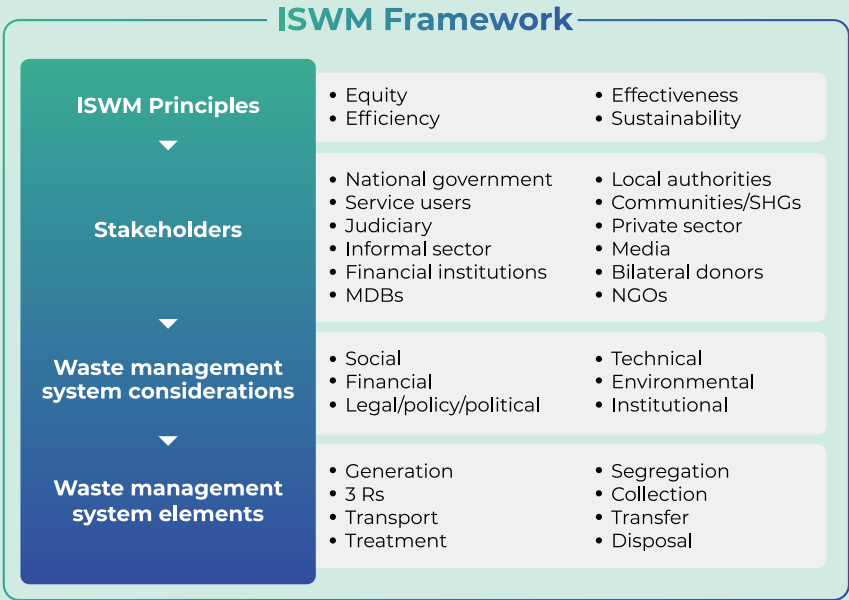
- **Equity:** Everyone is entitled to a functioning waste management system that protects human health as well as the environment.
- **Effectiveness:** Any SWM plan must meet its objectives; at minimum, all waste should be collected and disposed of in a safe and environmentally friendly manner.
- **Efficiency:** Maximizing benefits, minimizing costs, and optimizing use of resources.
- **Sustainability:** The system should be effective, maintained over time, and without exhausting resources.

An ISWM framework should ideally consider all aspects of government, from national waste policies and directives to local-level implementation. It is intended to be used as a practical tool to evaluate local conditions

and needs and then to select the most appropriate waste strategies, given legal conditions, technical capacity, know-how, and financial capacity. For instance, a city that does not have the financial ability and technical knowledge to establish a waste-to-energy facility should not consider waste incineration in its ISWM plan.

Notice that the waste hierarchy and 3 Rs are only one aspect of the ISWM framework. A number of other factors need to be considered and fit together like a jigsaw puzzle in order to have a truly integrated solid waste management plan.

Figure B5.2.1: Illustrated representation of ISWM



Box 5.3: A note on how to use the tables on suggested actions

- Recommendations are grouped based on an integrated solid waste management framework.
- Each table focuses on a set of recommendations and related implementable actions.
- The SWM challenges identified in the course of this study have formed the basis for these recommendations.
- Proposed actions are organized horizontally into three phases loosely denoting immediate, medium-term, and long-term, with the assumption that once the actions in the first phase are achieved, the recommendations in the next phase can be worked on, and so on.
- Actions are also organized vertically in a logical flow for each phase.
- Each action proposes suggestions for which stakeholders may be most appropriate in implementing these recommendations. These may be modified depending on the local situation or change over time.

5.2.1 Recommendations related to Institutional Coordination, Financing, and Stakeholders

Recommendations related to institutional coordination, financing, and stakeholders in mountain areas include:

- Develop local government policies and regulations in line with national guidelines and standards
- Operationalize the SWM system at the local government level through technical capacity development
- Involve local communities and community-based organizations (CBOs) in waste segregation and collection
- Create systemic opportunities to bring in economies of scale and to engage the private sector as well as other stakeholders
- Enable integration of the informal sector to engage in waste management services
- Enable collaboration of related agencies, such as tourism, forestry, and natural resource management
- Establish a monitoring and enforcement system to improve and sustain waste management services.

Based on these recommendations, suggested actions for implementation in a phased manner are presented in Table 5.1.

Table 5.1: Suggested actions related to institutional coordination, financing, and stakeholders

Issue	Phase 1	Phase 2	Phase 3
Policy/strategy for mountain waste	Approach the problem of mountain waste via an ILM approach, which would provide livelihood options while at the same time preserving and protecting the environment and developing related sectors in a sustainable manner G I	Prepare a mountain SWM policy/strategy with input from all stakeholders and based on ISWM principles and considering an ILM approach G I N P S	Enforce and monitor the adoption of mountain SWM policy/strategy G
	Adopt the goal to develop a policy/strategy for mountain waste G	Convene all stakeholders at regular intervals in order to facilitate cooperation and understanding and to promote a coordinated approach G I N P S	When national policies regarding waste are created, ensure that mountain areas are not only considered, but that their unique issues are accommodated G I
	Provide policy support for development of bylaws and regulations to meet national guidelines and standards G I N		Local SWM plans should incorporate a climate and disaster waste management focus to prepare for earthquakes, landslides, and floods, especially in the seismically active Himalayan region, and the impact on waste sites G I N
	Adopt ISWM and 3 R goals for mountain waste G N S		Develop SWM plans for waste types other than MSW (e.g., healthcare, household hazardous, C&D), depending on the data collected on these waste types G I
	Acknowledge that rural areas also are an important part of SWM and can no longer be ignored. With improvements in road networks, waste composition is changing (e.g., increase in use of sachets); tourism waste also increases non-biodegradable fraction G		
	To work towards a decentralized approach, analyze the "capacity to act" of various institutions and stakeholders G I N P S		

Table 5.1: Suggested actions related to institutional coordination, financing, and stakeholders (contd.)

Issue	Phase 1	Phase 2	Phase 3
Institutions	Establish SWM department at the local level G	Incentivize local governments and institutions to adopt policies G I	Set-up formal structures for inter-municipal cooperation to help with procurement of bins, vehicles, storage and treatment equipment, disposal facilities G I N P
	Set up facility for inter-agency cooperation (e.g., tourism, forest, natural resource management, SWM), which is essential in an ILM approach G I	Build capacity of waste management governance G I	
Financing	Review methods of user fee collection and what is most applicable and practical to implement G I	Consider various forms of sustainable financing (e.g., user fees, taxes, gate fees, EPR, etc.) G I N P S	User fee collection should be well established by now and close to 100%; can then shift to variable pricing, such as based on volume or weight generated G I
	Identify ways to support micro-enterprises; micro-loans for those who want to generate income from waste G I N S	Determine appropriate model for fee collection based on local context (e.g., polluter pays, cross-subsidy across income levels, flat fee) and how to collect it (e.g., through utility bill, property tax, door-to-door, etc.) G I	Consider other methods such as results-based financing to improve service delivery and cost recovery G I
	Identify options for segregated waste (e.g., sell in nearby cities, take to the plains) that could earn revenue for collectors of the waste G I N	Review methods to improve cost recovery G I	Initiate local-level EPR such as tourism tax through hotels, companies being responsible for collection of materials, deposit-refund schemes, eco-tax, etc. G I
	Identify options for providing small-scale financing or microloans to the most vulnerable populations G I	Initiate microfinancing on a pilot basis for vulnerable populations G N S	Institute and/or enforce refundable fees for protected areas to support waste collection, clean-up campaigns, etc. G N
			Expand micro-financing options to reach a wider section of people as well as to cover wider areas G N S

Table 5.1: Suggested actions related to institutional coordination, financing, and stakeholders (contd.)

Issue	Phase 1	Phase 2	Phase 3
Stakeholders	Approach NGOs, SHGs, and CBOs as stakeholders and invite them to participate in the decision-making process G N S	Establish a think-tank to connect policy makers with academics, private sector, informal sector, and civil society to develop the best possible solutions G I	Establish public-private partnerships to improve efficiency in the SWM chain, if private sector participation is desired G P
	Identify ways to include or formalize participation of the informal sector in providing mountain SWM services G N S	Formalize participation of informal sector in mountain SWM services G N S	The role of local government shifts from service provision to regulation as private sector gets increasingly involved in providing SWM services G N P
	Identify whether private sector would be better suited to provide services than the municipality G I	Develop and provide incentives for reuse of materials (e.g., wood from demolition) by including informal sector as well as other stakeholders G N P	Ban single-use plastics once substitutes are available in the market G
	Encourage private sector as part of their CSR to fund clean-up activities, e.g., “adopt a highway” G P S	Promote women’s representation and leadership in committees and decision-making roles at the community level G S	Encourage development of substitutes for single-use plastics by providing initiatives G I N P S
Monitoring and enforcement	Review enforcement and monitoring processes G	Initiate a score card system for citizens in mountain areas to rank implementation of policies, service delivery, cleanliness, etc. to provide an additional layer of monitoring G I N	Encourage action by citizens to participate in monitoring of mountain SWM services G N S
	Strengthen monitoring capacity and enforcement of penalties by installing cameras as a deterrent, spot fines, etc. G	Develop monitoring and evaluation capacity of civil society by supporting CBOs to use sound methodologies and systems to measure results G I N S	

Note: **G**: Government (includes all levels of government: national/central, state/provincial, and local; urban and rural local governing bodies); **I**: International/bilateral agencies, multilateral development banks, donor funds; **N**: Non-governmental organizations; **P**: Private sector; **S**: Self-help groups, including CBOs

5.2.2 Recommendations related to Availability of Data and Public Awareness

Recommendations related to data and public awareness in mountain areas include:

- Coordinate with various agencies to improve data collection, availability, and to create public awareness
- Start data gathering as a continuous exercise in order to make better decisions, set targets, and monitor policy implementation
- Increase public awareness on managing waste and impacts of SWM in mountain areas

- Introduce and expand training programs to build capacity of local government staff and decision makers.

Based on these recommendations, suggested actions for implementation in a phased manner are presented in Table 5.2.

Table 5.2: Suggested actions related to availability of data and public awareness

Issue	Phase 1	Phase 2	Phase 3
Data gathering, analysis, and implementation; record-keeping	Conduct rapid assessments to gather data on key waste indicators to indicate how to move forward G I N	Detailed data gathering exercise to identify specific types of waste, amounts, etc., especially seasonality of waste based on tourism and climate G I	Identify other types of waste generated (e.g., healthcare, household hazardous, C&D) besides MSW which may require different procedures and processes for collection, treatment, and disposal G I N
	Set up short and long-term targets to monitor newly established systems to analyze whether they are successful or need tweaking G I	Institute recordkeeping, preferably digitally, of waste data G I	
		Establish or adopt performance monitoring/benchmarking G	
Public awareness and behavioral change	Generate public awareness through social media, websites; schools and education; door-to-door campaigns G I N P S	Create a regional/global network for knowledge sharing, capacity building for solid waste in mountain areas G I N	Strengthen ability of residents/civil society to monitor SWM activities; give them a sense of ownership through citizen reporting apps G N S
	Acknowledge the changing nature of waste (even in rural areas) and thus flexibility needed to make changes G I	Require tourism industry to be up-to-date on waste regulations and educate tourists through websites, tour companies, brochures, posters, etc. G N P S	Implement waste monitoring programs G N S
	Plan behavioral change campaigns for better SWM practices through media (e.g., press, radio, digital) and education (e.g., schools) G I N P S	Implement and expand behavioral change campaigns for better SWM practices; utilize community health workers to deliver regular training on the importance of better SWM practices G I N P S	Create regional platforms to share dialogue on mountain waste management practices G I N
			Foster community responsibility for improved SWM by building community awareness and equipping citizens with resources and training to practice those behaviors G N S

Table 5.2: Suggested actions related to availability of data and public awareness (contd.)

Issue	Phase 1	Phase 2	Phase 3
Training on SWM in mountain areas	Work with various stakeholders to encourage clean-up campaigns G I N P S	Initiate training for local government staff on practical aspects such as cost recovery, comparing technologies G I N	Build capacity of mountain communities and local governments to meet SWM challenges G I N S
	Work with mountaineering associations and tour guides to generate ideas to reduce SWM issues on trails/expeditions G N	Design data toolkits to easily gather data in hard to reach places. Make it easy to use so that anyone can use it G I N	Create training programs through regional platforms to offer wide-spread training and opportunities to learn from various regions G I N S
	Promote 3 Rs and offer training on sustainable SWM to schools and colleges N S		

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5.2.3 Recommendations related to Waste Generation and Segregation

Recommendations related to waste generation and segregation in mountain areas include:

- Enable source segregation to allow for value extraction and recycling of both biodegradable and non-biodegradable materials
- Enable separation of biodegradable waste for useful purposes at the household or community level
- Involve local communities and CBOs by considering various aspects, such as income generation
- Create policies to manage other wastes (C&D, hazardous, healthcare, e-waste) in mountain cities.

Based on these recommendations, suggested actions for implementation in a phased manner are presented in Table 5.3.

Table 5.3: Suggested actions related to waste generation and segregation

Issue	Phase 1	Phase 2	Phase 3
Waste generation at household and commercial entity level	Distribute waste bins for free to promote segregation into wet and dry fractions G N S	Scale-up three-stream source segregation in cities/large towns that generate considerable amounts of non-biodegradable waste, provide ways to encourage segregation G I N P S	Waste segregation at source becomes mandatory G
	Pilot source segregation into three streams, e.g., biodegradable (wet), non-biodegradable (dry), and domestic hazardous (e.g., diapers, household hazardous waste) fractions G I N S		Introduce segregation of dry waste into various categories depending on results of waste characterization studies (e.g., paper, cardboard, plastic, metal, glass) G
			Segregation of domestic hazardous waste (e.g., batteries, engine oils, paints, etc.) and storage until they can be shipped to the plains G N P S
Composting at source	Pilot or scale-up composting options such as in-vessel, vermicomposting, and biomethanation at household- and community-level G N S	Study use of biodegradable waste for biomethanation, which has multiple co-benefits like reducing use of kerosene or LNG for cooking at source level G N	Promotion of organic farming through the use of compost G N P S
	Scale-up segregation of biodegradable waste to be used as compost, animal feed, or for biomethanation in mountain areas itself G N P S	Provide subsidies for home composting techniques, such as vermicomposting or bin composting G	Phase out the use of chemical fertilizers in public parks, gardens, and nurseries and mandate the use of local compost G N P S
	Provide awareness and training on how to compost at home G I N S		Compost made from biodegradable waste can be marketed and sold to farmers, nurseries G I N P S
Generation of mountaineering/ trekking waste, waste from adventure tourism	Develop and promote awareness of guidelines for mountaineering/ trekking waste and waste from adventure tourism G I N S	Require mountaineering associations, tour guides, etc. to strictly enforce Leave No Trace/“Pack it in, Pack it out” policies G N	Institute and enforce refundable fees for protected areas to support waste collection, clean-up campaigns, etc. G N
	Introduce Leave No Trace/“Pack it in, Pack it out” to reduce waste from adventure tourism G N P S		

Table 5.3: Suggested actions related to waste generation and segregation (contd.)

Issue	Phase 1	Phase 2	Phase 3
Construction and demolition (C&D) waste	Identify companies involved in construction/renovation to use C&D waste generated by them as landfill cover G N P	Companies to begin minimal processing of C&D waste in order to make it suitable for use as landfill cover and other uses G P	Inert waste (e.g., C&D material) transported directly to nearest sanitary landfill for use as daily cover G P
	Identify other uses of C&D waste G I N	Consider policies related to using C&D waste for slope stabilization and other uses G P	Implementation of other uses for C&D waste G I N P S
Other wastes (mountaineering, healthcare, e-waste)	Understand the types and quantities of other wastes generated in mountain areas G I N S	Prepare guidelines/plans for segregation, collection, storage, and transport of these wastes to locations/facilities that can treat and dispose these wastes G I N	Implement and enforce guidelines/plans for other wastes developed in previous phase G

Note: **G**: Government (includes all levels of government: national/central, state/provincial, and local; urban and rural local governing bodies); **I**: International/bilateral agencies, multilateral development banks, donor funds; **N**: Non-governmental organizations; **P**: Private sector; **S**: Self-help groups, including CBOs

5.2.4 Recommendations related to Waste Collection, Transfer, Storage, Processing, and Transport

Recommendations related to waste collection, transfer, storage, processing, and transport in mountain areas include:

- Improve waste collection systems and upgrade service delivery
- Establish waste storage and transfer systems to manage waste
- Enable sorting and processing of non-biodegradables for higher monetary returns
- Find innovative ways to collect and transport waste from mountain areas that are particularly challenging due to remoteness, topography, and lack of road network.

Based on these recommendations, suggested actions for implementation in a phased manner are presented in Table 5.4.

Table 5.4: Suggested actions related to waste collection, transfer, storage, processing, and transport

Issue	Phase 1	Phase 2	Phase 3
Waste collection	Identify existing collection routes, collection schedules, and mapping, if available, to see how they can be improved and how efficiently they work G I N P S	Improve collection coverage in all areas, including streets, tourist spots, etc. G I N P S	Expand collection coverage to 100% to reach all areas G N P S
	Explore the best ways to collect waste, keeping in mind that in hilly and mountain areas, door-to-door collection may not always be possible G I N	If source segregation has commenced, separate collection of biodegradable and non-biodegradable waste required G I N P S	
	Waste collection frequency should be increased so that users of the service recognize that the government is serious about SWM; this will positively impact user fee collection G	Involve the informal sector in waste collection, street sweeping, and segregation activities through NGOs, cooperatives/associations G N S	
	Identify spots that are frequently littered (e.g., tourist spots) and set up waste collection bins there G N S		
Budgeting waste collection	Local governments to allocate budget for waste collection so that once residents see an improvement in SWM, they are likely to pay for services G	In-depth study on waste fee systems as collection rates increase to identify most suitable options G I	Enforce waste fee system, starting with a flat fee to pay-as-you-throw system eventually G
Clean-up campaigns	Increase street sweeping in crowded areas as cleanliness provides an important first impression and will make residents proud and tourists aware of the no littering policy G	Incentivize tourists and pilgrims to bring their waste back to more populated areas where waste can be sorted by giving them vouchers, discounts in areas G P	Institute refundable fees or tourist fees in protected areas to support waste collection, clean-up campaigns, etc. G N
	Implement clean-up campaigns to bring down waste left over from previous mountain expeditions G N S	Add signage in popular tourist areas regarding cleanliness and littering G N S	
Collection bins	Waste collection bins should be frequently emptied so that they are not an eyesore nor attract vermin or animals G	Upgrade waste collection bins to source-separated bins that are clearly labeled to ensure separation of waste G P	
		As far as possible, use locally-made bins as they are easily available and less expensive G N P	

Table 5.4: Suggested actions related to waste collection, transfer, storage, processing, and transport (contd.)

Issue	Phase 1	Phase 2	Phase 3
Waste storage, transfer, and sorting	Identify sites to store recyclable and non-recyclable waste before they can be taken to the plains for further processing G N S	Establish storage sites/mini-transfer stations for both biodegradable and non-biodegradable waste G N P	Establish deposit centers/ storage facilities for domestic hazardous waste G N P
	Identify sites for treatment of biodegradable waste, especially in mountain cities where households and communities lack space for individual composting units G N P S		Sorting of recyclable and non-recyclable waste at sorting/mini-transfer stations by local inhabitants to create livelihood opportunities N P S
Waste processing and upcycling	Identify ways to sort/process waste in mountainous regions in order to provide livelihood opportunities G I N P S	Work with cottage industries, provide training to women's groups to process waste before selling non-biodegradables in order to gain more value G N P S	Work with cottage industries, tourism agencies, women's groups to upcycle waste into products that can be sold (e.g., souvenirs at tourist shops) G N P S
	Identify opportunities and areas for jobs creation and local entrepreneurship (e.g., fiber-based packaging) G I N P S	Initiate micro-financing loans on a pilot basis to encourage vulnerable populations, such as the poor and women, to participate in livelihood activities G I N S	Expand micro-financing options for broader outreach both in terms of numbers of people as well as by geography G I N
Waste transport	Consider various options for transport, including non-motorized modes and pack animals, keeping in mind that not all mountain communities are connected by road G I N S	Design transportation systems based on waste characteristics (e.g., volume, moisture), which can be done only after thorough waste data is collected G I P S	Transport equipment/vehicles and labor should meet 100% collection efficiency and source segregation goals G I N P S
	Transportation options need to be considered in concert with waste segregation and collection practices, as well as taking into account transportation costs, which can be considerable in these areas G I N	Transport equipment/vehicles must be able to handle source segregated waste G I N P S	

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5.2.5 Recommendations related to Waste Treatment and Disposal

Recommendations related to waste treatment and disposal in mountain areas include:

- Ban the open dumping and burning of waste
- Find suitable alternatives for treatment of non-biodegradable waste and for waste disposal.

Based on these recommendations, suggested actions for implementation in a phased manner are presented in Table 5.5.

Table 5.5: Suggested actions related to waste treatment and disposal

Issue	Phase 1	Phase 2	Phase 3
Waste treatment	Initiate review of various waste treatment technologies that could be applied while considering all variables (see Table 5.6 for menu of possible options) G I N	Design of treatment and disposal facilities should be done based on the characteristics of waste; this can be done only after thorough waste data is collected G I	Identify if RDF/SRF processing can be established and nearby entities that can use RDF/SRF as feedstock, such as local or regional cement plants G N
	Analyze technical options in the context of cultural norms, political and societal feasibility, as well as costs and benefits G I	As far as possible, identify and use locally-available technology as maintenance, repair, and spare parts are easily available and less expensive G I N P S	Establish combined/regional treatment and disposal facilities to provide services to multiple municipalities G I N P S
Mid- to large-scale composting	Biodegradable waste generated in sufficiently large quantities to be treated in mid- to large-scale facilities, e.g., windrow composting, biomethanation G I N P S	Identify markets for ready compost, provide certification of compost quality in order to increase revenue from composting treatment G I P	Enforce phase-out of synthetic, petroleum-based fertilizers and switch to compost; facilitate organic farming through the use of locally-made compost G I N P S
Dump sites	Identify and map out illegal waste dumps and areas where waste is routinely dumped (e.g., ravines) G I N S	Institute a complete ban on waste dumping and burning by levying large fines on offenders, at the same time that storage facilities become operational G	Close all illegal dumping areas by clearing out the accumulated waste and installing signage regarding closure G N S
Landfills	As far as possible, avoid constructing sanitary landfills in mountain areas; if unavoidable, keep in mind that mind topography, depth to aquifer, control of inflowing water, availability of daily cover are necessary G I N	If landfilling is unavoidable, construct smaller landfills close to densely-populated areas and away from water sources G I P	Construct sanitary landfills if only absolutely necessary; identify options for landfill sites in the plains, if possible G I P
	Initiate zero-landfill strategies for mountainous regions G I N	Develop sanitary landfill site selection criteria and operating guidelines specifically for mountain areas G I	

Note: **G**: Government (includes all levels of government: national/central, state/provincial, and local; urban and rural local governing bodies); **I**: International/bilateral agencies, multilateral development banks, donor funds; **N**: Non-governmental organizations; **P**: Private sector; **S**: Self-help groups, including CBOs

5.3 Menu of Options for Collection, Transport, and Treatment of Mountain Waste

Keeping in mind that waste collection, transport, and treatment are challenging in hilly and mountain areas, a menu of broad options for these SWM services are presented in Table 5.6. The table also shows which mountain area(s) a particular option might be most suited to. Some of these methods are already used in mountainous regions and are highlighted in the *Good Practice Options for Sustainable Solid Waste Management in Mountain Areas of India, Nepal, and Pakistan* report. Many of these options may be applicable (or modified

to suit) non-mountain areas also; however, the options have been presented here based on their applicability to mountain areas. It should be noted that this is not meant to be an exhaustive list, and there may be other options that may be better suited depending on the local context.

Table 5.6: Menu of options for collection, transport, and treatment of mountain waste

Option	Mountain cities and towns	Rural areas with road access	Remote areas not connected by road	High-altitude areas (mountaineering/trekking waste)
Collection and Transport				
Use of pack animals to collect non-biodegradable waste			✓	✓ (base camps)
Use of non-motorized options (e.g., tricycles, animal-drawn carts)		✓	✓	
Use of locally-available motorized options (e.g., three-wheelers, tractors)	✓	✓	✓	
Use of containerized handcarts, three-wheelers for segregated waste	✓	✓		
Use of dump trucks and waste transport vehicles suitable to mountain regions	✓	✓		
Workers collect non-biodegradable waste in back-packs provided by service provider ⁸			✓	✓ (base camps)
Drop-off waste at specific collection points	✓	✓	✓	✓
Pooling resources through inter-municipal cooperation to improve service delivery and reduce costs	✓	✓	✓	
Special non-biodegradable wastes (e-waste, climbing equipment): Ensure collection through EPR/deposit fees, which factor in costs of transportation to nearest processing/disposal center	✓	✓	✓	✓
Treatment				
Biodegradable waste: Composting at source (e.g., pit, bin, vermicomposting, pile)	✓	✓	✓	
Biodegradable waste: Composting at community-level (e.g., bin, vermicomposting, black soldier fly larvae)	✓	✓	✓	✓ (base camps)
Biodegradable waste: Medium- to large-scale composting	✓	✓		
Biodegradable waste: Community-scale biomethanation to be used output as cooking or energy source	✓	✓	✓	✓ (base camps)
Biodegradable waste: Combine household and animal/livestock waste to improve biomethanation		✓	✓	
Biodegradable waste: Large-scale composting facilities	✓			
Non-biodegradable, recyclable waste: Sorting and minimal processing for value addition at transfer stations	✓	✓	✓	
Non-biodegradable, non-recyclable waste: Conversion to RDF/SRF for use in nearby cement, WTE plants	✓	✓		
Non-biodegradable waste: Upcycling waste for local use and tourists	✓	✓	✓	

⁸ This option is provided in *Swachh Bharat* Mission guidelines for hilly areas in India (CPHEEO 2016).



6. Looking Ahead: Role of the World Bank and Other Donors

The World Bank finances and advises on solid waste management (SWM) projects using a diverse range of products and services, including traditional loans, development policy financing, Program-for-Results (PforR), results-based financing, and technical advisory services. World Bank-financed waste management projects encompass the entire waste management chain, from generation to collection and transportation, and finally treatment and disposal.

Since 2000, the World Bank has committed over \$4.7 billion to more than 340 SWM programs in all six regions of the World Bank. Numerous initiatives to develop infrastructure and technical assistance have been implemented. For instance, the following projects in South Asia itself:

- In Nepal, a results-based financing project of \$4.3 million increased user fee collection and improved waste collection services in five municipalities, benefitting 800,000 residents.
- In Pakistan, a \$5.5 million-dollar project supported a composting facility in Lahore in market development and the sale of emission reduction credits under the Kyoto Protocol of the United Nations Framework Convention on Climate Change (UNFCCC). Activities resulted in reductions of 150,000 tonnes of carbon dioxide equivalent and expansion of daily compost production volume from 300 to 1,000 tonnes per day (World Bank 2019).

World Bank engagement in SWM is supported through valuable partnerships such as with the Korea Green Growth Trust Fund, which provided funding for this project.

National and state/provincial governments are generally supportive of efforts to accelerate improvements to the SWM sector although this is fundamentally a municipal function and challenges have to be addressed at the municipal level. Support to clients to improve SWM services and practices in mountain areas in the South Asia Region—and elsewhere—could include the following, as summarized in Figure 6.1:

Client engagement: The World Bank supports its client countries in the form of analytical advisory activities as well as through operations. The World Bank supports infrastructure creation and service provision through various financing mechanisms such as traditional loans, program-for results, results-based financing, private sector financing and guarantees, to name a few. It can guide client countries on capacity building, training, and initiating pilot studies. It also supports the development of institutions, promotes institutional coordination, and facilitates inter-municipal cooperation in order to enable economies of scale through green procurement policies.

Data tools and management: There is a significant need for a well-defined system to collect and use SWM data from mountain areas. This is required in order to make informed decisions, as data is the backbone of any policy. Assistance could be provided in the form of rapid data assessments, devising robust data collection, recordkeeping, and monitoring systems.

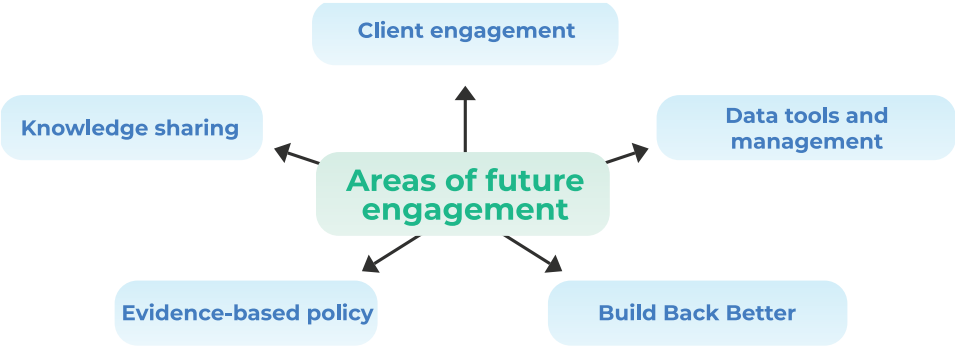
Build Back Better: Like many other countries, India, Nepal, and Pakistan face unprecedented challenges of managing the consequences of the COVID-19 pandemic. While all three countries have initiated stimulus

packages to include investments and drive the creation of jobs, not all stimulus spending has long-term benefits. The World Bank has started a sustainability checklist through a new initiative, Build Back Better, to help policymakers identify potential projects, policies, and measures that are best suited for inclusion in a stimulus package, with the key objective to deliver both short- and long-term gains. Combining the Build Back Better approach with landscape management techniques or nature-based solutions could have numerous long-term potential benefits in these three countries, and elsewhere. Particularly in mountain areas, it can help create green jobs in the SWM sector.

Evidence-based policy: In-depth examination is required about which laws and policies support the development of better waste strategies in mountain areas. If current policies do not support better SWM implementation, the World Bank can effectively support clients in this regard. In addition, it can also help to coordinate various sectors to adopt a landscape approach.

Knowledge sharing: The World Bank can assist in setting up a knowledge-sharing network especially for mountain waste in order to learn from similar communities about how they manage specific challenges. Policy think-tanks, such as the ones created specifically for SWM in Korea, connect government agencies with academia and communities, thus supporting and sharing research and enhancing coordination, not only in mountain areas but also in the rest of the country.

Figure 6.1: Potential areas of future World Bank engagement for mountain waste



To achieve sustainable growth, the World Bank supports improved natural resource management, environmentally-friendly fiscal policies, greener financial markets, and effective waste management programs. In South Asia (SAR), the World Bank's Environment, Natural Resources, and Blue Economy (ENB) Global Practice is working regionally to meet the goals of a clean, green, and healthy environment.

Box 6.1: Related regional World Bank projects

This Advisory Services and Analytics (ASA) activity on sustainable management of solid waste in mountain areas is spread across the Himalayan regions of India, Nepal, and Pakistan. It represents the first attempt by the World Bank to examine solid waste management in ecologically-sensitive areas that face unique challenges. The lessons and recommendations from this study may also be applicable to mountain areas in other regions and countries.

Other current regional projects across SAR that integrate the environment, including water resources, with improved waste management practices include PLEASE and SAWI. A PROBLUE study in Pakistan looks at the impact of marine pollution in the Arabian Sea. These projects are further described below.

Plastic Free Rivers and Seas for South Asia (PLEASE): The objectives of the PLEASE project are to strengthen innovation as well as coordination of circular economy approaches across South Asia in all SAR countries. The project consists of three components that will be implemented over a period of five years and hopes to sharply drive innovation and results for plastics waste and plastic pollution reduction that would lead to cleaner coasts, rivers, and seas across the region.

South Asia Water Initiative (SAWI): The South Asia Water Initiative (SAWI) is a multi-donor trust fund in support of a program of activities to develop a shared understanding of trans-boundary river pollution across countries in South Asia (Afghanistan, Bangladesh, India, Nepal, Pakistan, Sri Lanka), with a particular focus on plastics. Projects under SAWI include assessments of plastics leakage and pathways into rivers, identifying commonly used and problematic single-use plastics, and water quality and related pollution data collection and analysis, among others.

In the three countries of this regional study on mountain waste, SAWI-funded projects include:

India: The study will inform Enhancing Coastal Ocean Resource Efficiency (ENCORE) Program on plastic waste management activities that are (1) suitable for communities' engagement, (2) cost effective, (3) sustainable, and (4) easy to upscale.

Nepal: Studies on plastic material flow analysis, estimating plastic leakage in five cities across Nepal, including in the Kathmandu Valley, and estimating the types and quantities of plastic healthcare waste expected to be generated during the COVID-19 pandemic.

Pakistan: This study looks at plastic pollution at selected sites across the Indus River Basin to understand the volume and nature of plastic load in the river. Targeted recommendations to stakeholders will include policy and institutional solutions and behavior change.

Pakistan Marine Pollution & Marine Waste Management: The Pakistan Marine Pollution & Marine Waste Management study, funded by PROBLUE, aims to present a diagnostic analysis of marine pollution (including solid waste, plastics, sewage, industrial wastewater, and microplastics) and develop recommendations for a roadmap to control marine pollution and marine waste management. The study will inform the first-of-its-kind PLEASE project to combat plastic pollution ending up in rivers and seas. PROBLUE is a World Bank-administered multi-donor trust fund that supports the sustainable and integrated development of marine and coastal resources in healthy oceans.



Appendix 1: Pakistan Field Study: Waste Sampling Data Summary

The data collected during the waste sampling in the Khyber Pakhtunkhwa Province in Pakistan as part of this study are presented here. Tables A1.1 and A1.2 provide a summary of the waste quantities collected and sampled, while Tables A1.3 and A1.4 and Figures A1.1-A1.3 provide provide a compositional analysis of the waste samples.

It should be noted here that due to the relatively small sample size, these data should be used with caution when making generalizations about the waste generation or composition in Khyber Pakhtunkhwa, its districts, or, broadly, in mountain areas of Pakistan.

Table A1.1: Waste quantity sampled at households and hotels for the Pakistan field study

Total sampled numbers	Total waste generation per day	Total waste generation per unit	Waste generation per person
60 households	251.64 kg	4.19 kg per household per day	0.775 kg per person per day
15 commercial entities	209.67 kg	13.98 kg per commercial entity per day	

Table A1.2: Composition of waste sampled at various locations for the Pakistan field study

Clusters	Readily biodegradable waste (kg)	Biodegradable waste (kg)	Non-biodegradable waste (kg)	Total waste (kg)
30 households for 8 days (Mingora)	977.11	113.66	434.14	1524.91
5 commercial entities for 8 days (Mingora)	743.36	47.25	158.67	949.28
30 households for 5 days (Abbottabad)	100.81	64.75	139.59	305.15
5 commercial entities for 5 days (Abbottabad)	44.50	22.81	54.80	122.11
5 commercial entities for 8 days (Nathia Gali)	381.27	102.44	48.99	532.71

Table A1.3: Composition of waste samples from sites in Abbottabad City and Nathia Gali in Abbottabad District

Waste classification	Abbottabad						Nathia Gali
	Households (%)			Household average (%)	Commercial average (%)	Household + commercial average (%)	Commercial (%)
	Low-income	Middle-income	High-income				
Readily-biodegradable waste	25.05	34.41	31.28	30.24	37.77	34.01	71.63
Biodegradable waste	22.43	18.69	33.25	24.79	17.82	21.31	19.14
Non-biodegradable, non-recyclable waste	5.15	4.03	10.79	6.66	10.06	8.36	3.21
Non-biodegradable, recyclable waste	47.38	42.87	24.68	38.31	34.35	36.33	6.02
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Note: Red circle denotes highest value in column

Table A1.4: Composition of waste samples from Mingora in Swat District

Waste classification	Waste component	Households (%)			Household average (%)	Commercial (%)	Household + commercial average (%)
		Low-income	Middle-income	High-income			
Readily-biodegradable waste	Kitchen waste	64.37	60.14	59.16	61.22	68.02	64.62
	Grass and wood	0.70	1.92	6.04	2.89	7.75	5.32
	Total: Readily-biodegradable waste	65.07	62.07	65.20	64.11	75.77	69.94
Biodegradable waste	Paper (recyclable)	1.86	3.26	4.87	3.33	1.19	2.26
	Hair	0.00	0.00	0.00	0.00	0.00	0.00
	Textile	4.14	3.78	3.16	3.70	3.33	3.51
	Leather and rubber	0.15	0.45	0.15	0.25	0.34	0.30
	Total: Biodegradable waste	6.16	7.49	8.19	7.28	4.86	6.07

Table A1.4: Composition of waste samples from Mingora in Swat District (contd.)

Waste classification	Waste component	Households (%)			Household average (%)	Commercial (%)	Household + commercial average (%)
		Low-income	Middle-income	High-income			
Non-biodegradable, non-recyclable waste	Plastic (non-recyclable)	8.09	8.01	9.40	8.50	8.40	8.45
	Paper (non-recyclable)	4.79	3.63	3.42	3.95	2.70	3.32
	Metal (non-recyclable)	0.00	0.35	0.03	0.13	0.40	0.27
	Glass (non-recyclable)	0.59	0.12	0.74	0.48	0.26	0.37
	Domestic hazardous wastes	1.02	0.96	0.47	0.82	0.06	0.44
	Tetra Pak	1.70	0.55	1.69	1.31	0.78	1.05
	Diapers	5.24	6.30	4.99	5.51	0.90	3.21
	Bones	0.37	0.45	0.47	0.43	2.84	1.63
	Inert (e.g., soil, ceramics)	1.77	0.41	0.25	0.81	1.52	1.17
	Sieve (particles)	3.20	3.94	3.09	3.41	0.41	1.91
	Sieve (fine)	0.63	3.12	0.05	1.27	0.35	0.81
	Total: Non-biodegradable, non-recyclable waste	27.39	27.85	24.59	26.61	18.62	22.62
Non-biodegradable, recyclable waste	Plastic (recyclable)	0.92	1.60	1.27	1.26	0.49	0.88
	Metal (recyclable)	0.13	0.42	0.33	0.29	0.21	0.25
	Glass (recyclable)	0.33	0.58	0.41	0.44	0.04	0.24
	Total: Non-biodegradable, recyclable waste	1.38	2.59	2.02	1.99	0.74	1.37
Total		100.00	100.00	100.00	100.00	100.00	100.00

Note: Red circle denotes highest value in column

Figure A1.1: Composition of waste samples from Mingora in Swat District (%)

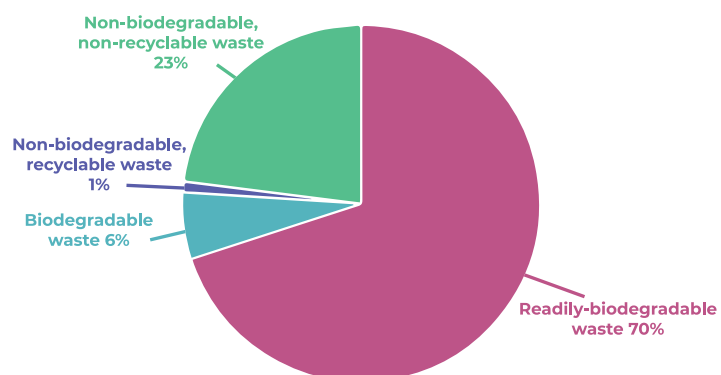


Figure A1.2: Composition of household waste samples according to income in Abbottabad and Swat Districts

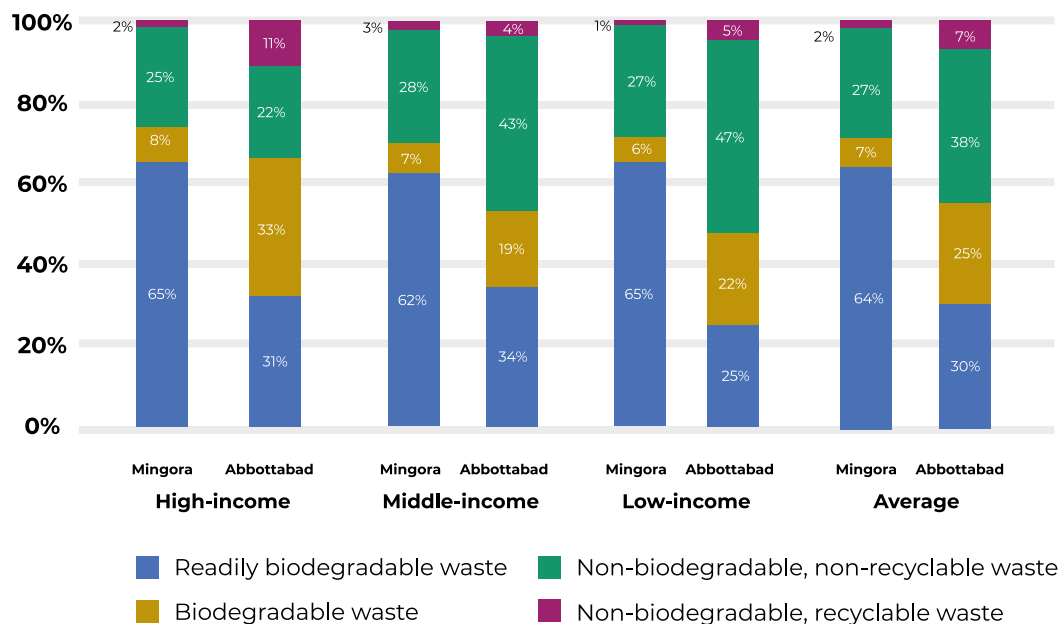
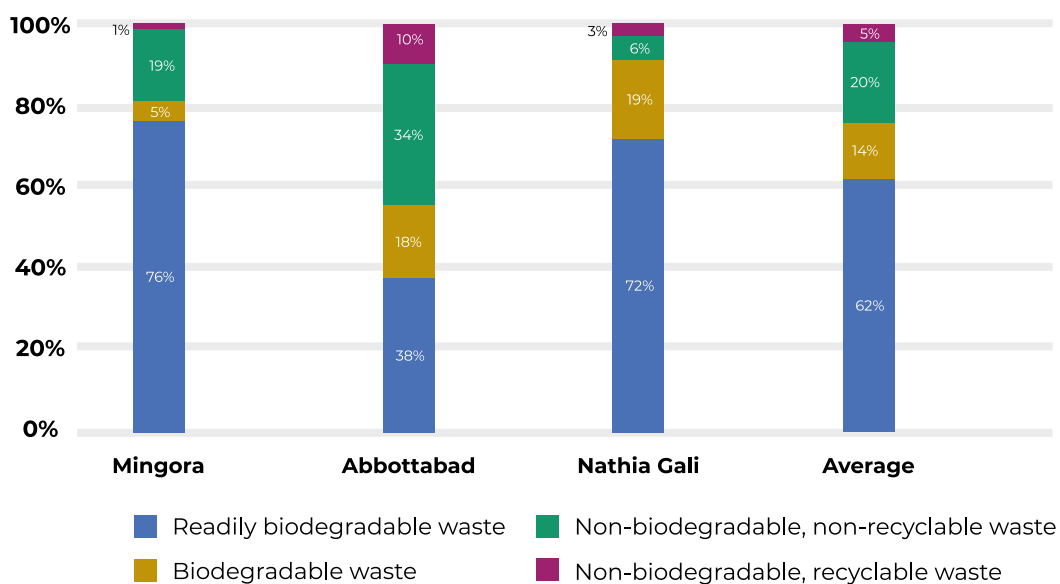


Figure A1.3: Composition of commercial waste samples in Abbottabad and Swat Districts



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The Korea Green Growth Trust Fund is a partnership between the World Bank Group and the Republic of Korea, established in 2011 to support client countries as they shift to green development path. Both partners share a common goal to reduce poverty and promote shared economic prosperity in an environmentally responsible and socially inclusive way.

The Trust Fund finances on-the-ground programs as well as knowledge exchange activities, and to date has approved 144 programs in the urban, transport, information and communication technology, energy, environment, water, climate and agriculture sectors. Based on strong performance as well as increasing demand for collaborative development implementation programs, the fund has grown from \$40 million to \$138 million to support World Bank Group programs through 2026.

Supporting the Development of Sustainable Solid Waste Management Strategies for the Mountainous Regions of India, Nepal and Pakistan

The *Pakistan: Sustainable Solid Waste Management in Mountain Areas* report provides an overview of the municipal solid waste management (SWM) scenario in the country. Furthermore, the report investigates the impacts and challenges of mountain waste, including a detailed analysis of the data collected from the field study undertaken for this project. The report presents recommendations and specific actions—tailored to mountain areas—to improve SWM systems and practices. In conclusion, suggestions for further World Bank and donor engagement are provided.

Other Publications in this Study:

India: Sustainable Solid Waste Management in Mountain Areas

Nepal: Sustainable Solid Waste Management in Mountain Areas

Technical Guidance Report: Sustainable Solid Waste Management in Mountain Areas of India, Nepal, and Pakistan

Good Practice Options for Sustainable Solid Waste Management in Mountain Areas of India, Nepal, and Pakistan



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