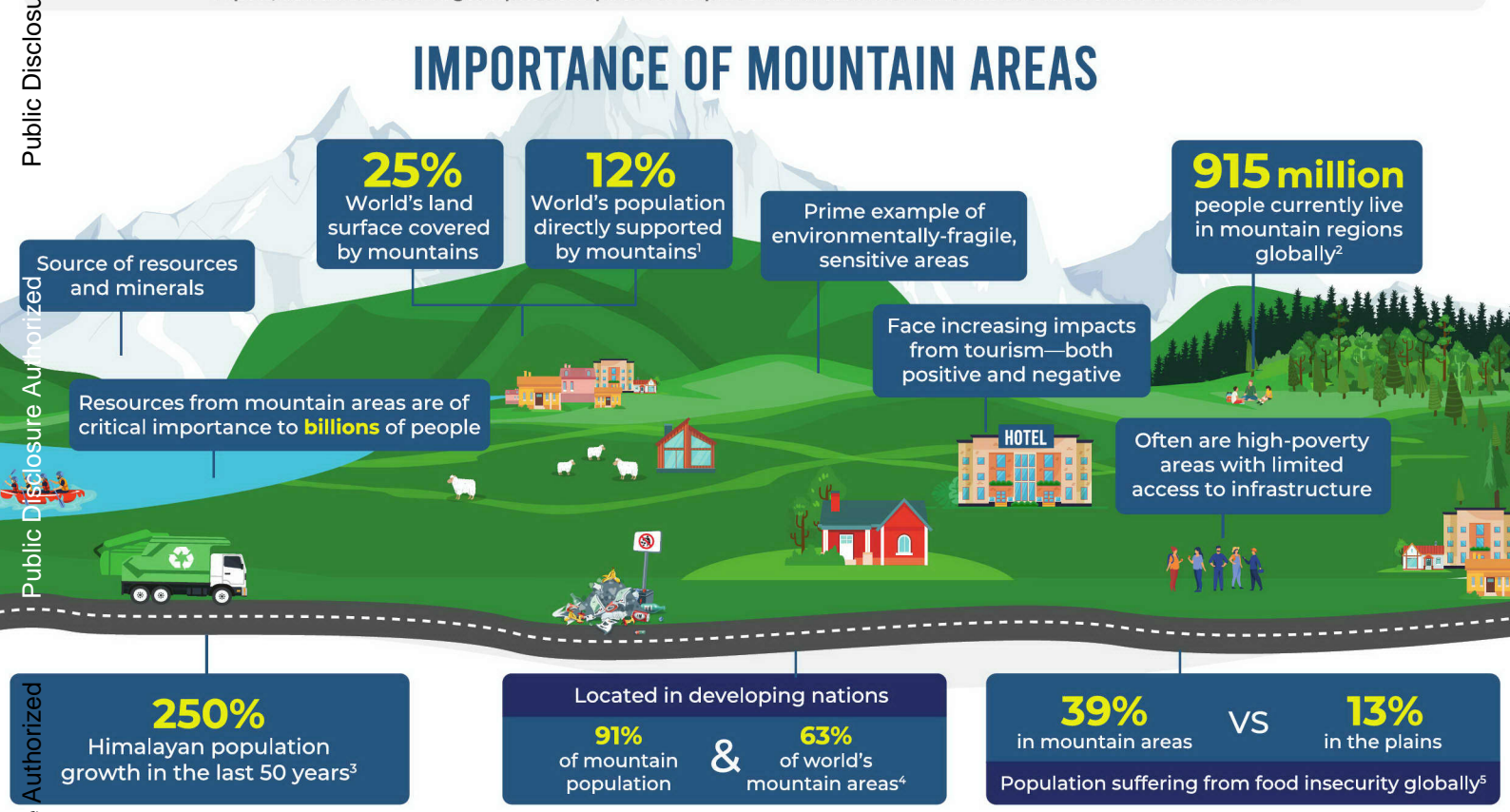


SUSTAINABLE SOLID WASTE MANAGEMENT in Mountain Regions of India, Nepal, and Pakistan

This study represents the first attempt of the World Bank to examine SWM issues in unique and ecologically-fragile mountain areas. This infographic presents a synopsis of the findings from five knowledge products, including individual country studies on India, Nepal, and Pakistan, a technical guidance report, and a collection of good practice options to improve sustainable SWM in mountain areas of the three countries.

IMPORTANCE OF MOUNTAIN AREAS



IMPORTANCE OF HIMALAYAS TO INDIA, NEPAL & PAKISTAN

- Source of fresh water
- Provides resources and minerals
- Supports agriculture downstream
- Ecological diversity
- Tourism revenue
- Regulates climate

Growing waste volumes

Changing waste composition

Unmanaged waste

IMPACTS OF MOUNTAIN WASTE

- Uncollected waste contributes to flooding
- Dumped waste creates visual pollution
- Soil, surface, and groundwater pollution
- Open burning causes air pollution and respiratory ailments
- Litter carried downstream results in marine pollution

MOUNTAIN AREAS & OTHER ECO-SENSITIVE AREAS SHARE SIMILAR CHALLENGES

- Scattered and remote settlements
- Situated far from developed infrastructure
- Lack of or poor road networks
- Diverse weather conditions
- Influx of tourists results in additional waste, particularly plastics
- Sensitive environmental and ecological conditions

WITH CHALLENGES COME OPPORTUNITIES

- Cleaner areas equal healthier populations
- Immense potential for eco-tourism
- New ventures for local entrepreneurs
- More local jobs
- Waste as a fertilizer substitute
- Waste as an energy source

Areas where field studies were conducted



Himachal Pradesh
India



Annapurna Conservation Area
Nepal



Khyber Pakhtunkhwa
Pakistan

FIELD STUDY: FINDINGS

Types of respondents surveyed



Households



Hotels



Tourists



Plastics are the main constituent of mixed waste at tourist hotspots



Biodegradable waste is the main constituent of mixed waste at other locations



Collection coverage and accessibility are poor



High proportion of waste disposed ends up in drains, valleys, and in or alongside rivers and streams



Dump sites are widely spread in the natural environment



Open burning occurs frequently



Households are unaware and unconcerned about disposal practices



Willingness to pay for SWM services is common

FRAMEWORK TO BUILD SOLUTIONS

A framework on which solutions can be steadily built is crucial in order to overcome SWM challenges in mountain areas



Integrated landscape management approach



Sources of waste



Geography and location



Types of waste



Seasonality



Tourism-based waste

RECOMMENDATIONS

In support of a policy or plan specifically on mountain waste, the study offers recommendations based on the ISWM framework



Recommendations are supported by implementable actions. These are presented in a phased approach loosely denoting immediate, medium-term, and long-term, rather than in a time-bound fashion, to allow for flexibility. Actions may be initiated simultaneously and may work concurrently with each other. Suggestions for appropriate stakeholders to initiate or implement proposed actions are also provided.

MENU OF OPTIONS

Given that waste collection, transport, and treatment are challenging in hilly and mountain areas, various alternatives to manage these SWM services are provided. Options may be suited to one or more of the four mountain areas, as indicated.



Mountain cities



Villages with road access



Remote areas with no connectivity



Mountaineering/trekking areas

COLLECTION AND TRANSPORT

- Pack animals
- Non-motorized options
- Three-wheelers
- Drop-off at collection points
- Dump trucks & waste transport vehicles
- Containerized vehicles
- On foot (backpacks)
- Special wastes
- Pooling of inter-municipal resources

WASTE TREATMENT

- Composting at source
- Community-level composting
- Mid- to large-scale composting
- Sorting & processing at transfer stations
- Biomethanation
- Conversion to RDF/SRF
- Upcycling

1. Mountain Partnership. n.d. *Mountain as the Water Tower of the World: A Call for Action on the Sustainable Development Goals (SDGs)*. 2. Alfthan, B., L. Semernya, A. Ramola, C. Adler, L.F. Penaranda, M. Andresen, I. Rucevska, M. Jurek, T. Schoolmeester, E. Baker, W. Hauer, and M. Memon. 2016. *Waste Management Outlook for Mountain Regions: Sources and Solutions*. UNEP, IETC, GRID-A, and ISWA. 3. Between 1961 and 2011, Himalayan population in Bhutan, China, India, Nepal, and Pakistan increased from 19.9 to 52.8 million; Apollo, M. 2017. "The population of Himalayan regions – by the numbers: Past, present and future." Chapter 9, *Contemporary Studies in Environment and Tourism*. Recep Efe and Münir Öztürk (Eds.). Cambridge Scholars Publishing. 4. Alfthan et al. 2016. 5. FAO. 2015. *Mapping the vulnerability of mountain peoples to food insecurity*.
ISWM: Integrated solid waste management; **RDF**: Refuse-derived fuel; **SRF**: Solid recovered fuel; **SWM**: Solid waste management.