Logo

Description automatically generated with medium confidenceA picture containing text

Description automatically generated

**To:** Bhupender Yadav, Union Ministry of Environment (MoEF&CC)

**From:** Apoorva Shetty, Policy Analyst, World Bank

**Date:** November 30th, 2022

**Subject:** Waste Management in Indian Himalayan Region – Recommendations for effective collection

**ABSTRACT**

Solid waste management (SWM) in the Indian Himalayan region (IHR) is an onerous task by virtue of their inaccessibility, varied topography, sensitive ecosystems, lack of infrastructure, and poor institutional capacity. Tourism adds to the strain of waste collection and processing in these remote areas. This memo explores recommendations for the ministry to implement measures such as a ban on single-use plastic and increased investment in waste collection infrastructure to improve SWM. Installation of solar trash compactors and reverse vending machines at tourist spots are supplementary technological interventions that aid in waste-collection logistics. Implementing these recommendations in the IHR would involve successful coordination between the central government, tourism department, local interest groups, and the informal sector involved in waste management. Effective data collection and storage strategies are crucial for monitoring the implementation of these recommendations.

**WASTE MANAGEMENT IN THE MOUNTAINS IS CHALLENGING BUT CRUCIAL**

*Difficult terrain, Growing Population*

Indian Himalayan region is home to over 50 million residents and accommodates another 1.2 million tourists annually[[1]](#endnote-1). The waste generated by this population is difficult to collect, transport, and treat primarily due to geographical remoteness and distance to existing infrastructure. The non-uniform weather conditions and sensitive ecological conditions also add another dimension of difficulty for storing waste.

*Tourists contribute mostly non-biodegradable waste*

With the post-pandemic revival of the domestic tourism industry, tourists are becoming increasingly frequent in the IHR, regardless of the season. This generates a lot of revenue for these scenic mountain locations, but the waste generated by them is largely non-biodegradable in comparison to the local households as referenced in Fig1. The responsibility of addressing this waste composed primarily of plastic cutlery, PET bottles, and polythene bags is often shouldered by local NGOs or the community due to the lack of enforcement of the existing waste management measures.[[2]](#endnote-2)

**Chart, bar chart

Description automatically generated**

*Fig 1: Waste composition at sampled locations*

*Improper waste management disrupts the mountain ecosystem*

Our study conducted in 2021[[3]](#endnote-3) reinforces how improper waste treatment and disposal pose a threat to downstream areas as well as to ecosystems and human health. The footprint left by garbage from alpine regions can extend thousands of kilometers or more downstream, and even as far as the ocean, depending on river flows and gravity. Considering this, the buildup of solid waste in mountainous locations has emerged as a genuine regional and worldwide concern for the reasons delineated below.

A screenshot of a computer

Description automatically generated

**MEASURES FOR EFFECTIVE WASTE MANAGEMENT: A SYSTEMIC APPROACH**

The IHR needs comprehensive measures for solid waste management to be environmentally, financially, and socially sustainabl*e.* The local government needs to allocate a budget for waste collection for the improvement of SWM services. The willingness to pay for these services will increase among residents once better practices are established. Additionally, a few key measures delineated below should further this goal.[[4]](#endnote-4)

***Enforcing the ban on single-use plastic cutlery and incentivizing eco-friendly alternatives***

Banning single-use plastic bags and reducing plastic bottles/cutlery at establishments would be an effective way to reduce the waste generated near popular attractions. A similar ban was implemented in Sikkim (declared the cleanest state in India-2016) in 2003 and currently, 30% of the waste gets recycled and 66% of the shops use biodegradable paper bags. [[5]](#endnote-5)

Furthermore, making a switch to disposable alternatives will reduce the decomposition time from 500 years to under 90 days. This helps in managing waste storage and producing a profitable by-product like compost, all while being environmentally sustainable. Enabling and incentivizing industries that promote sustainable products will increase the production and adoption of plastic alternatives, ultimately leading to a behavior shift among local businesses and consumers.

***Investing in better infrastructure for waste collection and transportation***

 “The tourism department invests in setting up dustbins in different tourist destinations, but the collection and processing system is broken.  The IHR has a dearth of infrastructure for waste collection (vehicles), dry waste processing (material recovery facilities), and wet waste processing (composting or biogas units).”[[6]](#endnote-6) Garbage transportation should be carried out in covered trunks to eliminate spillage

Additionally, formal dumping grounds need to be established far away from the riverbanks to prevent the waste from getting washed away into the water bodies during monsoon. Protective equipment needs to be accessible to waste collectors, rag pickers, and street sweepers involved in the manual collection and transportation of waste to these disposal sites. A failure to establish a safer streamlined process has not only disrupted the ecosystem near the local rivers but also led to various occupational health-related hazards in the IHR (Thakur et al., 2018)[[7]](#endnote-7).

**TECHNOLOGICAL INTERVENTION TO DEAL WITH COLLECTION ISSUES**

Addressing some of the challenges mentioned above with technology is a holistic way to further both the Swachh Bharat (2016) and the Digital India(2015) initiatives.

***Solar Trash Compactor eases the pressure on waste collection infrastructure***

A solar trash compactor is an upgrade to the informal dumping areas which involves a one-time installation and annual maintenance checks. The bin holds more than six times the average 120 liters of mobile garbage bin volume[[8]](#endnote-8), leading to the elimination of at least three of every four collection trips. A few Internet of Things (IoT) enabled models also send out signals for when the trash is full so that the collection can be strategically targeted. This reduces operating costs, litter overflows, and unpleasant odors and minimizes emissions from waste-carrying vehicles.

***Reverse vending machines improve recycling rates***

**RVMs IN ACTION**

**THAILAND**

26% increase in the number of recycled PET bottles with reduced better segregation accuracy.

**NORWAY**

* 941 million *cans*were returned to RVMs, equating to 91.5% of all cans sold.
* 92.8% of *plastic bottles* were returned through the deposit scheme mechanically recycling over 23,000 tons of plastic.

Reverse vending systems (RVM) are an automated way to collect, sort, and handle the return of certain types of plastic waste which incentivizes recycling with some form of monetary benefit. In this scenario, it could involve discount coupons at local establishments thus having the added benefit of increasing footfall at small businesses.

They do not take up a lot of space but usually can handle up to 200 beverage containers and 900 cans[[9]](#endnote-9) which is substantially higher than small-medium-sized dustbins currently available at the tourist spots. A similar implementation in Thailand[[10]](#endnote-10) (another Asian tourism powerhouse) and Norway[[11]](#endnote-11) has led to improved waste collection operations and effective recycling.

**IMPLEMENTATION, ENFORCEMENT, AND MONITORING**

Implementation of these recommendations would require a framework that ensures financial, social, and environmental sustainability. Swachh Bharat Mission-Gramin scheme could be leveraged to utilize the [INR 16 lakh](https://swachhbharatmission.gov.in/SBMCMS/writereaddata/portal/images/pdf/SBM_G_Guidelines_amendment.pdf) per block granted for plastic waste[[12]](#endnote-12). Effective utilization of these funds would involve two key action items explained below.

***Address stakeholder needs for optimal enforcement***

**KEY RECOMMENDATIONS**

**INVESTMENT**

* Land allocation for waste collection and treatment
* Waste management technology
* Safety gear for the workers

**LEGISLATION**

* Ban on single-use plastic cutlery
* Incentive frameworks for promoting biodegradable alternatives

**ENFORCEMENT**

* Local bodies dedicated to SWM for feedback building
* Better data collection mechanism to monitor targets
* Enable feedback from the local community and existing

non-profits engaged in waste segregation and collection

* Promote sustainable industries: “Create systemic

opportunities to bring in economies of scale and engage

the private sector as well as other stakeholders”[[13]](#endnote-13)

* Integrate the informal sector into waste management

services to prevent their exploitation

* Set up channels for inter-department collaboration

among tourism, water & sanitation, and forest agencies

***Improve data gathering to support monitoring***

* Gather data regularly to make data-driven decisions and

optimize targets for policy implementation

* Digitize recordkeeping for waste collection and

composition for reliable data management.

* Create a regional/global network for knowledge

sharing and capacity building for solid waste in mountain

areas[[14]](#endnote-14)

* Establish benchmarks using the data collected to track

progress on targets

**CONCLUSION**

“Mountain habitats need to be managed carefully to maintain community viability and environmental sustainability”[[15]](#endnote-15). Improving the state SWM in the IHR is both feasible and sustainable using a comprehensive approach that involves optimal policy measures, technological aid, and stakeholder management. Prompt action is crucial to prevent any more damage to these fragile ecosystems. Thus, the World Bank urges that the ministry act upon the above recommendations to preserve the beauty and balance of these sensitive areas.

**CITATIONS**

1. I Group, World Bank. “Solid Waste Management in the Mountains.” Geowb.maps.arcgis.com, 2021. <https://geowb.maps.arcgis.com/apps/Cascade/index.html?appid=4fc4d98059c349e498daed91f6ebd85f>. [↑](#endnote-ref-1)
2. India Development Review. “Photo Essay: Why the Himalayas Are Drowning in Waste | IDR,” July 22, 2022. <https://idronline.org/article/environment/photo-essay-why-the-himalayas-are-drowning-in-waste/>. [↑](#endnote-ref-2)
3. Ibid [↑](#endnote-ref-3)
4. Ibid [↑](#endnote-ref-4)
5. UNEP. “How the Indian State of Sikkim Is Working to End Plastic Pollution.” UNEP, April 26, 2018. <https://www.unep.org/news-and-stories/story/how-indian-state-sikkim-working-end-plastic-pollution>. [↑](#endnote-ref-5)
6. Ibid [↑](#endnote-ref-6)
7. Thakur, Aman, Sareeka Kumari, Shruti Sinai Borker, Swami Pragya Prashant, Aman Kumar, and Rakshak Kumar. “Solid Waste Management in Indian Himalayan Region: Current Scenario, Resource Recovery, and Way Forward for Sustainable Development.” Frontiers. Frontiers, February 8, 2021. <https://www.frontiersin.org/articles/10.3389/fenrg.2021.609229/full#B91>. [↑](#endnote-ref-7)
8. Gawade, P.P, A.B Patil, G.P Jadhav, and S.B Ingale. “Review Paper on Solar Trash Powered Compactor Bin.” IARJSET, May 25, 2021. <https://iarjset.com/november-17/>. [↑](#endnote-ref-8)
9. Tiyarattanachai, Ronnachai. “Reverse Vending Machine and Its Impacts on Quantity and Quality of Recycled PET Bottles in Thailand.” View of reverse vending machine and its impacts on quantity and quality of recycled PET bottles in Thailand, 2015. https://li01.tci-thaijo.org/index.php/cast/article/view/130146/9773. [↑](#endnote-ref-9)
10. Ibid [↑](#endnote-ref-10)
11. TOMRA. “Norway's Deposit Return Scheme Is World's Recycling Role Model.” TOMRA, September 14, 2022. <https://www.tomra.com/en/discover/reverse-vending/feature-articles/norway-deposit-return-scheme> . [↑](#endnote-ref-11)
12. Ibid [↑](#endnote-ref-12)
13. Ibid [↑](#endnote-ref-13)
14. Ibid [↑](#endnote-ref-14)
15. Ibid [↑](#endnote-ref-15)