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Abstract
Plastic pollution has become a defining environmental and governance challenge in the Indian Himalayan Region, with Ladakh standing out as a critical case. Despite its sparse population, the Union Territory generates disproportionately high volumes of plastic waste due to tourism influx, military presence and shifting consumption patterns. Seasonal surges overwhelm existing systems, with just Leh's daily waste generation quadrupling during the tourist season. While awareness of plastic hazards is relatively high, enforcement of bans is partial, alternatives remain limited and rural areas lack even basic waste management infrastructure. This reflects systemic governance gaps, particularly in linking waste management with tourism regulation and scaling regionally-adapted recycling solutions. Addressing Ladakh's plastic challenge requires moving beyond fragmented bans toward integrated strategies that emphasize stricter enforcement, community-led monitoring, sustainable alternatives and cross-sectoral coordination to safeguard fragile mountain ecosystems.

Keywords: Plastic Pollution; Solid Waste Management; Tourism, Ladakh

Introduction

Plastic pollution has become a pressing environmental challenge in fragile mountain ecosystems (Mountain Research Initiative 2022). In the Indian Himalayan Region (IHR), remoteness, weak waste management infrastructure and seasonal surges in consumption make this issue persistent and damaging. Ladakh—a cold-arid plateau and Union Territory in India—exemplifies these pressures. Despite its small resident population of about 300,000, Ladakh recorded over 525,000 tourist arrivals in 2023, creating concentrated waste loads that exceed local disposal capacity (Tourism Department 2023).

Community-led efforts to address the issue predate national policies. The Women's Alliance of Ladakh (WAL) initiated a self-imposed ban on plastic carry bags in 1998, well before the national Plastic Waste Management Rules of 2016 (*The Statesman* 2021; *Daily Excelsior* 2024). WAL, with around 4,000 volunteers, continues to play a key role in advocacy and awareness. The Union Territory formally prohibited single-use plastics in August 2021, but enforcement has been inconsistent (Verma 2024).

Municipal management remains limited in scope. Waste from Leh town is collected by the Municipal Committee and transferred to the Skampari Solid Waste Management Plant, where it is segregated into recyclable and non-recyclable components (Dasal 2024). Tourism, packaged consumer goods and lifestyle shifts drive most plastic inflows, with bottled water, snack wrappers and disposable service-ware dominating waste streams (Shrivastava 2023). Legacy sites such as Bombgarh landfill, once a livestock pastureland, have borne the brunt of unmanaged disposal, while more recent clean-up initiatives attempt centralization (Singh 2021; Dasal 2025).

Ladakh's extreme climate conditions do not favour decomposition, allowing plastics to persist for decades. Open dumping and burning further threaten soil, water and air quality, undermining rangelands and livestock productivity that underpin Ladakh's socio-ecological systems (LEDeG-BORDA 2023; Talukdar et al. 2023).

This issue brief situates Ladakh's waste challenge in the broader Himalayan context. It examines comparative findings, traces dominant plastic flows, identifies governance gaps

and explores mountain-adapted responses aimed at reconciling ecological fragility with developmental pressures.

Trends in Plastic Pollution in Ladakh

Comparative analysis situates Ladakh uniquely within the IHR. The Himalayan Clean-Up[i] (THC) 2024, reports the region's highest use of non-woven bags (56 per cent) alongside Sikkim and Uttarakhand while thin-film bags remain relatively low (32 per cent). By contrast, Himachal Pradesh records the greatest use of thick plastic bags, underscoring variation in consumer patterns across the Himalayan states.

Beyond bag-use patterns, detailed waste audits provide sharper insights into Ladakh's plastic burden. In 2024, the THC and its partner Little Green World[ii] coordinated 18 clean-ups across the region with the participation of 1,069 volunteers. Together, they collected 11,975 items of waste, of which plastics alone accounted for 93.3 per cent (11,168 items). Within these, non-recyclable plastics dominated (75.8 per cent), leaving only 24.2 per cent as recyclable. Food and beverage packaging constituted the bulk share at 67 per cent, followed by smoking-related materials at 23.2 per cent. Notably, the audit revealed regional consumption preferences, with brands such as Mountain Dew showing disproportionately high representation in Ladakh (similar to Arunachal Pradesh), underscoring how lifestyle changes and market penetration are reshaping local waste profiles (THC 2024).

Despite official bans on plastic bottles and utensils in government offices, enforcement remains patchy. Awareness levels are relatively high, but weak monitoring means plastic waste continue to circulate widely in markets and tourist zones (THC 2024; UT Ladakh 2024).

According to regional audits, local stores contribute more than 50 per cent of plastic waste, followed by vegetable markets, underscoring both structural dependence on packaged goods and limited alternatives (Zero Waste Himalaya & Integrated Mountain Initiative n.d.).

Daily waste generation further illustrates the scale of the challenge. In Leh, over 50,000 plastic bottles are discarded every day, with approximately 16 tonnes of waste dumped at the Bombgarh landfill (Singh 2021). Garbage loads nearly doubled from 4 tonnes in 2010 to 7.5 tonnes in 2019 and peak tourist seasons now push daily dry waste to 9–10 tonnes (*Ground Report* 2023). Tourist influxes intensify the pressure: at Pangong Lake alone, around 300-600 vehicles visit daily during season, with tourists carrying plastic water bottles and packaged snacks, compounding the load. This illustrates how seasonal mobility creates point-source waste hotspots at fragile sites (Singh 2021).

These dynamics reflect not only the sheer quantity of waste but also its composition, heavy dependence on imports and Ladakh's weak regulatory capacity. The persistence of plastics in a cold-arid climate compounds the ecological risks, as waste accumulates in soils, water bodies and rangelands central to pastoral livelihoods. These patterns highlight the systemic nature of Ladakh's plastic burden, which current governance responses have struggled to contain.

Policy Landscape and Governance

Given these growing waste pressures, Ladakh's governance response has been fragmented.

Waste management faces multiple structural constraints: financial limitations, harsh weather and limited human resources. Although Solid Resource Management Centres[iii] (SRMCs) have been established in parts of Ladakh (Goswami 2024b) , but their effectiveness remains limited due to lack of planning for channelling reusable materials and weak community participation. As a result, waste is often dumped, burnt or buried without regulation (Goswami 2024a). This marks a stark departure from earlier traditional Ladakhi practices where, under conditions of resource scarcity, almost every item was reused and most waste was biodegradable. Today, high volumes of non-biodegradable and low-reusability waste dominate, with many materials being market-sourced rather than locally available.

Recent interventions include:

- Awareness programmes by the Ladakh Pollution Control Committee (UT Ladakh 2023 and 2024).
- A Memorandum of Understanding between Housing and Urban Development Department (HUDD) Ladakh and Project Himank under Border Roads Organization to repurpose plastic waste for road construction (Dasal 2024).
- The Skampari Waste Management Plant, India's first solar-powered facility, with a 30-tonne capacity (Dasal 2025).
- A recycling unit at Nimoo Thang capable of processing two tonnes of plastic daily into tiles and furniture (*Daily Excelsior* 2024).
- PlanetFirst Recycling's network of scrap collection linked to satellite SRMCs (Wangmo 2022).

Other recent developments show growing administrative pressure to enforce Extended Producer Responsibility[iv] (EPR) in Ladakh. Discussions on this issue date back to October 2022, when the Ladakh Autonomous Hill Development Council (LAHDC) hosted a Mountain Legislators' Meet in Leh. One of the primary agenda was 'Extended Producer Responsibility: Policy to Practice', where a resolution was passed urging national-level producers to take back the waste they introduce to Himalayan states (LAHDC 2022). LAHDC Leh issued a formal warning to major brands, including Coca-Cola and PepsiCo, on 15 July 2025 for evading their Extended Producer Responsibility obligations under Mission Indus. It also declared 1 August as '*Tsangday Lasgul/Safai Andolan Day*', which saw a district-wide cleanliness drive involving civil society, trade, tourism and local government bodies (*Indus Dispatch* 2025). The session set up monitoring squads and emphasized accountability for brands that fail to manage their plastic footprint, signalling a shift from symbolic regulation to more enforceable and visible oversight.

Despite these initiatives and growing administrative pressure under EPR frameworks, participation remains uneven, highlighting the need for additional incentives and behavioural strategies.

Emerging Pathways

Ladakh exemplifies the paradox of high environmental awareness but limited action. Waste management challenges fluctuate seasonally. Currently, the UT administration provides limited direct incentives for local stakeholders. For example, the Sewage Treatment Plant (STP) Incentive Scheme 2024 offers partial reimbursement for hotels and guesthouses installing STPs, with additional benefits for women-owned businesses (UT Ladakh 2024). Expanding similar support to rural households and waste collectors could strengthen participation in both plastic and general waste management. Assigning shared responsibility to departments such as Tourism, particularly to compare tourist-season versus off-season pressures, could further enhance effectiveness.

Comparative experience shows that the behavioural nudges could be as effective as bans. In Bhutan, a United Nations Development Programme supported programme provided households with segregation bins and regular monitoring, which significantly improved compliance with waste segregation norms (UNDP 2022). Adapting such approaches to Ladakh's cold-arid context could strengthen participation while reducing dependence on bans alone.

Conclusion

Plastic pollution in Ladakh highlights the tension between ecological fragility and development pressures. Despite early grassroots initiatives and recent bans, plastics remain entrenched in daily life due to tourism dependence, limited alternatives and weak institutional capacity. Plastic pollution is only one dimension of Ladakh's environmental crisis—water contamination, air pollution, and broader waste mismanagement also pose grave risks to both human health and fragile ecosystems. The key challenge is to translate awareness into enforceable local action. Strengthening community-led models, integrating plastic-free norms into tourism, and ensuring producer accountability under national frameworks are crucial. If sustained, Ladakh has the potential not only to mitigate its own plastic crisis but also to lead Himalayan strategies for sustainable mountain development.

To achieve meaningful impact, Ladakh's plastic management efforts must combine policy enforcement with community engagement and innovative practices. Integrating behavioural incentives—such as household segregation bins, monitoring, and local recognition schemes—can improve compliance, as demonstrated in other Himalayan contexts. Strengthening coordination among departments like Tourism, Municipal Committees, and rural governance bodies can ensure that waste generation and disposal are addressed seasonally and spatially, especially during peak tourist influxes. Finally, fostering partnerships with private sector actors under EPR frameworks can reduce the burden on local infrastructure while promoting corporate accountability. Together, these measures can create a more resilient, adaptive system that balances environmental stewardship with livelihood and tourism development.

ENDNOTES:

[i] The Himalayan Cleanup (THC), launched in 2018 by two non-profit organizations, the Integrated Mountain Initiative (IMI) and Zero Waste Himalaya (ZWH), is an annual citizen-drive campaign that tracks and reduces plastic waste across Himalayan states.

[ii] Little Green World (LGW) is a social enterprise based in Ladakh that leads local cleanup campaigns, brand audits and zero-waste education through projects in schools, festivals and rural communities.

[iii] Part of the Rural Development Department's initiative under the Swachh Bharat Mission; it collects and manage solid waste from households and commercial units in rural areas.

[iv] Extended Producer Responsibility (EPR) is an environmental policy framework that holds manufacturers accountable for their products throughout the entire lifecycle, including after they are discarded by consumers.

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