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Plastic pollution: Effect of tourist arrival, status and management in Himachal Pradesh

Dr. Diljeet Singh
Associate Professor, Department of Zoology, Government Arya Degree College Nurpur, Kangra, Himachal Pradesh, India

Abstract
The tourist places of Himachal Pradesh attract tourists for beautiful landscapes, calm environment, adventurous activities, temples, historical buildings and cultural activities etc. These places have become loaded with plastic waste due to the increasing number of tourists during the past few years. The sources of pollution are plastic made articles for frequent human use such as disposable wrappings, coverings, bags, cups, bottles and others. During the last 16 years (2008 to 2023), the influx of tourists has increased from 97.49 Lakh (2008) to 1.9601 Crore (2017) and 1.6004 Crore (2023) in Himachal Pradesh. The estimated plastic waste generation during the last 10 years (2011-12 to 2022-23) in Himachal Pradesh (10 districts) has increased from 202.67 Tonnes per Annum (2011-12) to 14093.559 Tonnes per Annum (2022-23). The total quantity of estimated plastic waste generation during the last 5 years (2017-18 to 2022-23) in Himachal Pradesh has been reported to be 47541.021 Tonnes and in district-wise manner (10 districts) found to be highest in district Shimla (14570.108 Tonnes) and lowest in district Bilaspur (708.796 Tonnes). According to the Himachal State Environment Plan (2024), the estimated plastic/ dry waste generation per day under 60 ULB's (10 districts) of Himachal Pradesh has been found to be 145.98 Tonnes. Further, Aryabhatta Geoinformatics and Space Applications Centre with the help of satellite imagery has identified 70 plastic waste dump sites in 10 districts of Himachal Pradesh (2023). The Himachal Pradesh Government has implemented various laws and policies for control of plastic pollution: Himachal Pradesh Nonbiodegradable Garbage (Control) Act, 1995; Himachal Government Novel Scheme for Plastic Waste Management, 2009; Plastic Waste (Management & Handling) Rules, 2016 and Amendments upto 2024; Himachal Government Non-recyclable and Single Use Plastic Waste Buy Back Policy, 2019; and Himachal Pradesh Revised Eco-tourism Policy, 2024. The present study concludes that the causes of plastic pollution are an increasing number of tourists every year, lack of awareness among the public for proper disposal of wastes, mismanagement of handling wastes and lack of strict enforcement of pollution control laws in the state.

Keywords: Plastic waste, plastic pollution, garbage, tourist arrival, Himachal Pradesh, waste management

Introduction

The accumulation of plastic waste in the environment that adversely affects the life of humans, animals, plants and non-living objects constitute plastic pollution. The non-biodegradable material such as plastic pollutants because of their slow rate of degradation are more damaging to the health of living beings and the abiotic environment. These include non-biodegradable products made from polythene, nylon, polyvinyl chloride, polypropylene and polystyrene etc. These materials can not be easily degraded or decomposed and take more than 400-600 years for their breakdown process. The major sources of plastic pollution around tourist places are junk food wrappers, covers, packets, polythene bags, containers, bottles / cups for drinking water and beverages, disposable utensils, plates, cups, spoons, straws, stirrers, caps, tubes and other personal care products.

The reasons for tourist attractions in Himachal Pradesh are scenic beauty; cool temperature in summer; serene environment; thrilling and adventurous activities like trekking, rafting, mountaineering and paragliding; road trips and biking expeditions; sightseeing and research for abundant wildlife; religious, historical, archeological temples and monasteries; and local fairs and festivals.

The tourist places of Himachal Pradesh including snow clad mountains, lakes, rivers, streams, roadsides, parks, forests, towns, villages, industrial areas, historical sites and other areas are now seen covered with plastic waste/ garbage. Some of the important tourist places of Himachal Pradesh include Dalhousie, Khajjiar, Manimahesh Lake, Dharamshala, Mcleodganj, Pong Dam Lake, Manali, Rohtang Pass, Manikaran, Keylong, Kaza, ChandraTal Lake, Rewalsar Lake, Barot, Shimla, Narkanda, Renuka Lake, Kasauli and Chail etc. The present study was carried out to investigate the main cause of plastic pollution in Himachal Pradesh and management strategies adopted by the Himachal Government for its control.

Methodology

The present study is based on the collection and interpretation of data available in the published research works, published reports of various departments of the government, information available on the internet websites of governmental or nongovernmental organisations and other reliable sources.

Tourist Arrival (Domestic and Foreign) in Himachal Pradesh during the last 16 years (2008 to 2023)

As per Himachal Pradesh Government Tourism Statistics (2008 to 2023), the status of tourist arrival including both domestic and foreign tourists in Himachal Pradesh (12 districts) during the last 16 years is shown in Table 1 and Fig 1 (Himachal Tourism 2024) [1].

Table 1: Tourist Arrival (Domestic and Foreign) in Himachal Pradesh during the last 16 years (2008 to 2023)

Sr. No.	Year	Months	Total Number	In Lakh / Crore	% Increase	% Decrease
1	2008	January to December	9749433	97.49 Lakh	-	-
2	2009	January to December	11437155	1.1437 Crore	17.3%	
3	2010	January to December	13265602	1.3265 Crore	15.9%	
4	2011	January to December	15089406	1.5089 Crore	13.7%	
5	2012	January to December	16146332	1.6146 Crore	7.0%	
6	2013	January to December	15129835	1.5129 Crore	-	6.3%
7	2014	January to December	16314400	1.6314 Crore	7.8%	
8	2015	January to December	17531153	1.7531 Crore	7.4%	
9	2016	January to December	18450520	1.8450 Crore	5.2%.	
10	2017	January to December	19601533	1.9601 Crore	6.2%	
11	2018	January to December	16450503	1.6450 Crore	-	16.8%
12	2019	January to December	17212107	1.7212 Crore	4.6%	
13	2020	January to December	3213379	32.13 Lakh	-	81.33%
14	2021	January to December	5637102	56.37 Lakh	74.4%	
15	2022	January to December	15100277	1.5100 Crore	167.87%	
16	2023	January to December	16004924	1.6004 Crore	5.99%	

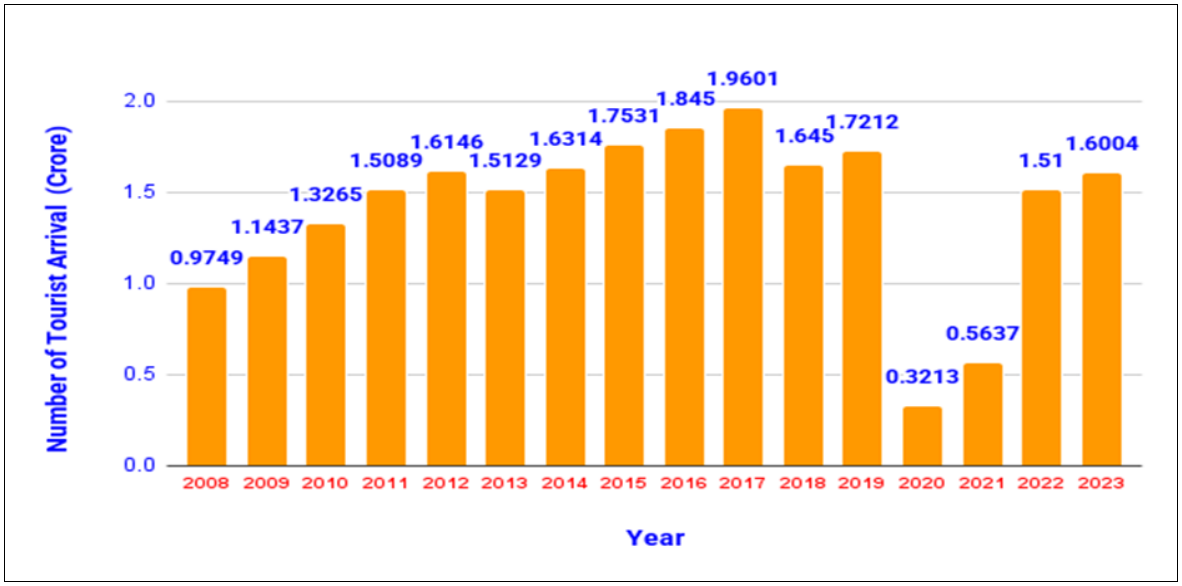

Fig 1: Tourist Arrival in Himachal Pradesh during the last 16 years (2008 to 2023)

From above given data, it is clear that the tourist arrival in Himachal Pradesh (12 districts) has increased during the last 16 years from 97.49 lakh (2008) to the highest value 1.9601 crore (2017) and 1.6004 crore (2023) except some decline during the years 2013 (1.5129 crore), 2018 (1.6450 crore) and Covid-19 period 2020 (32.13 lakh) (Table 1, Fig 1).

According to a statement by the Department of Information and Public Relations, Government of Himachal Pradesh, the tourist arrival in Himachal Pradesh during the first six months of the year 2024 (January to June 2024) was reported to be 10087440 (1.0087 crore). (Himachal Government 2024) [2]. This tourist arrival from January to June 2024 was found to be higher than tourist arrival from January to June 2023 i.e. 10006752 (1.0006 crore) and also tourist arrival from January to June 2022 i.e. 8642390 (86.42 lakh) (Himachal Tourism 2024) [1].

Table 2: District-wise Tourist Arrival in Himachal Pradesh during the last 10 years (2014 to 2023)

District	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Bilaspur	1241423	1369157	1432271	1617371	1437537	1499987	228596	253510	1844175	1328261
Chamba	1091844	1124091	1163090	1181777	1043182	1044591	270842	221888	411099	889951
Hamirpur	753193	855267	906926	980613	856111	901740	71763	60124	206255	473993
Kangra	2333367	2509813	2652732	2823289	2225126	2342887	227748	236952	410843	676836
Kinnaur	28545	119911	100727	466380	231348	249946	2391	60070	384175	512221
Kullu	3291745	3423931	3637233	3865101	3008753	3159411	770459	1647581	2880219	2759601
Lahaul & Spiti	90393	91203	116037	118920	133153	132983	15371	960952	745850	830441
Mandi	945721	1096709	1163795	1242040	1115224	1162206	284551	397978	2271734	1675809
Shimla	3349872	3415307	3582105	3480997	2995013	3162854	620313	952617	2275967	2143930
Sirmaur	902338	1019437	1063176	994874	966254	1008600	341391	400962	1383841	1527890
Solan	919498	1079178	1124810	1231559	1149082	1201211	275317	382640	1755813	2466741
Una	1366425	1427149	1507618	1598612	1289720	1345691	104637	61828	230306	719250

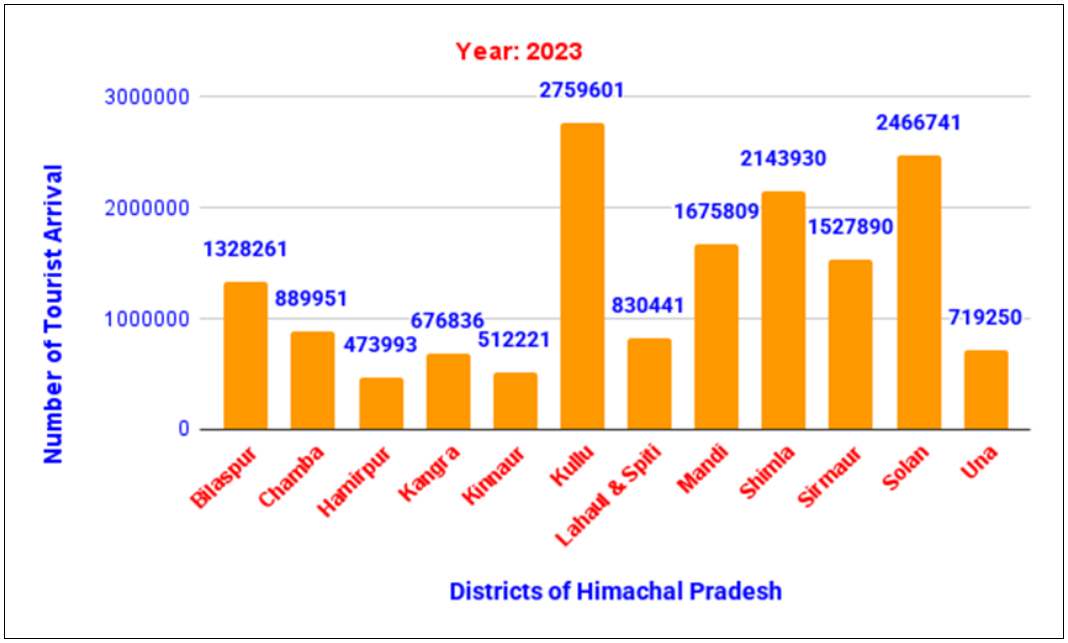

Fig 2: District-wise Tourist Arrival in 12 districts of Himachal Pradesh during the year 2023.

From above given data, it is clear that the tourist arrival during the last 10 years from 2014 to 2023 in 12 districts of Himachal Pradesh has increased mostly from 2014 to 2017, however some decline has also been observed between 2017 to 2023. In Bilaspur district, it increased from 12.41 lakh (2014) to 16.17 lakh (2017) and reached highest value 18.44 lakh (2022) and again decreased to 13.28 lakh (2023). In Chamba district, it increased from 10.91 lakh (2014) to 11.81 lakh (2017) and then decreased to 8.89 lakh (2023). In Hamirpur district, it increased from 7.53 lakh (2014) to 9.80 lakh (2017) and then decreased to 4.73 lakh (2023). In Kangra district, it increased from 23.33 lakh (2014) to 28.23 lakh (2017 and then decreased to 6.76 lakh (2023). In Kinnaur district, it increased from 0.28 lakh (2014) to 4.66 lakh (2017) with some decline afterwards and again increased to 5.12 lakh (2023). In Kullu district, it increased from 32.91 lakh (2014) to 38.65 lakh (2017) and then decreased to 27.59 lakh (2023). In Lahaul & Spiti district, it increased from 0.90 lakh (2014) to 1.33 lakh (2018) with some decline afterwards and then again increased to 9.60 lakh (2021) and 8.30 lakh (2023). In Mandi district, it increased from 9.45 lakh (2014) to 12.42 lakh (2017) with some decline afterwards and again increased to 16.75 lakh (2023). In Shimla district, it increased from 33.49 lakh (2014) to 35.82 lakh (2016) and then decreased to 21.43 lakh (2023). In Sirmaur district, it increased from 9.02 lakh (2014) to 10.63 lakh (2016) with some decline afterwards and again increased to 15.27 lakh (2023). In Solan district, it increased from 9.19 lakh (2014) to 12.31 lakh (2017) with some decline afterwards and again increased to 24.66 lakh (2023). In Una district, it increased from 13.66 lakh (2014) to 15.98 lakh (2017) and then decreased to 7.19 lakh (2023) (Table 2).

Further, as depicted in Fig 2, the tourist arrival in 12 districts of Himachal Pradesh during the year 2023 shows that the highest number of tourists arrived in district Kullu (27.59 lakh) followed by districts Solan (24.66 lakh), Shimla (21.43 lakh), Mandi (16.75 lakh) and Sirmaur (15.27 lakh), while the lowest number of tourists arrived in district Hamirpur (4.73 lakh) followed by Kinnaur (5.12 lakh) and Kangra (6.76 lakh) (Table 2, Fig 2).

Estimated Plastic Waste Generation in Himachal Pradesh during the last 10 years (2011-12 to 2022-23)

According to Annual Reports of the Central Pollution Control Board for plastic waste management in the states of India and Himachal Pradesh State Pollution Control Board for plastic waste, the estimated plastic waste generation in Himachal Pradesh from 2011-12 to 2022-23 is shown in Table 3 & Fig 3 (Central Pollution Control Board 2023; Himachal Pradesh State Pollution Control Board 2024) [3, 4].

Table 3: Estimated Plastic Waste generation in Himachal Pradesh during the last 10 years from 2011-12 to 2022-23 in Tonnes Per Annum (TPA)

Sr. No.	Year	Estimated Plastic Waste generation (Tonnes per Annum)
1	2011-12	202.67
2	2012-13	106.72
3	2013-14	2326.80
4	2014-15	1004
5	2016-17	255
6	2017-18	3903.227
7	2019-20	13683
8	2020-21	6206.782
9	2021-22	9654.453
10	2022-23	14093.559

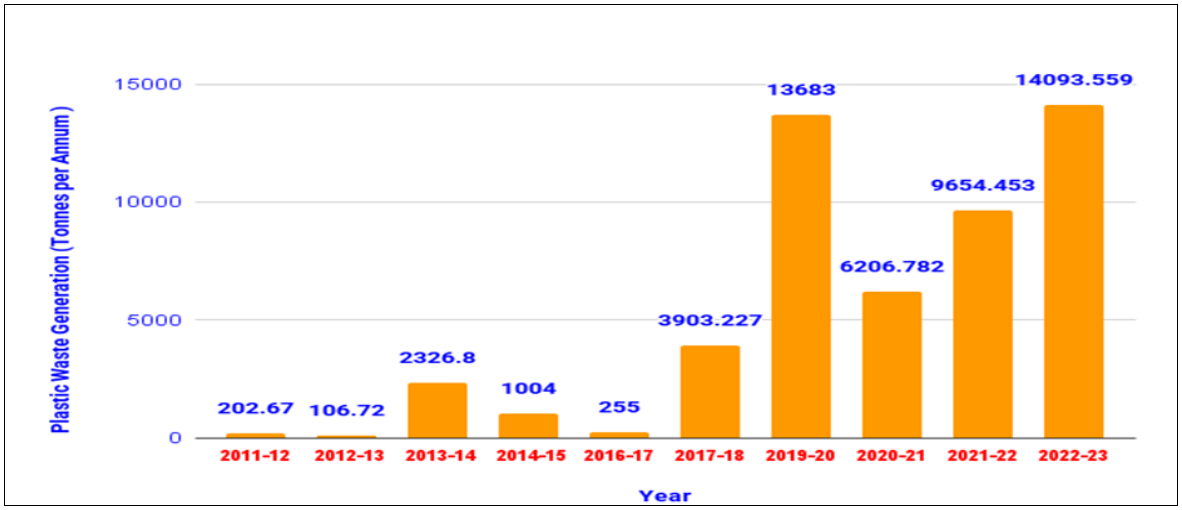

Fig 3: Estimated Plastic Waste generation in Himachal Pradesh during the last 10 years (2011-12 to 2022-23)

From above given data, it is clear that the plastic waste generation per annum in Himachal Pradesh has increased from year 2011-12 (202.67 TPA) onwards except for a few years of decline i.e. 2012-13 (106.72 TPA) and 2016-17 (255 TPA). The highest increase in plastic waste generation was observed during the years 2019-20 (13,683 TPA) and 2022-23 (14093.559 TPA) while the highest decrease was observed during 2012-13 (106.7 TPA) (Table 3, Fig 3).

District-wise Plastic Waste generation in Himachal Pradesh during the last 5 years (2017-18 to 2022-23)

According to Annual Reports of the Himachal Pradesh State Pollution Control Board for plastic waste, district-wise estimated plastic waste generation in 10 districts of Himachal Pradesh during the last 5 years i.e. from 2017-18 to 2022-23 is shown in Table 4 and total estimated plastic waste generation during the last 5 years in 10 districts is shown in both Table 4 and Fig 4 (Himachal State Pollution Control Board 2023) [4].

Table 4: District-wise (10 districts) estimated Plastic Waste generation in Himachal Pradesh during the last 5 years from 2017-18 to 2022-23 in Tonnes per Annum (TPA)

Sr.No.	District	2017-18 (TPA)	2019-20 (TPA)	2020-21 (TPA)	2021-22 (TPA)	2022-23 (TPA)	Total (T)
1	Bilaspur	0.626	304	81.45	85.2	237.52	708.796
2	Chamba	0.371	457	5	8.04	9.4	479.811
3	Hamirpur	11.765	344	74.66	1526.6	1755.95	3712.975
4	Kangra	6.48	2007	401.758	550.8	734.5	3700.538
5	Kullu	8.575	1488	2007.2	2315.5	2269	8088.275
6	Mandi	326.3	1847	668.665	1651.096	5245.945	9739.006
7	Shimla	3001.395	3672	2520.805	2830.108	2545.80	14570.108
8	Sirmaur	1.485	669	11.3	13.5	104.4	799.685
9	Solan	546.05	1811	386.1	625.545	1111.21	4479.905
10	Una	0.180	814	15.074	16.154	48.809	894.217
	Cantonment Boards 1. Jutogh-Shimla 2. Kasauli-Solan 3. Dagshai-Solan 4. Subathu-Solan 5. Dalhousie-Chamba 6. Bakloh-Chamba	-	270	34.77	31.91	31.025	367.705
Total		3903.227	13683	6206.782	9654.453	14093.559	47541.021

The estimated plastic waste generation during the last 5 years (2017-18 to 2022-23) under urban local bodies (ULBs) of 10 districts is shown in district-wise manner while under cantonment boards in 3 districts (Shimla, Solan & Chamba) is shown separately (Table 4). The estimated plastic waste generation in 10 districts of Himachal Pradesh as shown in Fig 4 includes only urban local bodies and excludes the estimated plastic waste generation under 6 cantonment boards because of availability of cumulative data only. However, plastic waste generation under cantonment boards is also a part of 3 districts i.e. Shimla, Solan and Chamba.

From above given data, it is clear that during the last 5 years i.e. from 2017-18 to 2022-23, the highest quantity of total estimated plastic waste generation has occurred in the district Shimla (14570.108 Tonnes) followed by districts Mandi (9739.006 Tonnes) and Kullu (9739.006 Tonnes), while the lowest quantity of total estimated plastic waste generation has occurred in district Chamba (479.811 Tonnes) followed by district Bilaspur (708.796 Tonnes) (Table 4, Fig 4).

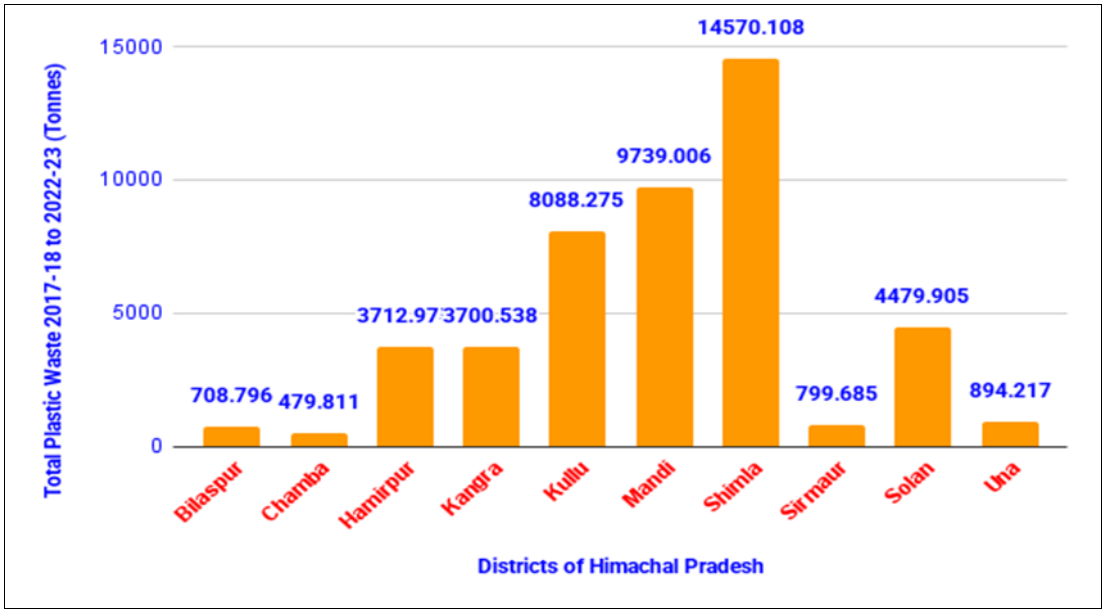

Fig 4: District-wise (10) estimated Plastic Waste generation during the last 5 years (2017-18 to 2022-23)

Estimated Quantity of Plastic Waste/ Dry Waste generation per Day (Tonnes) under 60 Urban Local Bodies (ULBs) of Himachal Pradesh

According to the State Environment Plan (2024), Department of Environment, Science Technology and Climate Change, Government of Himachal Pradesh, the estimated quantity of plastic waste/ dry waste generation per day under 60 ULBs (Urban Local Bodies) of 10 districts in Himachal Pradesh is shown in Table 5. The collection centres for plastic waste have been set up in various urban local bodies. Out of 60 ULBs, 57 ULBs have established separate plastic waste collection centres with a proactive approach of managing plastic wastes through recycling and other processes. (Himachal State Environment Plan 2024) [5].

Table 5: Estimated Quantity of Plastic Waste / Dry Waste generation per Day under 60 ULBs (Urban Local Bodies) of 10 districts in Himachal Pradesh in Tonnes (MCorp: Municipal Corporation, MC: Municipal Council, NP: Nagar Parishad)

Sr. No.	District and ULB	Estimated Quantity of Plastic / Dry Waste generated per Day (Tonnes)	Sr. No.	District and ULB	Estimated Quantity of Plastic / Dry Waste generated per Day (Tonnes)
	District Bilaspur		30	MC Sarkaghat	0.90
1	MC Bilaspur	2.21	31	MC Jogindernagar	0.86
2	MC Ghumarwin	1.28	32	NP Rewalsar	0.29
3	MC Naina Devi	0.43	33	NP Karsog	0.42
4	NP Talai	0.50		Total	15.08
	Total	4.42		**District Shimla**	
	District Chamba		34	MCorp. Shimla	40.99
5	MC Chamba	3.34	35	MC Rampur	1.61
6	MC Dalhousie	1.74	36	MC Rohru	1.11
7	NP Chowari	0.61	37	MC Theog	0.70
	Total	5.69	38	NP Sunni	0.42
	District Hamirpur		39	NP Chopal	0.30
8	MC Hamirpur	2.84	40	NP Jubbal	0.26
9	MC Sujanpur	1.28	41	NP Kotkhai	0.19
10	NP Nadaun	0.75	42	NP Narkanda	0.39
11	NP Bhota	0.23	43	NP Nerwa	0.27
	Total	5.1	44	NP Chirgaon	0.41
	District Kangra			Total	46.65
12	MCorp. Dharamshala	8.45		**District Sirmaur**	
13	MCorp. Palampur	5.79	45	MC Nahan	4.81
14	MC Jawalamukhi	0.87	46	MC Poanta Sahib	4.67
15	MC Kangra	2.14	47	NP Rajgarh	0.50
16	MC Nagrota Bagwan	1.31		Total	9.98
17	MC Nurpur	1.82		**District Solan**	
18	MC Dehra	0.78	48	MCorp. Solan	6.58
19	NP Baijnath	3.10	49	MC Nalagarh	2.33
20	NP Jawali	1.66	50	MC Parwanoo	2.02
21	NP Shahpur	0.54	51	MC Baddi	5.34
	Total	26.46	52	NP Arki	0.49
	District Kullu		53	NP Kandaghat	0.31

22	MC Kullu	3.00		Total	17.07
23	MC Manali	1.91		**District Una**	
24	NP Banjar	0.23	54	MC Una	3.27
25	NP Bhunter	0.72	55	MC Mehatpur	1.61
26	NP Nirmand	0.24	56	MC Santokhgarh	1.63
	Total	6.1	57	NP Daulatpur	0.61
	6. District Mandi		58	NP Gagret	0.74
27	MCorp. Mandi	7.29	59	NP Amb	0.87
28	MC Sundernagar	3.94	60	NP Tahliwal	0.70
29	MC Ner Chowk	1.38		Total	9.43
Under 60 ULBs of Himachal Pradesh				Grand Total	145.98

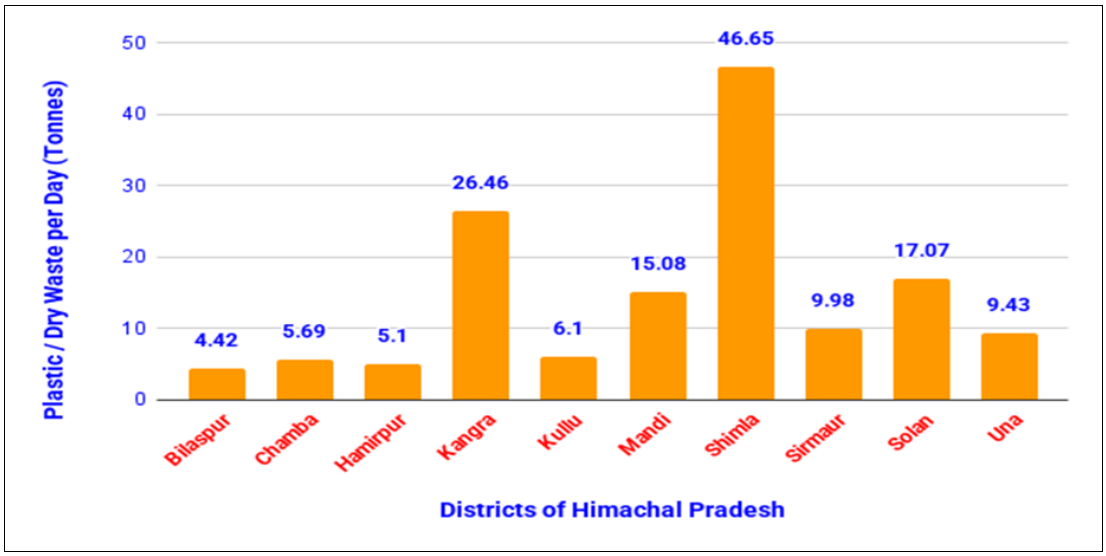

Fig 5: Estimated quantity of Plastic/ Dry Waste generation per Day in 10 districts of Himachal Pradesh

From above given data for ULBs, it is clear that the highest quantity of estimated plastic/ dry waste generation per day has occurred under Municipal Corporation Shimla (40.99 Tonnes) followed by Municipal Corporations of Dharamshala (8.45 Tonnes), Mandi (7.29 Tonnes) and Solan (6.58 Tonnes), while the lowest quantity of plastic/ dry waste generation per day has occurred under Nagar Parishad Kotkhai (0.19 Tonnes) followed by Nagar Parishads of Bhota (0.23 Tonnes), Banjar (0.23 Tonnes) and Nirmand (0.24 Tonnes) (Table 5).

From above given data for districts, the highest quantity of estimated plastic/ dry waste generation per day has occurred in district Shimla (46.65 Tonnes) followed by districts Kangra (26.46 Tonnes), Solan (17.07 Tonnes) and Mandi (15.08 Tonnes), while the lowest quantity of estimated plastic/ dry waste generation per day has occurred in district Bilaspur (4.42 Tonnes) followed by Hamirpur (5.1 Tonnes) (Table 5, Fig 5).

Further, the total quantity of estimated plastic/ dry waste generation per day under all 60 ULBs of Himachal Pradesh has been reported as 145.98 Tonnes (Table 5).

The generation of plastic waste/ garbage during tourist season in some important tourist places of Himachal Pradesh has been found to be higher than the normal days. The data of important tourist places for the generation of plastic waste/ garbage has been estimated as Manali (30-40 tonnes/day), Shimla (60-90 tonnes/day), Dalhousie (30 tonnes/day) and Dharamshala (20 tonnes/day). These four tourist destinations collectively generate about 150 tonnes of garbage/ plastic waste per day during peak tourist season and 40-60 tonnes in lean season. It has also been observed that out of total waste generated per day, only less percentage is disposed of scientifically while higher percentage of it goes into the environment as a pollutant. (The Times of India 2020) [6].

Plastic Waste Dump Sites in Himachal Pradesh

According to a satellite imagery done by the Aryabhatta Geo-informatics and Space Applications Centre (AGISAC), a division of Himachal Pradesh Council of Science, Technology and Environment (HIMCOSTE) in 10 districts of Himachal Pradesh (except two tribal districts i.e. Kinnaur and lahaul-Spiti), 70 plastic waste dump sites have been observed in urban and rural areas of Himachal Pradesh (2023) as shown in Table 6 and Fig 6 (Himachal Scape 2023; The Tribune 2023) [7, 8]. The central Pollution Control Board has laid down the guidelines for safe disposal of legacy waste as its accumulation over the years lead to generation of harmful gases.

Table 6: Plastic Waste Dump Sites in 10 districts of Himachal Pradesh (2023)

Sr. No.	District	Number	Location of Plastic Waste Dump Sites in Urban and Rural Areas
1	Bilaspur	7	Diara Sector, Naina Devi, Dholra Bilaspur & Luhnu Ground Bilaspur.
2	Chamba	5	Chowari, Dalhousie & Chamba.
3	Hamirpur	9	Bhoranj, Bijhari, Hamirpur & Nadaun.
4	Kangra	9	Kangra, Dehra, Baijnath, Paprola, Jawali, Nurpur & Dharamshala.

5	Kullu	4	Kullu, Bus Stand Kullu, Bhuntar & Manali.
6	Mandi	7	Mandi, Churag, Chauntra, Sundernagar, Sarkaghat & Rewalsar.
7	Shimla	17	Jubbal, Rohru, Rampur, Mehli, Bharyal Tutu, Malyana, Ghora Chowki Anji, Chailla, Anti, Dhainda & Ghanahatti Kufri (Dhami), Dochi, Saraswati Nagar & Kharapathar.
8	Sirmaur	3	Rampur Ghat Road, Banah Ki Ser & Koti.
9	Solan	4	Solan, Salogra, Baddi & Gowshala (Kunihar).
10	Una	5	Una, Santokhgarh, Gagret & Daulatpur Chowk.
Total		70	

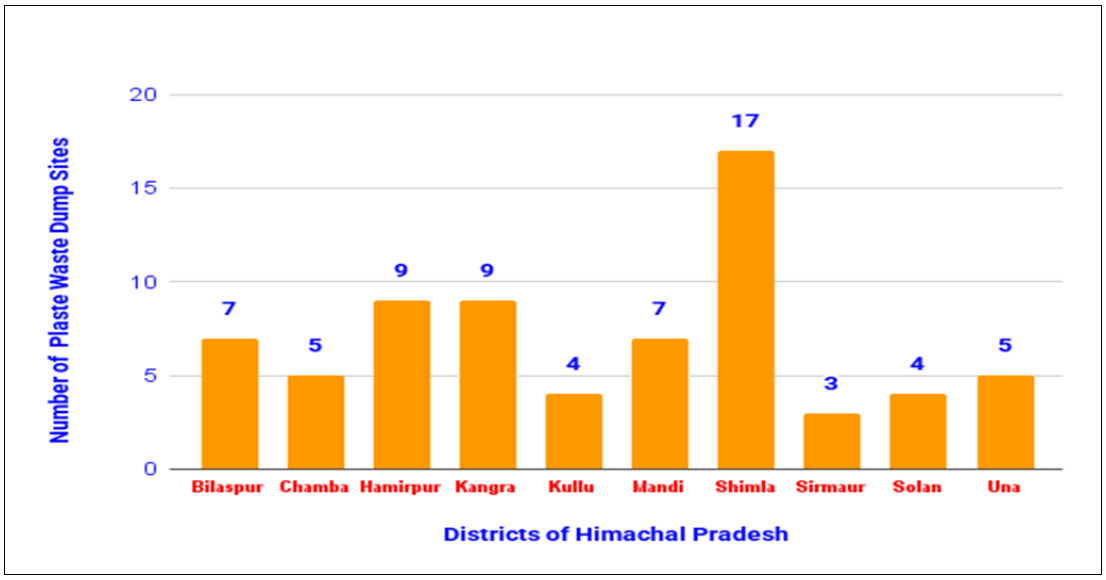

Fig 6: Plastic Waste Dump Sites in 10 Districts of Himachal Pradesh.

From above given data, it is clear that the highest number of dump sites has been observed in district Shimla (17) followed by districts Kangra (9) and Hamirpur (9), while lowest number has been observed in district Sirmaur (3) followed by districts Solan (4) and Kullu (4). Out of 70 plastic waste dump sites in Himachal Pradesh, 43 have been found in the rural areas (Table 6, Fig 6).

Himachal Pradesh Government Laws and Management for control of Plastic Pollution

Himachal Pradesh Non-Biodegradable Garbage (Control) Act, 1995 provides for prevention of throwing or depositing non-biodegradable garbage in public drains, roads and places open to public view and also to regulate the use of non-biodegradable material in the state (H.P. Non-Biodegradable Act, 1995) [9]. In 1999, Himachal Government imposed prohibition on the traders, retailers and vendors in the state for using coloured polythene carry bags manufactured from recycled plastic, food packaging and the goods traded/ sold by them. In 2004, Himachal Government imposed prohibition under section 7(h) of the Himachal Non-biodegradable Garbage (Control) Rules on the stockists, traders, retailers and vendors for all kinds of commodities within the same state for using carry bags made of non-biodegradable material (polythene) of thickness less than 70 microns and size less than 12"x 18". In 2009, Himachal Government started Novel Scheme for Plastic Waste Management *Polythene Hatao-Paryavaran Bachao* and under this scheme it was decided to collect the plastic waste littered on the hill slopes, forest areas, near rivers, streams, nallahs and other areas. The ban was imposed on the use, sale and manufacture of polythene/ plastic carry-bags made up of non-biodegradable material w.e.f. 02-10-2009. In 2010, Himachal Pradesh was the first state to use plastic waste for road construction and the Government announced to use plastic waste in construction of roads, mixing it with bitumen. According to the Himachal Pradesh State Pollution Control Board -A construction of 2 km long & 3.7 km wide road requires 1 tonne of plastic waste. Further, 10 lakh polythene bags can save upto 1 tonne of coal tar. The use of plastic waste in road construction helps in increasing the road strength. Due to the presence of plastic in roads, there is less frequency of road repairs because of reduced chances of rain water seepage and minimized water stagnation. The plastic waste replaces about 10-15% of the bitumen and saves approx. Rs. 35000-45000 per km of a road. In 2010, Himachal Government started the co-processing of plastic waste in cement kilns which resulted in bridging the coal deficit as plastic/ polythene waste has high calorific value for cement production. Himachal Government also has a scheme for use of plastic waste in generation of electricity (Himachal Novel Scheme 2010; Himachal Buy back Policy 2019) [10, 11].

The Plastic Waste (Management and Handling) Rules 2011, 2016 and Plastic Waste Management (Amendment) Rules 2018, 2021, 2022, 2023, 2024 provide regulatory framework for management and handling of plastic waste generated in the state. These include effective implementation of rules, plastic waste reduction, recycling and processing of collected waste. These rules stipulate the role and responsibilities of local authorities for scientific disposal of solid waste. In 2019, Himachal Government started the Buy-back of Non-recyclable and Single-use plastic and decided to buy this waste @ Rs. 75/- per kg. through registered rag pickers and individual households w.e.f. 2nd October, 2019. Under this policy, all types of packaging, pouches and packets of plastic wastes will be purchased by

the local bodies in each district of Himachal Pradesh. For this purpose, Himachal Pradesh Council for Science, Technology & Environment came out with a buy back policy scheme and identified a number of Eco-Clubs in schools and colleges (Himachal Buy back Policy 2019) [11]. In 2024, Himachal Pradesh Revised Eco-tourism Policy 2024 came into effect. The forest department of Himachal Pradesh framed an Eco-tourism policy in 2001 which was revised in 2015, 2016, 2017 and 2024 to promote ecotourism in the state. The Revised Eco-Tourism Policy 2024 aims at bringing the wilderness and virgin ecosystems of the state close to visitors and at the same time ensure adequate safeguards and systems for protection and conservation of these natural resources (Himachal Eco-Tourism Policy 2024) [12].

Conclusion

The trends of tourists in Himachal Pradesh during the last 16 years (2008-2023) have shown that tourist numbers are increasing year after year except for a few years of decline. The increase in generation of plastic waste/ garbage during the peak tourist seasons in some of the important tourist places of Himachal Pradesh have shown that local people in these areas are not adding as much pollutants as tourists do. Despite the implementation of various laws and policies for control of plastic pollution in Himachal Pradesh from 1995 to 2024, the burden of plastic pollutants is still increasing day by day due to lack of public awareness and mis-management of handling wastes.

The main causes of plastic pollution are increasing number of tourists in the state during the last few decades; irresponsible behaviour of the public and throwing away of wastes everywhere; discarded single use plastic products; insufficient number of dustbins and containers for keeping wastes; mismanagement of local bodies for timely disposal of wastes; and weak enforcement of pollution control laws by administration.

Out of total plastic waste generated per day in tourist places of the state, the higher percentage of pollutants are going into the environment causing all types of pollution while only less percentage of pollutants are scientifically disposed of. The estimated plastic waste generation per annum has increased in the state from year 2011-12 to 2022-23 despite few exceptions and reached its highest value during 2022-23 (14093.559 tonnes/year). Further, more haphazard spreading of wastes in the form of plastic waste dump sites and identification of such 70 plastic waste dump sites in 10 districts of the state shows the passive attitude of local bodies and administration in handling the wastes for its timely and speedy disposal.

Suggestions

- There should be awareness programs and sensitization of the general public about the harmful effects of plastic use.
- The replacement of packing, storing and bagging plastic products with biodegradable material.
- There should be a sufficient number of waste containers/ dustbins in the high influx tourist areas of Himachal Pradesh for avoiding waste heaps everywhere.
- There should be timely scientific disposal and management of plastic waste by local bodies.

There must be involvement of all stakeholders on a common platform such as administrators, politicians, scientists, environmentalists, NGOs, clubs and societies for making a pollution free clean environment.

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