Assessment of Solid Waste Composition and Tourist flow at Doodhpathri Kashmir.

ABSTRACT:

The present study was carried out at Doodhpathri, a forest ecosystem and tourist resort, in the Kashmir valley during 2018 with the objectives of determining the municipal solid waste (MSW) generation at 3 sites in the months of May, June and July and also, the tourist rush (number of tourist and vehicles) in these months were also analyzed. Maximum solid waste was generated in the month of July (167.02 kg) followed by June (162.53 kg) and May (136.41 kg). The total quantity of biodegradable waste generated in the month of July was 167.02 kg while as 140.81 kg of non-biodegradable waste was generated during the same month. Similarly, in the month of June, total quantity of biodegradable and non-biodegradable waste generated was 162.53 and 132.58 kg respectively, compared to 136.41 and 108.65 kg respectively in the month of May. The data indicated that the quantity of biodegradable waste generated was higher as compared to non-biodegradable. The tourist flow was significantly higher in the month of July. The total number of tourists in the month of July was 5870 followed by June (5505) and May (4250) (DDA).

I. INTRODUCTION:

Solid waste includes solid or semi-solid domestic waste, sanitary waste, commercial waste, institutional waste, catering and market waste and other non-residential wastes, street sweepings, silt removed or collected from the surface drains, horticulture waste, agriculture and dairy waste, treated bio-medical waste excluding industrial waste, bio-medical waste and e-waste, battery waste, radio-active waste generated in the area under the local authorities and other entities. The production of solid waste has become a global concern, especially in urban areas and popular tourist destinations (Mgimba and Sanga, 2016). Economic conditions, living standards, and population all have an impact on garbage generation (Chiemchaisri *et al*., 2007; Liu and Wu, 2010; Saeed *et al*., 2009). The production of solid waste has expanded dramatically over the world due to the rapid urbanisation and economic development, and its composition has also changed significantly. These modifications put extra strain on the current environment, human health, as well as the waste disposal system. Solid waste needs to be characterized for source, generation rates, type of wastes produced and composition, in order to monitor, control and to improve prevailing waste management systems (Palanivel and Sulaiman, 2014)

Municipal solid waste management includes all aspects of the generation, storage, collection, transportation, processing, and disposal of municipal solid wastes in a way that is ecologically friendly and that adheres to the principles of economy, aesthetics, energy efficiency, and conservation (Tchobanoglous, 1993). The generation of MSW during peak tourist influx (Hindu Pilgrimage; Yatra) at forest areas was too high, which could alter all environmental parameters if proper disposal could not occur at right time (Bhat *et al.*, 2014). Among different problems, one of the biggest problems arising out of tourism activities is the solid waste problem (scientific management and disposal) even in sensitive areas of Himalayas and other similar mountainous tourist spots at the global level. Due to a lack of waste management programmes inside tourist locations, the bulk of created solid waste is illegally dumped, posing a concern to human safety, altering habitat, and lowering the recreational value of places (Najar and Khan, 2013). The amount of organic material in the solid waste attracts rodents in high concentrations. Furthermore, the high warmth and humidity promote rapid bacterial growth and waste breakdown, which creates olfactory annoyance as well as the spread of various diseases and disrupts the aesthetics of the area (Najar and Khan, 2013, Kariminia *et al.*, 2012, Najar and Khan, 2012).

Increased tourist flows and rapid development of tourism infrastructure increase the quantity of waste generated, which accelerates the magnitude of the problem in tourist destinations with negative environmental consequences, and the issue of sustainable waste management is becoming increasingly relevant in many tourist destinations (Murava and Korobeinykova, 2016). In order to choose better solid waste management strategies for the sensitive locations, it will be helpful to do research on the quality of solid waste created. In light of this, the current study was conducted to determine the makeup of the solid waste produced at Doodhpathri (Budgam).

II. MATERIAL AND METHODS

Study area: The present study was carried out in Doodhpathri area of Kashmir. Doodhpathri lies within the geo-coordinates of 33^{o} 54´ 23 N latitude and 74^{o} 36´ 15 E at an elevation of 2544 meters above sea level, in the Budgam district of Kashmir.

(i) Quantification and Classification of Solid Waste Generated

Solid waste samples were collected from dustbins, placed by the Doodhpathri Development Authority (DDA) at different locations. The samples were collected from dustbins on weekly basis in 5 kg polybags and estimation of generated solid waste was done by weighing of waste using digital balance. After estimation of total waste generated separately at each site, the composition analysis was carried out. The determination of the mean composition of the waste was based on spreading, manual sorting and segregation of samples on ground into individual waste components. All the waste components were then weighed separately and the total weight of each waste component was recorded. Finally the observed

components were categorized into biodegradable and non-biodegradable (Akhter and Najar, 2016).

(ii) **Tourist rush in the peak months:**

The data regarding the tourist flow was obtained from Doodhpathri Developmental Authority (DDA). The data pertaining to the number of vehicles and tourists was obtained through primary survey.

III. Results:

Solid waste quantification and composition

The solid waste was collected from the dustbins, parks, roadsides and hotels on weekly basis. The result depicts the quantity and composition of solid waste generated during peak months viz., May, June and July in Doodhpathri. The data clearly indicates that the maximum solid waste generated in the month of July followed by June and May. The total quantity of biodegradable waste generated in the month of July was 167.02 kg while as 140.81 kg of non-biodegradable waste was generated during the same month. Similarly, in the month of June the total quantity of biodegradable and non-biodegradable waste generated was 162.53 and 132.58 kg respectively, while in the month of May 136.41 and 108.65 kg. The data also indicates that the quantity of biodegradable waste generated was higher as compared to non-biodegradable.

Table 1: **Quantification and composition of solid waste (kg) for different months**

Month / **Solid waste**	**Site**	**Month**		
		May	**June**	**July**
Biodegradable	Site 1	31.45	40.68	43.29
	Site 2	65.75	81.65	83.87
	Site 3	39.12	40.20	39.86
	Total	**136.41**	**162.53**	**167.02**
Non-biodegradable	Site 1	25.30	32.25	36.63
	Site 2	50.90	68.93	69.39
	Site 3	32.45	31.40	34.79
	Total	**108.65**	**132.58**	**140.81**

The data are given in Mean of 6 replicates.

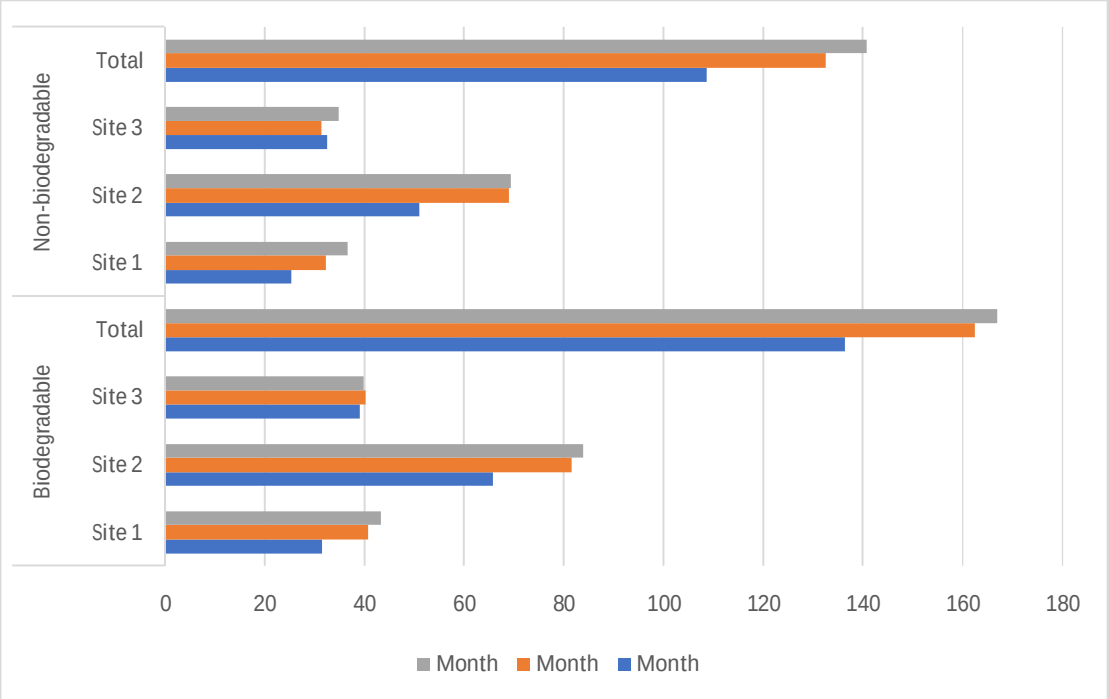

Fig. 1. Quantification and composition of solid waste (kg) for different months

Tourist rush analysis

The data was collected on weekly basis, the data revealed that tourist flow was significantly higher in the month of July. The total number of tourists in the month of July was 5870 followed by June (5505) and May (4250) (DDA).

Table 2: Tourist rush in the peak months at Doodhpathri

Month	No. of Buses/Cars/Bikes				Total
	Week 1	Week 2	Week 3	Week 4	
May	1050	950	1100	1150	**4250**
June	1310	1465	1320	1410	**5505**
July	1460	1510	1490	1480	**5870**

The data are given in Mean of 6 replicate

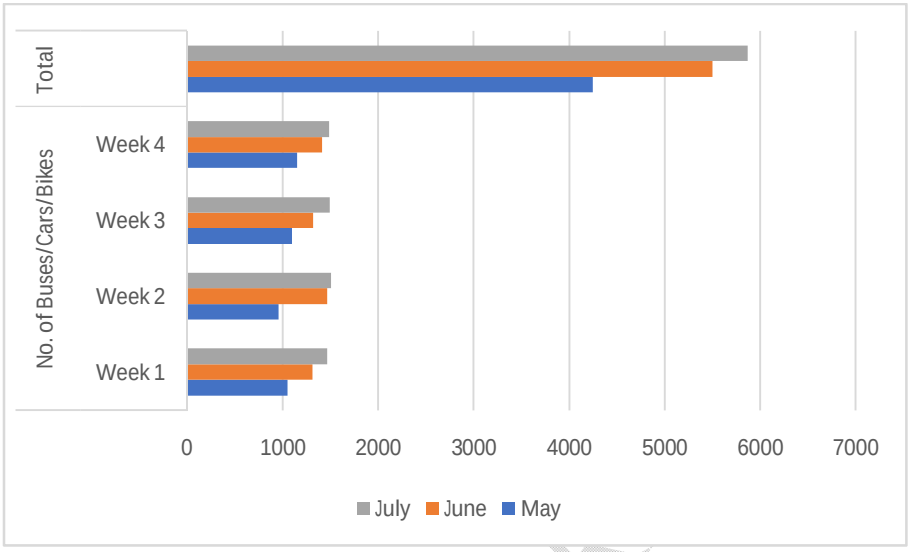

Fig. 2. Tourist rush in the peak months at Doodhpathri

Discussions:

Solid waste quantification and composition: Solid waste generation has become an issue of concern everywhere in the world, particularly in urban centers especially in tourist areas (Mgimba and Sanga, 2016). The solid waste is composed of two main categories- biodegradable and non-biodegradable and their proportion (%) at different sites is given in (Table 1). In the present study the observed values of biodegradable waste varied significantly in three sites during three different months viz, May, June and July, the observed values are 136.41, 162.53 and 167.02 respectively. Similarly, the observed values of non-biodegradable waste varied significantly in three sites during three different months viz, May, June and July, the observed values are 108.65, 132.58and 140.81 respectively. Highest quantity of biodegradable waste was recorded at site-II throughout the study with maximum value recorded during the month of July (83.87%). The highest percent of non-biodegradable was recorded at site-II throughout the study with maximum value recorded during July (69.39%). The reason might be that when the proportion of biodegradable waste increases the proportion of non-biodegradable decreases thus exhibiting an inverse relation between the two. The biodegradable waste comprised of food waste, paper, cardboard, rags and wood chips. The non-biodegradable waste comprised of plastic, glass, styrofoam, polythene and metal (ferrous and non-ferrous) waste and could be attributed to the buying of foodstuffs readily available in containers- plastic, metal, glass, paper board and or carried in polybags by tourists visiting the area. According to Kamran *et al.,* (2015), major component of municipal solid waste corresponds to organic residues followed by plastic, paper and glass. Abdoli *et al*., (2016), reported 60.4% biodegradable content of the total solid waste generated. The present findings are in accordance with Akhter and Najar, (2016).

Tourist rush analysis: The Jammu and Kashmir tourism is having greater abilities to become a best tourist destination in all over the world. As we know the tourism is becoming the economic tool of the countries. Tourism industry in the state as a whole has grown significantly, hence, resulted in upliftment of local service industry. The valley of Kashmir attracts a large number of domestic tourists and a fair proportion of foreign tourists as well (Singh and Bahadur, 2018). In the present study the data presented showed that tourist flow was significantly higher in the month of July. The total number of tourists in the month of July was 5870 followed by June (5505) and May (4250). It may be due to the temperature variations in months. The similar results were observed by Bhat and Sultan, (2013).

Conclusion:

The study revealed that open dumping behaviours by locals, visitors, retailers, and hoteliers are to blame for the current municipal solid waste situation in the Doodhpathri, a forest ecosystem and health resort in the Kashmir valley. The problem is also escalating alarmingly year after year. Designing effective waste treatment, disposal, and management methods requires accurate estimations of solid waste creation as well as evaluation of their physical and chemical characteristics. The Doodhpathri health resort's generated waste management practises have been revealed, allowing for the advancement of proposals for better collection and disposal techniques. More attention must now be paid to treatment systems that include recycling, composting, and recovery possibilities.

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