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# Wastes in Paradise

Volumes, composition and management of  
municipal solid wastes in Maldives



Source: telegraph.co.uk

Nicolas Pucino

## Table of Content

<b>Introduction.....</b>	<b>2</b>
What is waste? .....	2
Wastes and income .....	3
<b>The Maldives.....</b>	<b>6</b>
<b>Solid Wastes Dynamics.....</b>	<b>8</b>
Thilafushi .....	8
<b>The Tourism Controversy .....</b>	<b>9</b>
<b>Waste Characteristics .....</b>	<b>10</b>
Volumes .....	10
Composition .....	13
<b>References.....</b>	<b>16</b>

## Introduction

Nowadays, population and individual prosperity growth combine together to put an increasing pressure on environment resources. The main by-product of societies is their solid wastes (Hester *et al.*, 2002). Municipal Solid Wastes (MSW) are increasing dramatically faster than the rate of urbanisation (World Bank, 2012) as in modern times, the main challenge is still to break the historic link between waste creation and wealth creation.

### What is waste?

If someone think about “wastes” normally is imagining MSW, tough these are only a small fraction of all the solid wastes. For instance, the UK generates more than 400 million tonnes per annum of total generic solid waste, but the MSW account only for the 7%, followed only by commercial wastes in the hierarchy. Agriculture, mining, quarrying, construction, and demolition account all together for 54% of total solid waste (Hester *et al.*, 2002).

The definition of Municipal Solid Waste (MSW) vary according to local waste management policies complicating the collection of global statistics. In general, are considered MSW those arising from household (private) and collected by or on behalf of local authorities from any sources. They might or not include hazardous and bulky wastes as well as those coming from street, parks and garden sweepings and litter (public).

According to a study by the Dutch Environment Ministry in 1997 (ODEA, 1997), depending on definitions the ratio of private household waste to MSW varies dramatically from 45% (Norway) to 84% (Germany).

Global trends are difficult to summarise because of high variability of definitions and driving factors (income, population density, culture, consumption patterns, local resources, etc.). It is argued the MSW generation level will be doubled by 2025 (see figure 1). Current global MSW are about 1.3 billion tonnes per year, and it is projected to be around 2.2 billion tonnes per year by 2025 (World Bank, 2012).

Region	Current Available Data			Projections for 2025 (from Annex J)			
	Total Urban Population (millions)	Urban Waste Generation		Projected Population		Projected Urban Waste	
		Per Capita (kg/capita/day)	Total (tons/day)	Total Population (millions)	Urban Population (millions)	Per Capita (kg/capita/day)	Total (tons/day)
Lower Income	343	0.60	204,802	1,637	676	0.86	584,272
Lower Middle Income	1,293	0.78	1,012,321	4,010	2,080	1.3	2,618,804
Upper Middle Income	572	1.16	665,586	888	619	1.6	987,039
High Income	774	2.13	1,649,547	1,112	912	2.1	1,879,590
Total	2,982	1.19	3,532,256	7,647	4,287	1.4	6,069,705

Figure 1 Current global MSW generation rates and projected amounts. Source: World Bank, 2012

### Wastes and income

As the World Bank in 2012 reported, *“The higher the economic development and rate of urbanisation, the greater the amount of solid waste produced”* (World Bank, 2012), the correlation between income level and urbanisation means that higher standards of living, requiring more goods and services consumption, create more MSW. Thus, as figure 2 highlights, the majority of global MSW production is due to high levels of consumption in high income countries.

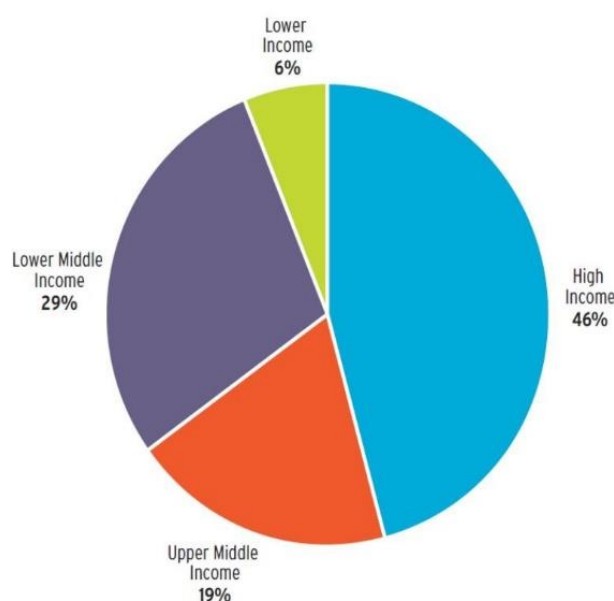


Figure 2 Generation of MSW per income level. Source: World Bank, 2012.

Waste composition is influenced by factors like culture, economic development, climate and energy sources. Generally, low-income country's wastes are mostly organic, while in high-income countries the highest proportion is for papers, plastics and inorganic materials. The World Bank image below (figure 3) provide a good overview of the relationship between income and waste composition.

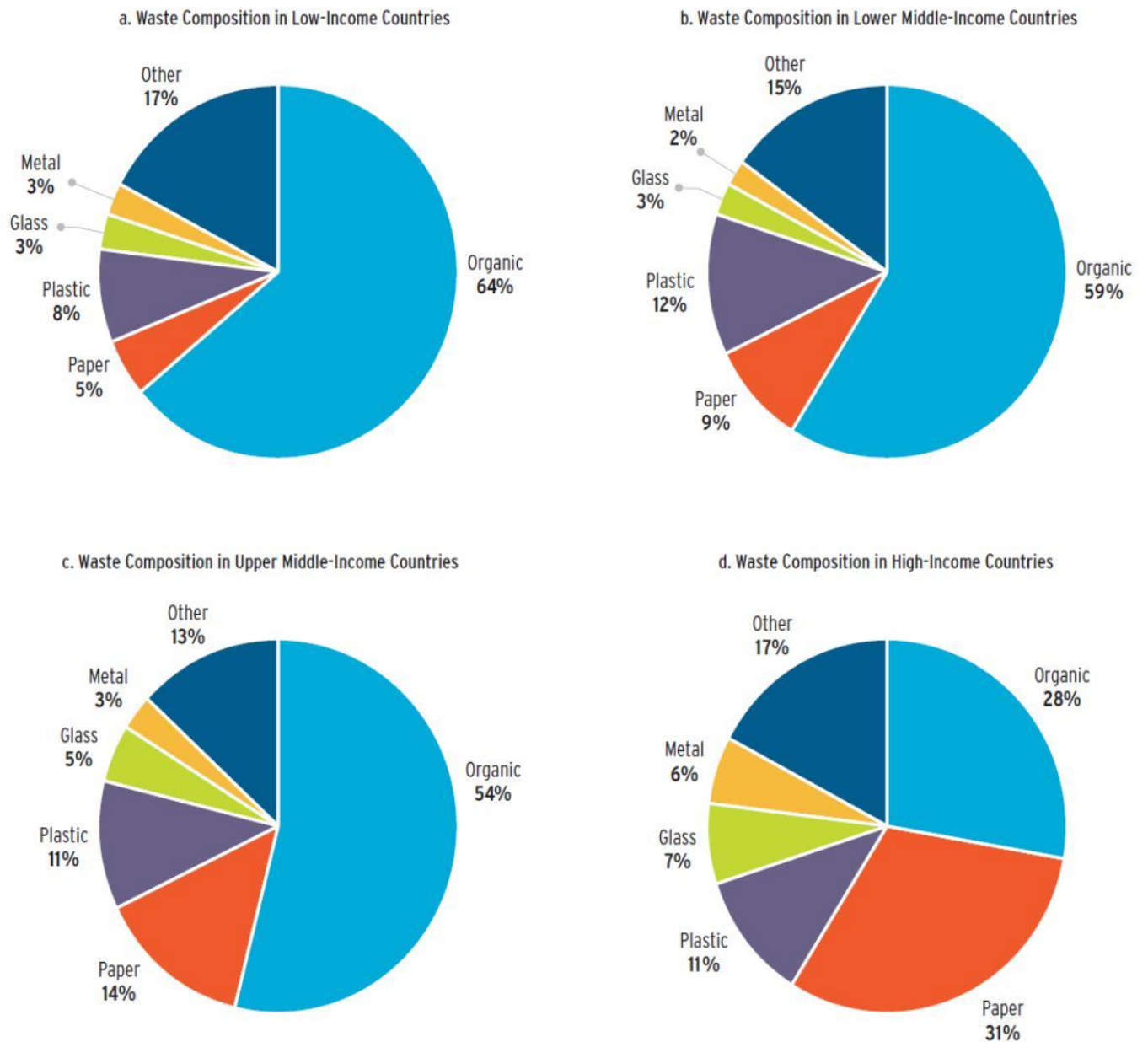


Figure 3 Waste composition per income level. Source: World Bank, 2012.

All considered, MSW are the most significant waste streams because they directly stem from the society, reflecting our lifestyle choice, consumption and resource recovery decisions.

What about Maldives? How a spatially constraint archipelago country, heavily relying on tourism and having its floating capital Malé with a population density four times greater than Sydney, manages its MSW? What are the MSW volumes and compositions of such a particular geographic, cultural and economical situation? Although very informally, this short report provides some statistics and facts covering MSW production, characteristics and management within such a



delicate context that Maldives face. Things are in fast transformation in the Maldives, thus, this report reflects a broad overview of the situation as it was until early 2015.



*Figure 4 Example of resort-atoll in Maldives. Source: telegraph.co.uk*

## The Maldives

The Republic of Maldives is located in the Indian Ocean (southern portion of the country) and the Arabian Sea (northern portion) about 340 kilometres (km) south-west of southern India. The Maldives lie about 750 km on a north-south axis and 120 km on an east-west axis. The archipelago country is comprised of 1,190 coral islands in 26 atolls spread over 90,000 km<sup>2</sup> (see figure 5). Of its 200 inhabited islands, which are spread across an area of 35,000 square miles, 99 are dedicated to resorts (Peterson, 2013). Environmental pressures in the Maldives stem from its fragile geography, coupled with rising population densities, increased tourism and changing consumption patterns. The quantity of wastes produced exceeds disposal and treatment capacity (World Bank, 2014).

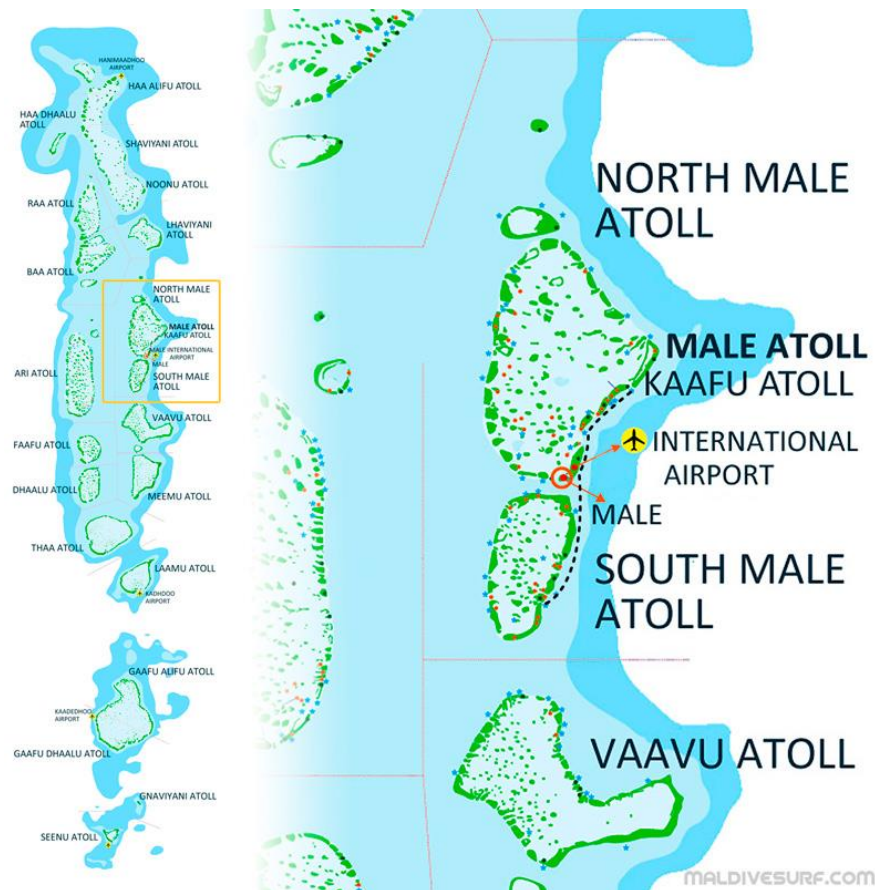


Figure 5 Source: [Maldivesurf.com](http://Maldivesurf.com)

In fact, Maldives have a really high population density, which stems from the limited land surface (only 1% of the total country surface) and a constantly increasing GDP. As figure 6 shows, since 1990



the wealth of the country is steadily increasing and the population density does the same. These considerations are drivers for waste generation and change in the consumption patterns. Malé, the capital city, has a population density almost 4 times greater than Sydney (2013). Its wealthy economy, compared to the rest of the Least Developed Asian Countries (LDAC) is due to the famous and affirmed tourism sector. Despite this, Malé is considered an unusual capital city because it lacks both of a municipal waste collection and of a recycling program (as in 2013). One-third of the Maldivian population lives in the capital, while the rest is scattered in small population centres in 200 islands.

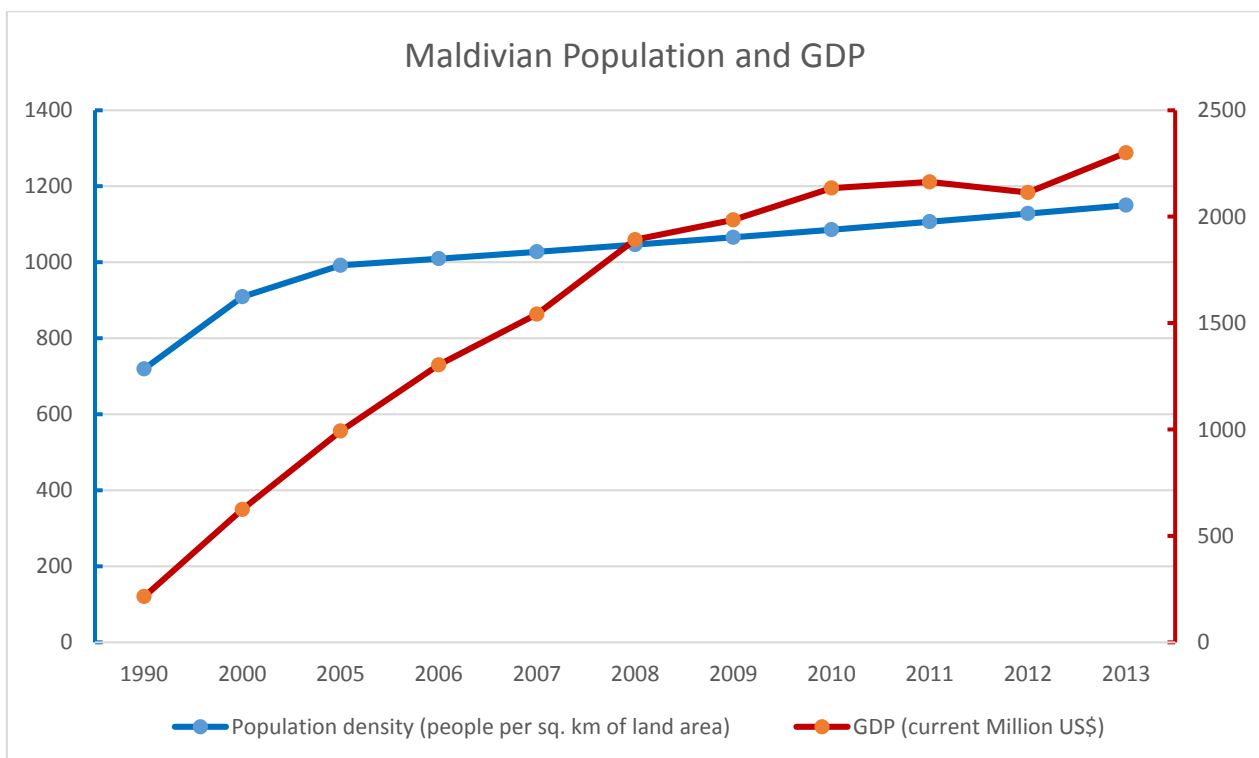


Figure 6 Source of data: World Bank

At the end of 2008, the World Bank funded a 13.5 million US Dollars program (ended in June 2015) which aimed to improve its waste management with:

- 1) A regional solid waste management program in the North Province, which is under-served by waste management facilities
- 2) Build human and technical capacity for environmental management so that the environmental dimension is integrated in the planning process

## Solid Wastes Dynamics

The waste producers must bring their own wastes to the transfer station or pay someone else to do it for them. Households business and institutions can sign a contract with a private company that collects wastes around Malé or they can also rely on about 200 informal collector who, for a small fee, they come by bicycle or pushcarts to collect MSW. Malé has two transfer stations; one for industrial and one for MSW where large trucks carry wastes to the ferry that connects the capital with its artificial open dump island: Thilafushi.

### Thilafushi

It is located 7 km northeast of Malé and it is the only waste disposal facility (figure 7) for the capital and surrounding islands. It has a disposal area of 0.5 km<sup>2</sup> but it has enough room for 30 more years of continual dumping. Until 1991, wastes were utilised to fill the Thilafushi lagoon and reclaim the land.



Figure 7 Source of images: [www.cntvna.com](http://www.cntvna.com)

Malé cannot develop horizontally for accommodating the increasing population, so it's growing vertically, producing large amounts of debris that mixed with ashes and residues (glass and metals not recovered) left from burning trash, are used to expand Thilafushi. Malé council owns the island and leases the land gaining a considerable profit and thus, any recycling or composting industry would have to demonstrate a higher profit than using trash for expanding the island.

The wastes are piled and burned and smoke can be seen from the tallest buildings in Malé. Tourists are not able to see the smoke because Thilafushi is out of the seaplane routes leading to resorts. Government does not manage recycling, thus local scavengers recover metal and PET informally.

Due to limited industrial activities in Maldives, most recovered recyclables are exported to India, the closest large market.

## The Tourism Controversy

Over the last 10 years, tourism has increased at an average annual rate of 8% (600'000 people annually) and accounts for two-thirds of the Republic of Maldives GDP.

Type of Establishment	2009		2010		2011		2012		2013	
	Nos	Beds	Nos	Beds	Nos	Beds	Nos	Beds	Nos	Beds
Resorts / Marinas	97	20,942	98	21,350	101	22,128	105	22,901	110	23,677
Hotels	15	1,368	17	1,449	19	1,603	19	1,627	19	1,626
Guest Houses	22	462	25	476	38	659	75	1,101	135	1,930
Safari Vessels	145	2,206	156	2,434	157	2,514	154	2,503	163	2,716
<b>Total</b>	<b>279</b>	<b>24,978</b>	<b>296</b>	<b>25,709</b>	<b>315</b>	<b>26,904</b>	<b>353</b>	<b>28,132</b>	<b>427</b>	<b>29,949</b>

*Figure 8 Accommodation Establishments and bed capacity, 2009-2013. Source: Tourism yearbook, Maldives, 2014.*

It has a significant impact on waste management in Maldives because a guest generate more than 7 times wastes more than an islander living outside Malé (see next section).

Each resort occupies an atoll and a large freedom is left concerning waste management. Those around Male can afford waste shipping to Thilafushi while the further ones dump their wastes in the ocean or simply burn them. About 67.5% of the resort bed capacity is located on the two atolls close to Malé, the airport and Thilafushi.

Some resorts are reducing their ecological impact by reducing waste generation. Some actions taken in this direction include:

- Purchasing supplies with minimal packaging
- Resort guest are provided of a refillable bottle and asked to take back to their countries batteries and hazardous wastes
- Composting sites that generate nutrients for gardens that provide vegetables for some guest meals
- Glass is crushed and used as construction materials in the island

This methodology allows sending only 7% of total wastes to final disposal (Soneva Fushi Resort).

## Waste Characteristics

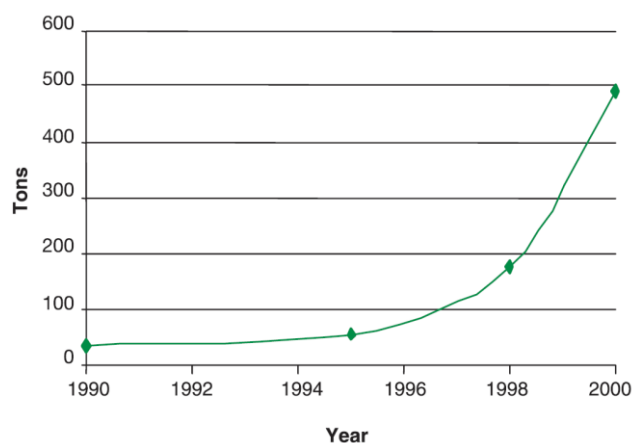
Even if Least Developed Asian Countries (LDAC) have a lower rate of waste generation compared to the cities of the more developed countries, their quantum is high due to their relatively high population densities. Their humid climate coupled with frequent rainfalls complicate the problem of waste disposal. As the cities become more and more urbanised, the rate of plastic and paper waste in MSW increase, reducing the organic one. Tough accurate information on waste generation is necessary to monitor existing management and current trends, reliable data are difficult to obtain in LDAC. The literature review that support the following data has evidenced a serious lack of continual and accurate data about waste volumes and composition in Maldives. In the following sections, I will provide three sources that, in my opinion, significantly depict the:

- 1) Temporal evolution: 1990-2000, by Regional Resource Centre for Asia and the Pacific (RRC.AP)
- 2) Regional context: Comparative analysis of LDAC, by Glawe et al. (2005)
- 3) Punctual state of waste: Assessment of MSW in Maldives, by Peterson (2013)

### Volumes

The quantity of waste discarded in a given area depends on the per capita generation rate, which is directly correlated to income, population and lifestyle standards. Thus, significative differences exist between Malé, the rest of the atolls and the resorts.

Figure 9 evidences how the generation of wastes rapidly increased in 1995 and the rapidly increasing trend match the rapid GDP and population density increase visible in the same period in figure 6.



*Figure 9 Amount of Generic Solid Waste generated daily in Malé. Source: RRC.AP, 2002.*

According to RRC.AP (2002), The MSW in Malé doubled between 1990 and 1995, but from 1995 to 2000 the amount increased by eight fold. Tourism has boomed in the same period and, as figure 11 highlights, a tourist generates much more wastes than a permanent resident in Maldives.

Figure 10 puts Maldives in a regional socioeconomic context, comparing its average value with some of the others LDAC.

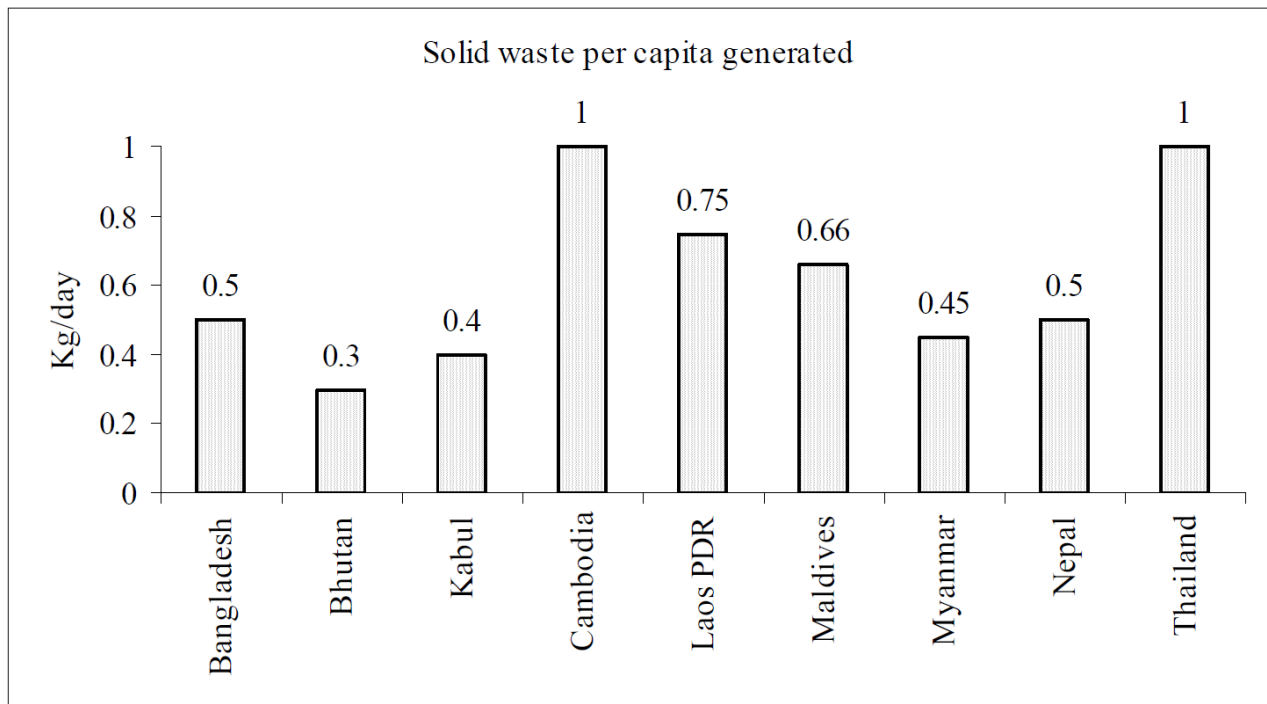


Figure 10 Solid waste generated per capita per day. Source: Glawe, 2005

**Attention:** for some reasons, the author (Glawe, 2005) used the value 0.66, which is representative for the islands communities in atolls different from Malé and without resorts. This was to compare the waste generation of **rural population of these countries**. Thus, this graph shows how Maldives island communities produce a relatively high amount of solid waste being the only archipelago countries represented in the chart, evidencing once again the extreme stress put by MSW on the environment.

Peterson (2013) assessed the waste situation in Maldives and according to its findings; figure 11 shows the differences in waste generation per capita between urban areas (mostly Malé atoll), island communities (not influenced by resorts and other kind of tourist facility) and tourism sector.

Waste Generators	Population	Generation Rate (kg / capita / day) <sup>1</sup>	Daily Waste Generation (mtpd)
Urban Areas	157,780	2.8	440
Island Communities	236,670	1.0	240
Subtotal - Residents	394,450	-	680
Tourist Bed Nights	24,995 <sup>2</sup>	7.2	180
TOTAL			860

1. Solid Waste Management in the Maldives.

2. Tourism Yearbook 2012.

*Figure 11 Estimated waste generation. Source: Peterson, 2013*

According to Peterson (2013), 860 metric tons per day (312.075 mtpd per year) are generated in all Maldives. Peterson estimated that 2.8 kg per capita per day are produced in Malé, 0.66 in the rest of the islands and in resorts is 7.2 kg per guest per day. This data show the importance of considering Tourism as a major issue for waste management in the country.

Due to the peak of occupancy rate during the touristic season (October to April), the amount of waste produced by the touristic sector increase to 205 mtpd or decrease (during less touristic periods) to 160 mtpd.

Tourism sector has a much higher rate of waste generation than Malé atoll or other islands. However, problems relating to waste management are relatively small due largely to better waste management facilities.

All resorts are required under their operating license to have appropriate waste treatment equipment such as bottle crusher, metal compactor and incinerator. Food waste is usually disposed offshore, during night and far from island, in order to minimise the tourist's concerns.



## Composition

There is a significant difference in waste composition between Malé, the atolls hosting resorts and the other non-resort atolls.

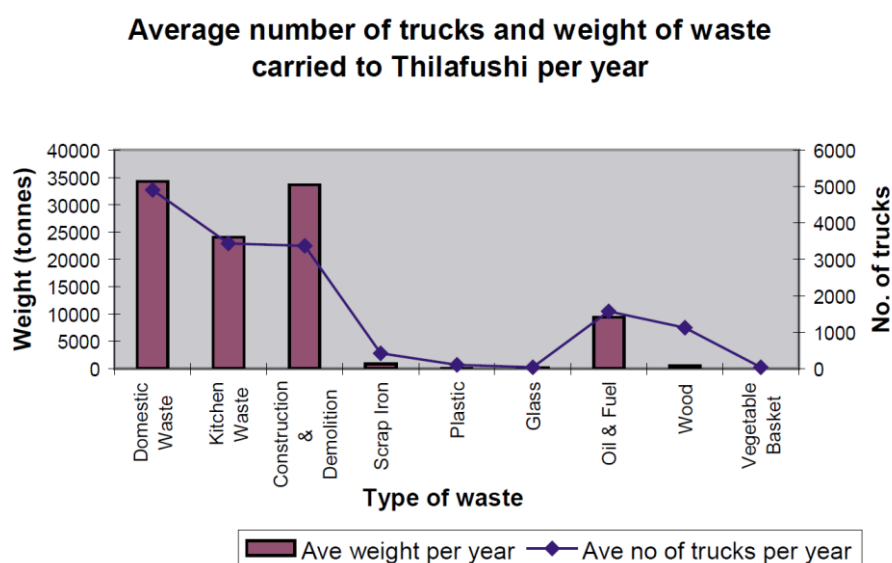
In atolls, the proportion of organic waste (kitchen plus garden) is relatively higher than other sources of wastes, even if backyard composting is a common practice amongst islanders.

In all inhabited islands governmental designated disposal site exist, but some major issues complicate the data acquisition:

- lack of free municipal collection service (93% of structures like households, shops et. do not pay for waste collection and transfer)
- prohibitive distances between homes and dumping sites and low level of awareness (mangroves are perceived as useless and good disposal sites)

These factors contribute to make random disposal of MSW a common practice, contributing to the “leakage” of data accuracy.

In order to have a broad idea of the waste composition coming from the urbanised area (Malé atoll and surrounding ones) in a 10 years time (1990-2000), the most recent (2002) State of the Environment Report of RRC.AP shows the average number of trucks and the weight of different classes of wastes coming to Thilafushi (figure 12).



*Figure 12 Average number of trucks & weight of waste carried to Thilafushi per year from Malé.  
Source: RRC.AP, 2002*

In average, 103.201 tonnes of waste is transferred to Thilafushi every year from Malé alone. The major source of wastes is MSW (domestic plus kitchen wastes), followed by the construction and demolition class. This is the evidence of the rapid developing economy of the urban Maldives. It must be noted that the y-axis is a weight measure which leads to an overestimation of kitchen and domestic (mostly organic) wastes due to their high content in moisture and liquids and an underestimation of other products such as paper, plastic and glass (lower specific weight). If we want to put Maldives in an LDAC context, Figure 13 shows the comparison of waste composition at a national level, according to Glawe (2005).

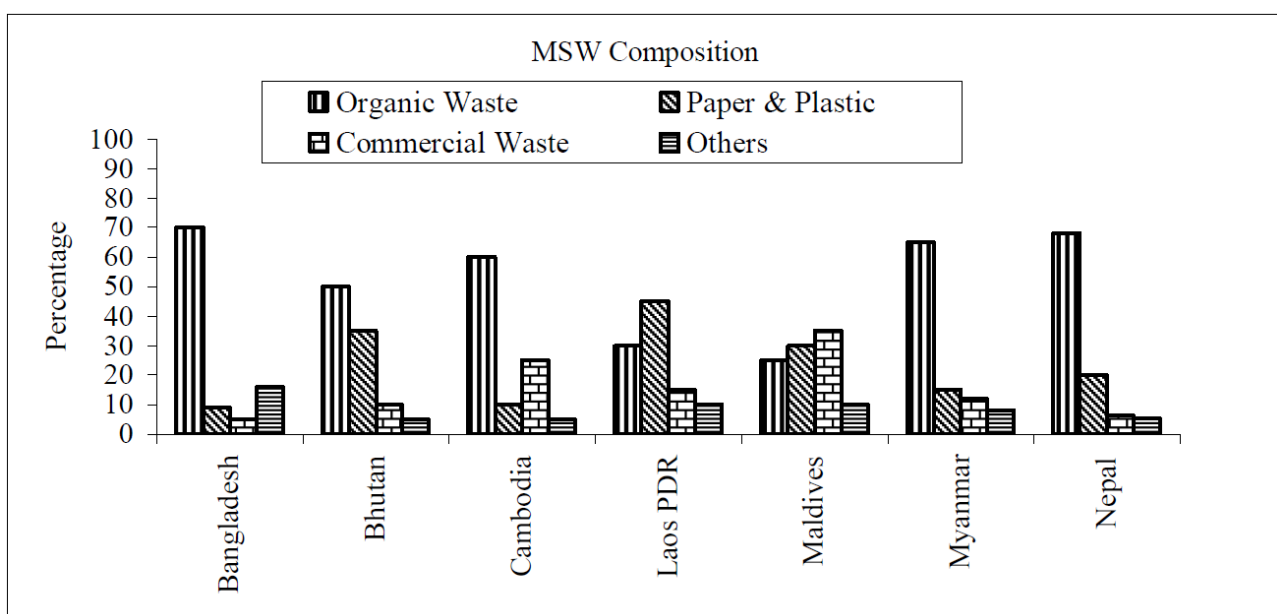


Figure 13 Comparison of organic and inorganic components of MSW. Source: Glawe, 2005.

Though it is expected organic components to be dominant in the distribution of total solid wastes (derived by MSW), this graph shows how in Maldives the trend is inverted. The lower organic portion is due to:

- Backyard composting practices in atolls and some ecological resorts (close to Malé area) with low waste generation practices
- Higher construction debris waste rates than other LDAC
- Source of data is Malé: much higher income and population density levels at a Maldivian scale; higher living and consumption standards, paper and plastics wastes increase with the urbanisation degree.

If we take a closer look to the more accurate 2013 Peterson's data (figure 14), the dominance of organic wastes in atolls communities is really clear and evident.

<b>Component</b>	<b>Island Communities<sup>1</sup> %</b>	<b>Resorts<sup>1, 2</sup> %</b>	<b>Safari Vessels<sup>1, 2, 3</sup> %</b>
Food, Garden/Yard Wastes, and Paper Products	70%	80%	67%
Recyclables - Metals / Plastics	3%	5%	9%
Residuals <sup>4</sup>	27%	15%	24%
<b>TOTAL</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

1. Republic of Maldives, Ministry of Environment and Energy. 2012.

2. Consultant estimate.

3. The different percentage in comparison to resorts is derived from the assumption that there is no landscaping discards in the safari vessel waste stream.

4. Residuals were estimated to include construction and demolition (C&D) debris (9%) - organics such as wood and paper and inorganics such as concrete, glass (4%), miscellaneous discards (2%) such as textiles, leather, rubber, and hazardous waste such as batteries.

*Figure 14 Average waste components from Island Communities. Source: Peterson, 2013*

These data shows the dominance of organic waste in islands communities, resorts and safari vessels (kind of hotels). These wastes derive mostly from food, paper and landscaping by-products, a clear sign of different lifestyle and consumption standards between rural and urbanised areas of the Republic of Maldives.

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