

ASERS

# Journal of Environmental Management and Tourism

Quarterly

Volume XIV

Issue 1 (65)

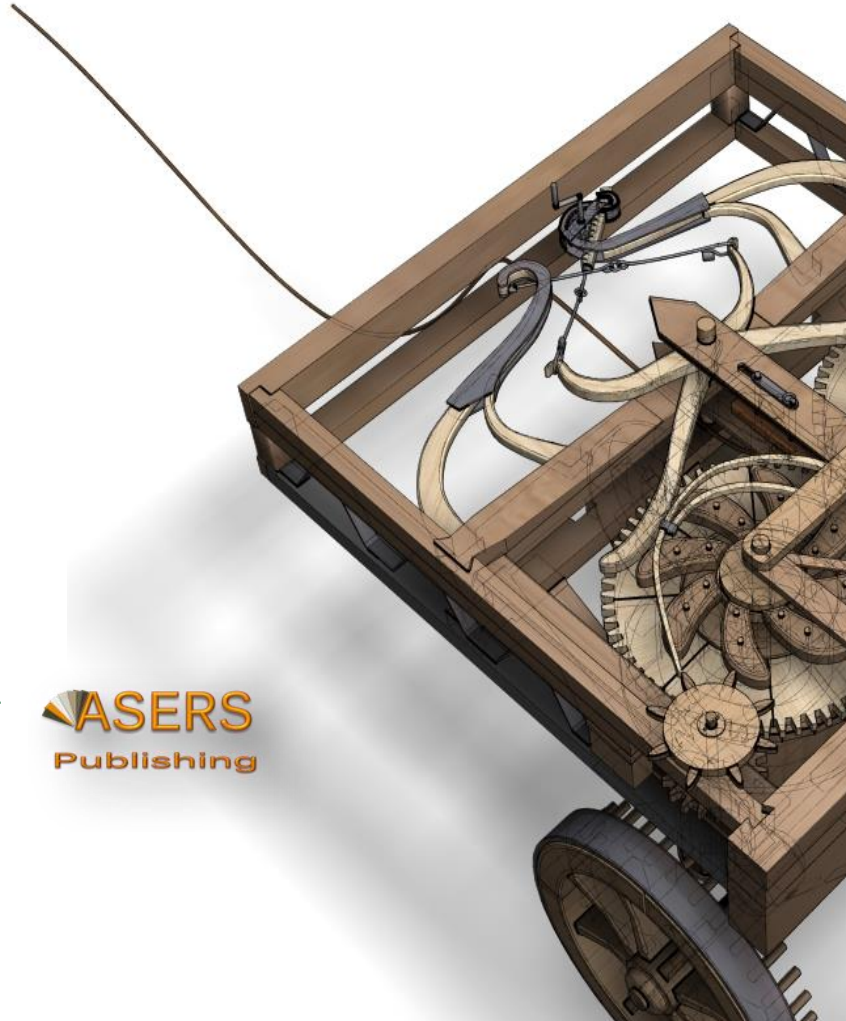
Spring 2023

ISSN 2068 – 7729

Journal DOI

<https://doi.org/10.14505/jemt>

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# Call for Papers Summer 2023 Issues Journal of Environmental Management and Tourism

**Journal of Environmental Management and Tourism** is an interdisciplinary research journal, aimed to publish articles and original research papers that should contribute to the development of both experimental and theoretical nature in the field of Environmental Management and Tourism Sciences.

Journal will publish original research and seeks to cover a wide range of topics regarding environmental management and engineering, environmental management and health, environmental chemistry, environmental protection technologies (water, air, soil), pollution reduction at source and waste minimization, energy and environment, modeling, simulation and optimization for environmental protection; environmental biotechnology, environmental education and sustainable development, environmental strategies and policies, etc. This topic may include the fields indicated above, but are not limited to these.

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All the papers will be first considered by the Editors for general relevance, originality and significance. If accepted for review, papers will then be subject to double blind peer review.

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<b>Website:</b>	<a href="https://journals.aserspublishing.eu/jemt">https://journals.aserspublishing.eu/jemt</a>
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DOI: [https://doi.org/10.14505/jemt.v14.1\(65\).27](https://doi.org/10.14505/jemt.v14.1(65).27)

## The Amount of Tourist Waste in the Altai Mountains. Mongolia and Kazakhstan Cases

Badyelgajy YERBAKHYT

Faculty of Natural Sciences

L.N.Gumilyov Eurasian National University, Kazakhstan

[erbahit.tourism@gmail.com](mailto:erbahit.tourism@gmail.com)

Bauyrzhan KAPSALYAMOV

Faculty of Natural Sciences

L.N.Gumilyov Eurasian National University, Kazakhstan

[ba.kapsalyamov@gmail.com](mailto:ba.kapsalyamov@gmail.com)

Gulnur SASPUGAYEVA

Faculty of Natural Sciences

L.N.Gumilyov Eurasian National University, Kazakhstan

[gulnur\\_erzhanovna@mail.ru](mailto:gulnur_erzhanovna@mail.ru)

Amarjargal MUNKH-ERDENE

Department of Tourism Management

International University of Ulaanbaatar, Mongolia

[a.munkherdene1@gmail.com](mailto:a.munkherdene1@gmail.com)

Zhazgul TUSSUPOVA

Faculty of Natural Sciences

L.N.Gumilyov Eurasian National University, Kazakhstan

[zh\\_tusupova@mail.ru](mailto:zh_tusupova@mail.ru)

### Suggested Citation:

Yerbakhyt, B. *et al.* (2023). The Amount of Tourist Waste in the Altai Mountains. Mongolia and Kazakhstan Cases. *Journal of Environmental Management and Tourism*, (Volume XIV, Spring), 1(65): 283 - 292. DOI:[10.14505/jemt.v14.1\(65\).27](https://doi.org/10.14505/jemt.v14.1(65).27)

### Article's History:

Received 19<sup>th</sup> of December 2022; Received in revised form 12<sup>th</sup> of January 2023; Accepted 22<sup>nd</sup> of February 2023; Published 10<sup>th</sup> of March 2023. Copyright © 2023 by ASERS® Publishing. All rights reserved.

### Abstract:

The article presents information about the result of the experiment that determined the amount of tourist waste in the Altai Mountains of Kazakhstan and the Altai Mountains of Mongolia. During the pandemic, traveling to the Altai Mountains became a trend for domestic tourism in both countries. Due to the low development of the infrastructure in this region, tourist vehicles drive on unpaved roads, build new branch roads, cross clay swamps to approach high mountains, damage the soil cover, and dump garbage into nature. The authors conducted a special experiment on the main tourist routes in the Altai Mountains and determined the amount of waste per tourist. Based on the results of the experiment, calculated the total amount of tourists' in the Altai Mountains in the last 5 years.

**Keywords:** Altai Mountain; Kazakhstan; Mongolia; tourism waste; waste volume.

**JEL Classification:** Q53; Z30; Z32.

### Introduction

The Altai Mountains are a large mountain system in Central Asia that stretches 2000 km along the borders of Russia, China, Kazakhstan, and Mongolia. The Altai Mountains, one of Central Asia's most prominent mountain ranges, are important both ecologically and climatologically. This mountain system attracts scientists and



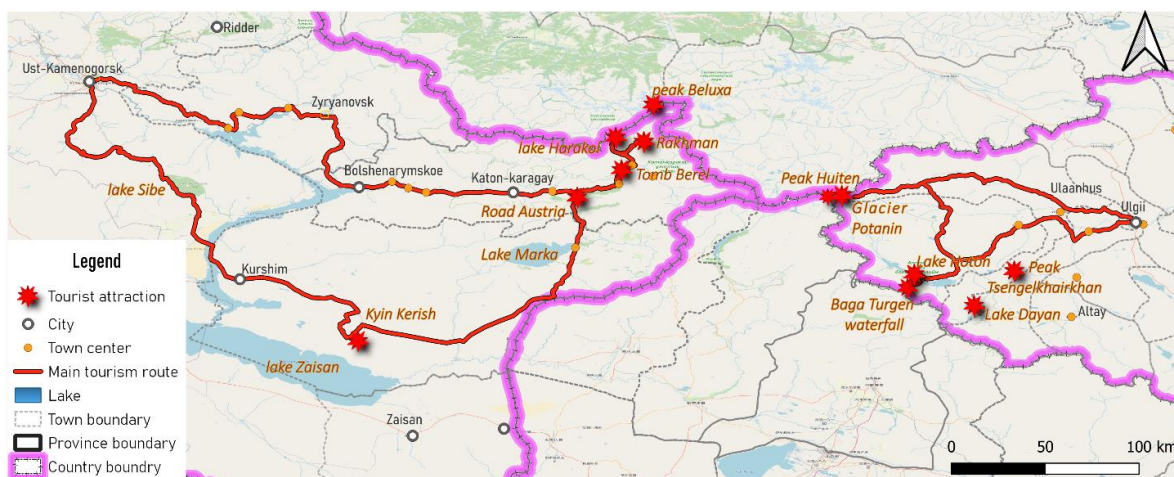
explorers (Aizen *et al.* 2001) and tourists with snow-capped peaks, glaciers, forests, and beautiful scenery. It is considered to be a region with a high potential for tourism development (Braden and Prudnikova 2008). In recent years, the Altai Mountains have become famous worldwide, and uncontrolled tourism of the Altai mountains had a negative impact on the environment (UNDP & GEF 2011, 14). Governments of Mongolia and Kazakhstan have planned to develop the main types of ecological tourism in the Altai Mountains, such as alpinism, mountaineering, hiking, horseback riding, and car trip (Erdavletov 2015, 27), (Government of Mongolia, No. 167 of 1996 year), (Parlament of Mongolia, No. 19 of 2016 year), (Parlament of Mongolia, No. 52 of 2020 year). The infrastructure in the Altai Mountains is not well developed (Chlachula *et al.* 2021; JICA&Mongolian Tourism Department 1999) this reason does not prevent tourists from traveling the region. As the number of tourists increases, the environment is negatively affected by soil damage, grassland compaction, accumulation of garbage near the exhibits, and greenhouse gases from tourist car encroachment of wildlife.

This study aims to determine the amount of waste generated by tourists traveling around the Altai Mountains. Belongs this purpose, 2 tasks were defined: 1) measuring the volume and weight of tourists' waste and 2) evaluating the negative effects of waste on the environment.

### 1. Research Background

There are many travel routes to the Altai Mountains (Erdavletov 1989, 28; Badarch *et al.* 2001; Sofya 2011). Due to the mountainous region, the routes are marked, cannot be bypassed, and return by the way they came. Therefore, it is easier to monitor tourists and conduct research in this area compared to other areas. We aim to make some research results, we have selected one of the popular routes in the Altai Mountains and Mongolian Altai.

Figure 1. Map of the travel routes



We collected the waste of tourists traveling this route for this paper. Brief description of the chosen route.

Table 1. The basic definition of selected routes

Indicators	Altai Mountains of Mongolia	Altai Mountains of Kazakhstan
Reason	A trending route in Mongolia's domestic tourism since 2019	A trending route in domestic tourism in Kazakhstan, after the pandemic,
Location	Western Mongolia, Bayan Ulgii province	East Kazakhstan, Khaton-karagai, Zaisan, Kurshim soums.
Destinations	Ulgii city→Khokhhotol town→Peak Tavanbogd, Potain glacier→ Lake Hoton-Hurgan→ Baga Turgen waterfall→Tsengel soum→Ulgii city	Ust-Kamenogorsk city→ Altai city → Katon-karagai→Berel museum→ Kharakol lake → Rakhan hot spring → Road of Austria → Zaisan lake → Kyin Kerish paleontological zone → 5 lake of Sibe
Length	580 km	1150 km
Duration	3-4 day	4-5 day
Type of roads	No asphalt during the route, bumpy and rough roads, travel only high-engine cars. Go by car up to 3200 altitudes.	Asphalt road, less rough road, few muddy roads. Comfortable traveling with family
Route type	Nature sightseeing, praying for Tavanbogd	Beautiful nature with many mountain lakes, drinking

Indicators	Altai Mountains of Mongolia	Altai Mountains of Kazakhstan
	peaks (Traditional habit)	the blood of deer antlers to health
Main attractions	The Khuiten – the highest peak of Mongolia, the largest glacier - Potanin, the beautiful Khoton Khurgan Lake, Baga Turgeni Waterfall	Berel Tomb Onsite museum, Karakol, Rahman spring, Austrian old road, Zaisan lake, Kyin kerish, 5 lakes of Sibe, Abylaikit
The annual number of tourists	2018y-4071, 2019y-44653, 2020y-51183, 2021y-29683, 2022-56096 domestic tourists (Mongolian Border Department, 2022)	2018y-168941, 2019y-181419, 2020y-121072, 2021y-125147, 101,791 domestic tourists until August 2022 (National Statistic Bureau of the Republic of Kazakhstan 2022)
Time for travel	From June 10, Until July 25	From June 10, Until July 30
Type of transport	High engine vehicles or UAZ cars	All type machines
Number of resorts	There are no large resorts. Total 4 small yurt tour camps of locals.	Total 136 tour camps. Mostly rental cottages
A place where tourists waste	There is no landfill site. Usually near the herdsman's yard or nearby the gas station in Khukhhotol and Tsengel sums	There is little trash in nature. Tourists often bring their garbage to the town center. Forest guards also collect discarded garbage.

## 2. Methodology and Data Collection

The research object is tourists who travelled defined 2 routes and trash from tourists. The sample was measured and the amount of waste per tourist was calculated. The amount of waste per tourist is multiplied by the number of tourists per year. And the volume was calculated using several formulas used in standard measurements. Environmental impact was assessed.

In Mongolia, tourist waste is collected in 3 ways. First, we made a contract with 3 companies to buy tourist waste. However, tourist waste was not collected for 1 month. Contracted companies refused to bring garbage. They explained that it was impossible to transport for a long time with bad smells. Because the garbage bags were disintegrating.

Therefore, on July 25, 2022, we announced that “we will buy garbage from tourists who visited Altai Tavan Bogd in the Mongolian Altai Mountains”. This news was shared by B. Bat-Erdene, the Minister of Environment and Tourism of Mongolia, on his Facebook page. After that, more than 1000 people shared this news with famous journalists on Facebook and broadcasts 20 information websites, media 2 TV. As a result, 16 samples were collected in 14 days. The number of samples was not enough, thus an expedition was organized to the Altai Tavan Bogd route and collected samples of tourists returning from the trip, on August 3-4, 2022. During the expedition were collected 29 samples, and the total number of samples reached to 45.

The 23 samples were taken in Kazakhstan. Here, 15 samples were collected from June 10, 2022, to September 20, 2022, by measuring the amount of garbage after every trip by a contracted tour guide named D.N who organizes a trip to Southern Altai. The last 6 samples were collected by the expedition to the main route of Kazakhstan Altai, On September 20-28, 2022.

## 3. Empirical Results and Discussion

The garbage was sorted into 6 types, and weight and volume were measured. After that, the amount of garbage was determined emitted per tourist. After determining the type and weight, the total amount of trash emitted by tourists was calculated using formulas.

### 3.1 Amount of Tourist Garbage in the Altai Mountains

After measuring and sorting all the samples, it was determined. The per tourist emits 441 grams of garbage who traveled to Mongolian Altai in 3-4 days. This amount is 2-3 times less than the daily emission of Mongolians. The citizen of Ulaanbaatar emits 440 grams of garbage per day (Asia Foundation & Mayor Office of Ulaanbaatar 2020). The Kazakhstan Altai per tourist emits 612 grams of garbage in 4-5 days. No information about how many grams of waste is emitted per person in Kazakhstan.



Figure 1. Expedition and trash collection process



Figure 2. Sorting process



Figure 3. Weighing process

Table 2. Annual volume of waste (tn)

Type	The waste composition (most common types)	Emitted garbage by per tourist (Mongol Altai)	2018	2019	2020	2021	Until August 2022	Emitted garbage by per tourist (Kazakhstan Altai)	2018	2019	2020	2021	Until August 2022
Paper	1. Cardboard boxes 2. Toilet paper, wet wipes 3. All kinds of papers	55 gr	0.2	2.5	2.8	1.6	3.1	55 gr	9.3	10.0	6.7	6.9	5.6
Plastic waste	1. Soft plastic bags 2. PET bottles for various beverages 3. Solid plastic waste (HDPE, LDPE, PVC)	76 gr	0.3	3.4	3.9	2.3	4.3	148 gr	25.0	26.9	17.9	18.5	15.1
Glass	1. Vodka and beer bottles 2. Appetizers in bottles	105 gr	0.4	4.7	5.4	3.1	5.9	120 gr	20.3	21.8	14.5	15.0	12.2
Tetra-pack	1. Box of fruit juices 2. Box of milk	14 gr	0.1	0.7	0.8	0.4	0.8	32 gr	5.4	5.8	3.9	4.0	3.3
Aluminum, metals	1. Beer, beverage can 2. Methane gas canister 3. Canned food	58 gr	0.2	2.6	3.0	1.7	3.3	93 gr	15.7	16.9	11.3	11.6	9.5
Food waste	1. Bone 2. Fruit and vegetable peels 3. Spoiled food	120 gr	0.5	5.1	5.9	3.4	6.5	142 gr	24.0	25.8	17.2	17.8	14.5
Toxic waste	1. Battery 2. Other chemical waste 3. Electrical products	0 gr	-	-	-	-	-	0 gr	-	-	-	-	-
Other	1. Clothes 2. Fabric items 3. Leather items 4. Machine parts	17 gr	0.1	0.8	0.9	0.5	1.0	22 gr	3.7	4.0	2.7	2.8	2.2
Total		441 gr	1.8	19.7	22.6	13.1	24.7	612 gr	103.4	111.0	74.1	76.6	62.3

Source: Estimation results














Plastic waste and glass bottles were found in all samples. The aluminum can waste was found in 92% of all samples. And metal gas cans-82.2%, food waste was found at 82.2%, 64.4% of tetra pack waste, and 75.6% of paper waste were found in all samples. By comparing the annual number of tourists shown in the table above, we calculated the weight of the garbage left by tourists in the last 5 years.

In the table-2, only 81.9 tons of garbage was emitted from 185.6 thousand tourists in Mongolia in the last 5 years, and 427.4 tons of garbage was emitted from 698.3 thousand tourists in Kazakhstan. This is one fact of tourism waste is light and bulky; we need a different perspective. Mostly, tourism waste is measured by weight. In the research, we tried to clearly show that there is an incorrect estimation by measuring the weight of tourism waste. So we used another methodology "comparing by unit". We estimated it by converting it into a unit of waste to compare. From it, we calculated the volume of the formula using the standard size of every type of waste.

### 3.2 Converting to a Unit of Waste to Compare

Comparing it with something the amount of garbage is one of the most common methods.

Table 3. The result of estimation the amount of garbage into converting "1 unit".

Type	Version 1	Mongol Altai	Kazakhstan Altai	Version 2	Mongol Altai	Kazakhstan Altai
Paper	One cardboard box <sup>*</sup> 	10,241 boxes in 5 years/ 3,095 in 2022	38,528 boxes in 5 years/ 5,615 in 2022	A piece of toilet paper <sup>†</sup> 	26,309 pieces of toilet paper in 5 years. 10,523 in 2022	106,714 pieces of toilet paper in 5 years/ 20,211 in 2022
Plastic waste	Plastic bag <sup>‡</sup>  100 bags= 0.77lbs	4,031,062 bags in 5 years/ 1,218,983 bags in 2022	29,531,079 bags in 5 years/ 4,304,313 bags in 2022	PET bottle <sup>§</sup> 	344,115 bottles in 5 years/ 103,983 in 2022	1,940,067 bottles in 5 years/ 367,441 in 2022
Glass	Wine bottle <sup>**</sup> 	39,780 bottles in 5 years/ 12,021 in 2022	171,029 bottles in 5 years/ 24,928 in 2022	Beer bottle <sup>††</sup> 	81,218 bottles in 5 years/ 24,542 in 2022	349,185 bottles in 5 years/ 50,896 in 2022
Aluminum, metals	Aluminum cans <sup>##</sup> Empty standart weight 16.7gr 	644,741 aluminum cans in 5 years/ 194,825 in 2022	3,413,508 aluminum cans in 5 years/ 353,526 in 2022	Methane gas canister <sup>§§</sup> 	104,536 gas cans in 5 years/ 31,588 in 2022	630,567 gas cans in 5 years/ 91,909 in 2022
Tetra-pack	Tetra-pack <sup>***</sup> 1 L 	24,643 tetra-paks in 5 years/ 7446 in 2022	197,769 tetra-paks in 5 years/ 28,826 in 2022	-	-	-
Food waste		4,744 plastic bags in 5 years/ 1434 bags in 2022	22,037 plastic bags in 5 years/ 3,212 bags in 2022	Other waste 	701 plastic bags in 5 years/ 212 bags in 2022	3,414 plastic bags in 5 years/ 498 bags in 2022

\* **Note-1:** The size of a OCC medium box- (24x30x30), standard weight – 997 gr = 2.2lbs, (EPA 2016).

† **Note-2:** Average weight of toilet paper – 277 gr=0.5 lbs, (Toiletseek 2022).

‡ **Note -3:** The standard weight of 100 plastic bags -350 gr=0.77 lbs, (EPA 2016, 3).

§ **Note-4:** The empty weight of a 1l plastic bottle - 41 gr=0.09 lbs, (EPA 2016, 3).

\*\* **Note-5:** The empty weight of a 0.75 l wine bottle-490 gr=1.08 lbs, (EPA 2016, 5).

†† **Note -6:** The empty weight of a 0.33 l beer bottle-240 gr=0.53 lbs, (EPA 2016,5).

## **Note -7:** The empty weight of 6 pieces aluminum can - 403 gr = 0.89 lbs, (EPA 2016,6).

§§ **Note -8:** The empty weight of 1l methane gas canister -230 gr, (Reddit.com 2021).

\*\*\* **Note-9:** Empty weight of 1 l tetrapak bottle -113 gr=4 oz, (System 2012).

There are many methods to compare. This method makes it easy for people to understand anything. We use the method of "converting into 1 unit by most emitted waste type".

If we calculate the total weight of tourist garbage in "1 unit": Mongolian Altai - 10,241 boxes, 4,031,062 pieces of plastic bags, 39,780 wine bottles, 644,741 aluminum cans, 24,643 tetra packs, 4,744 bags of food waste, 701 bags other waste emitted by tourist in the last 5 years. In Kazakhstan Altai 38,528 boxes, 29,531,079 pieces of plastic bags, 171,029 wine bottles, 3,413,508 aluminum cans, 197,769 tetra packs, 22,037 bags of food waste, 3,414 bags of other waste emitted by tourists in the same time. If we replace the most common types of waste with version 2, the piece of waste will be increased. For example: If calculating the number of plastics converted into plastics bottle, it was emitted 344,115 PET bottles in Mongolian Altai and 1,940,067 PET bottles in Kazakhstan in the last 5 years.

While toilet paper naturally decomposes in 2-4 weeks (National Park Service 1998), cardboard boxes decompose much more slowly in 8 weeks and wet wipes decompose in 100 years (Victoria Allen 2016). While on the expedition, we conducted tourists using wet wipes a lot in the Mongolian Altai. Most tourists throw away wipes in nature because they think wipes decompose quickly on nature.

### 3.3 The Volume of Waste

We can calculate the volume of every type of waste based on the total number of pieces. We calculated the volume of waste based on the standard indicators.

There is a large size of non-compactable waste such as wine, alcohol bottles, and plastic bottles. Therefore, if it is light in weight, it occupies a much larger area and more pollutes on nature. We couldn't find standard sizes for tetra-pak waste. Therefore, the volume of tetra-pak waste was not included in the volume calculation.

Table 4. The results of calculating the volume of tourist waste, versions

Types	Standard Measurements	Formulas, proportions	Mongolian Altai		Kazakhstan Altai	
			Volume	Garbage truck <sup>†††</sup>	Volume	Garbage truck <sup>‡‡‡</sup>
<b>Version-1</b>						
OCC Flattened boxes, loose	<ul style="list-style-type: none"> <li>1 cubic yard=50.8 lbs, (EPA 2016)</li> <li>60.96cm x 60.96 cm x 76.2cm=medium size Medium size = 1.1 lbs</li> </ul>	$N = \frac{\left(\frac{2.2lbs \times t_{gr}}{1000}\right) \times 50.8lbs}{1.30yard^3}$ $t_{gr} = \text{annual amount of waste}$	443.1 m <sup>3</sup> in 5 years	50.9	1667 m <sup>3</sup> in 5 years	191.6
Plastics bags, tightly packed by hand	<ul style="list-style-type: none"> <li>12inc x 12 inc x 12 inc =3 lbs, (EPA 2016)</li> <li>12 inc = 30.4 cm</li> </ul>	$N = \frac{28094.47cm^3 \times \left(\frac{2.2lbs \times t_{gr}}{1000}\right)}{3 lbs}$ $t_{gr} = \text{annual amount of waste}$	291.3 m <sup>3</sup> in 5 years	33.5	2134 m <sup>3</sup> in 5 years	245.2
By volume of wine bottles	<ul style="list-style-type: none"> <li>30cm x 7.5cm x 7.5 cm</li> <li>1 wine bottle =1,687.5 cm<sup>3</sup></li> </ul>	$N = T \times (V = h \times L \times W)$	67.1 m <sup>3</sup> in 5 years	7.7	182.8 m <sup>3</sup> in 5 years	21
Aluminum cans, crushed by can crusher	<ul style="list-style-type: none"> <li>13gal=7.02 lbs, (EPA 2016)</li> <li>1m<sup>3</sup>=220 gal</li> <li>3. 1000gr=2.2 lbs</li> </ul>	$N = \frac{x_{lbs} \times \frac{7.02lbs \times \left(\frac{2.2lbs \times t_{gr}}{1000}\right)}{S_{gal}}}{1m^3}$ <ul style="list-style-type: none"> <li><math>t_{gr}</math> = annual amount of waste</li> <li><math>x_{lbs}</math> = amount of total waste converted to lbs</li> </ul>	58 m <sup>3</sup> in 5 years	6.6	351 m <sup>3</sup> in 5 years	40.3
Aluminum cans, Sem-crushed	<ul style="list-style-type: none"> <li>1 cubic yard=91.4 lbs [18]</li> <li>1m<sup>3</sup>=1.30 cubic yard</li> </ul>	$N = \frac{x_{lbs} \times \left(\frac{2.2lbs \times t_{gr}}{1000}\right) \times 91.4lbs}{1.30yard^3}$ <ul style="list-style-type: none"> <li><math>t_{gr}</math> = annual amount of waste</li> <li><math>x_{lbs}</math> = amount of total waste converted to lbs</li> </ul>	200 m <sup>3</sup> in 5 years	22.9	1205 m <sup>3</sup> in 5 years	138.5

<sup>†††</sup> **Note-10:** in Mongolia, the mostly use 4-ton 8.7 m<sup>3</sup> press-type garbage truck "Mitsubishi R2"

<sup>‡‡‡</sup> **Note-11:** Same with Mongolia

Types	Standard Measurements	Formulas, proportions	Mongolian Altai		Kazakhstan Altai	
			Volume	Garbage truck <sup>†††</sup>	Volume	Garbage truck <sup>†††</sup>
<b>Version-1</b>						
Volume of Food waste, by plastic bag	• 15cm x 30.48cm x 30.48cm	$N=T \times (V=h \times L \times W)$	66.1 m <sup>3</sup> in 5 years	7.6	47.6 m <sup>3</sup> in 5 years	5.5
Volume of other waste, by plastic bag	• 15cm x 30.48cm x 30.48cm	$N=T \times (V=h \times L \times W)$	9.8 m <sup>3</sup> in 5 years	1.1	233 m <sup>3</sup> in 5 years	26.7
<b>Version-2</b>						
By the volume of new toilet paper	• 11.43cm x 11.43 cm x 10.4 cm [19] 1 paper=1,358.7cm <sup>3</sup>	$N=T \times (V=h \times L \times W)$	544.5 m <sup>3</sup> in 5 years	62.5	425.3 m <sup>3</sup> in 5 years	48.8
By the volume of used toilet paper	• 11.43cm x 11.43 cm x 10.4 cm • 1 paper=1,358.7cm <sup>3</sup>	$N=3 \times T \times (V=h \times L \times W)$	1633.5 m <sup>3</sup> in 5 years	187.7	1275.8 m <sup>3</sup> in 5 years	146.6
PET soda bottles, whole, loose	• 1 yard <sup>3</sup> =35 lbs, (EPA 2016) • 1m <sup>3</sup> =1.30 cubic yard	$N = \frac{x_{lbs} \cdot \frac{(2.2_{lbs} \times t_{gr})}{1000}}{35_{lbs}} \cdot \frac{1}{1.30_{yard^3}}$ <ul style="list-style-type: none"> <li><math>t_{gr}</math> = annual amount of waste</li> <li><math>x_{lbs}</math> = amount of total waste converted to lbs</li> </ul>	888.7 m <sup>3</sup> in 5 years	102.1	6510.5 m <sup>3</sup> in 5 years	748.3
By volume of beer bottles	• 23cm x 6.2cm x 6.2 cm • 1 beer bottle =884.12cm <sup>3</sup>	$N=T \times (V=h \times L \times W)$	91.2 m <sup>3</sup> in 5 years	10.5	271.4 m <sup>3</sup> in 5 years	31.2
By volume of methane gas canister	• 10.3cm x 4.5cm x 4.5 cm • 1 gas can =208.575cm <sup>3</sup>	$N=T \times (V=h \times L \times W)$	18.3 m <sup>3</sup> in 5 years	2.1	108 m <sup>3</sup> in 5 years	12.4
Volume of Food waste, by plastic bag	• 15cm x 30.48cm x 30.48cm	$N=T \times (V=h \times L \times W)$	66.1 m <sup>3</sup> in 5 years	7.6	47.6 m <sup>3</sup> in 5 years	5.5
Volume of other waste, by plastic bag	• 15cm x 30.48cm x 30.48cm	$N=T \times (V=h \times L \times W)$	9.8 m <sup>3</sup> in 5 years	1.1	233 m <sup>3</sup> in 5 years	26.7

In 5 years, a tourist emitted 5,558-6,117 m<sup>3</sup> of garbage in the Kazakhstan Altai on the selected route. If convert into garbage truck, it will be 644.8-1010.5 trucks.

In Mongolian Altai, tourists emitted 21.4 m<sup>3</sup>-23.4 m<sup>3</sup> of waste in 2017. in 2021, 155.6-181.6 m<sup>3</sup>, in 2022, 294.6-303.2 m<sup>3</sup> of garbage was emitted. The amount is increasing every year. If it is converted to a garbage truck, it will be 130-186 trucks in the last 5 years and only 33-35 trucks in 2022. Approximately 5-8 trucks of tetrapak waste are not included in the calculation.

### 3.4 The Negative Impact on Environment

Plastic waste is the most common waste emitted by tourists. In Mongolian Altai, it is observed that tourists often throw waste in nature, and then volunteer to clean up the waste. In 2022, the Mongolian Ministry of Environmental Protection and Tourism was implemented a "clean-up waste" campaign in every province. As a result, the amount of waste thrown into the environment is reduced. However, it was picked waste in nature, the collected waste is throw in open landfills. It decomposes under the sun or is scattered around and eaten by livestock. It is not being landfilled, neutralized, or destroyed.

In Altai of Kazakhstan, there is very little waste left in nature, most of it is left near the village. Village waste is being burned in the open. Burning waste with charcoal has become a normal phenomenon for local people. It emits toxic greenhouse gases into the environment. While on the expedition, we saw the open burning of waste in 2 villages, in Altai of Kazakhstan, and took photos and videos. In general, in Kazakhstan, compared to Mongolia, tourists emit 10 times more waste. Most of the waste is open burning emitted by tourists in the Altai Mountains of Kazakhstan. It means that the amount of greenhouse gases emits in nature is 10 times more. Open burning of waste is also common for local people in the Mongolian Altai.

It is known that plastic waste is the most common waste emitted by tourists. These types of garbage are very light in weight, but they are very large in volume. You can see this by comparing the data in "table-2" and "table-4". Plastic bottles decompose in 450 years (National Park Service 1998), thin type of plastic bag decomposes in 1-2 years, and thick type one is in 10-20 years.

Plastic waste contains chemical additives such as endocrine disruptors, which are associated with negative health effects including cancers, birth defects, and immune system suppression in humans and wildlife (Ecology Center 2021). So during decomposition, it is harmful to both the environment and humans.

In the Mongolian Altai, most of the garbage is dumped in the open dump, so it flies away, spreads everywhere, or is eaten by animals. Garbage left over from animal feeding is blown away by the wind in the Mongolian Altai. The number of livestock killed by eating garbage is increasing every year.

If we hypothesize 75% of all plastic waste is thrown into the environment of Mongolian Altai by international forecast (WWF 2019), it can be estimated that 25% of all garbage is burned or fodder for livestock. This is at least 2-4 trucks of plastic waste. In Mongolian Altai, garbage is picked up by volunteer tourists, and forest rangers but the collected garbage is blown away by the wind. In Kazakhstan, tourist waste is less thrown into the environment, but burning it increases the danger to the environment and humans.

Aluminum cans decompose in 80-100 years (Converse Energy Future 2021) and metal cans of methane gas in 50 years (Stacker 2022). 28,393 pieces of 0.75-liter glass bottles or 0.33-liter beer bottles were thrown away into nature, which decomposes the slowest in nature, more than 1 million years. It is not known how much carbon dioxide (CO<sub>2</sub>) is released into the air during the decomposition of these wastes. There are no clear indicators of that assessment of ecological damage from waste. Food waste belongs to the garbage that decomposes quickly in nature. But food waste emits a large amount of carbon dioxide (CO<sub>2</sub>) in a short time.

Assuming all food waste decomposes in nature or becomes fodder for animals, 198.3 tons of carbon dioxide (CO<sub>2</sub>) have been released in Kazakhstan's Altai, and 30.4 tons of carbon dioxide (CO<sub>2</sub>) has been released in Mongolian Altai into the air.

### Conclusion

Our results determined that in the Mongolian Altai, one tourist emits 441 grams of waste in 6 types during a 3-4 days trip. In 2022, 56 thousand tourists will travel on this route and emit 294.6-303.2 m<sup>3</sup> of waste, if it is transported, it will be 33-35 garbage trucks. In the last 5 years, tourists emitted 1077.4-1618.6 m<sup>3</sup> of waste into nature in Mongolian Altai.

It was determined that one tourist emits 612 grams of waste in Kazakhstan Altai during 4-5 days. And due to a large number of tourists here, the amount of waste is 6-7 times more than in Mongolian Altai. In the last 5 years, a total volume of 5,558-6117 m<sup>3</sup> or 644.8-1010.5 garbage truck waste was emitted. In the last 5 years, 698.3 thousand tourists traveled to 4 tourism zones in this area. This is 26.2 percent of all domestic tourists in the East Kazakhstan region, and this percentage is increasing every year.

In the Mongolian Altai, most of the garbage is dumped in the open dump, so it flies away, spreads everywhere, or is eaten by animals. In Kazakhstan Altai, waste is burned with charcoal by local people and it emits toxic greenhouse gases into the environment that have an enormous impact on nature.

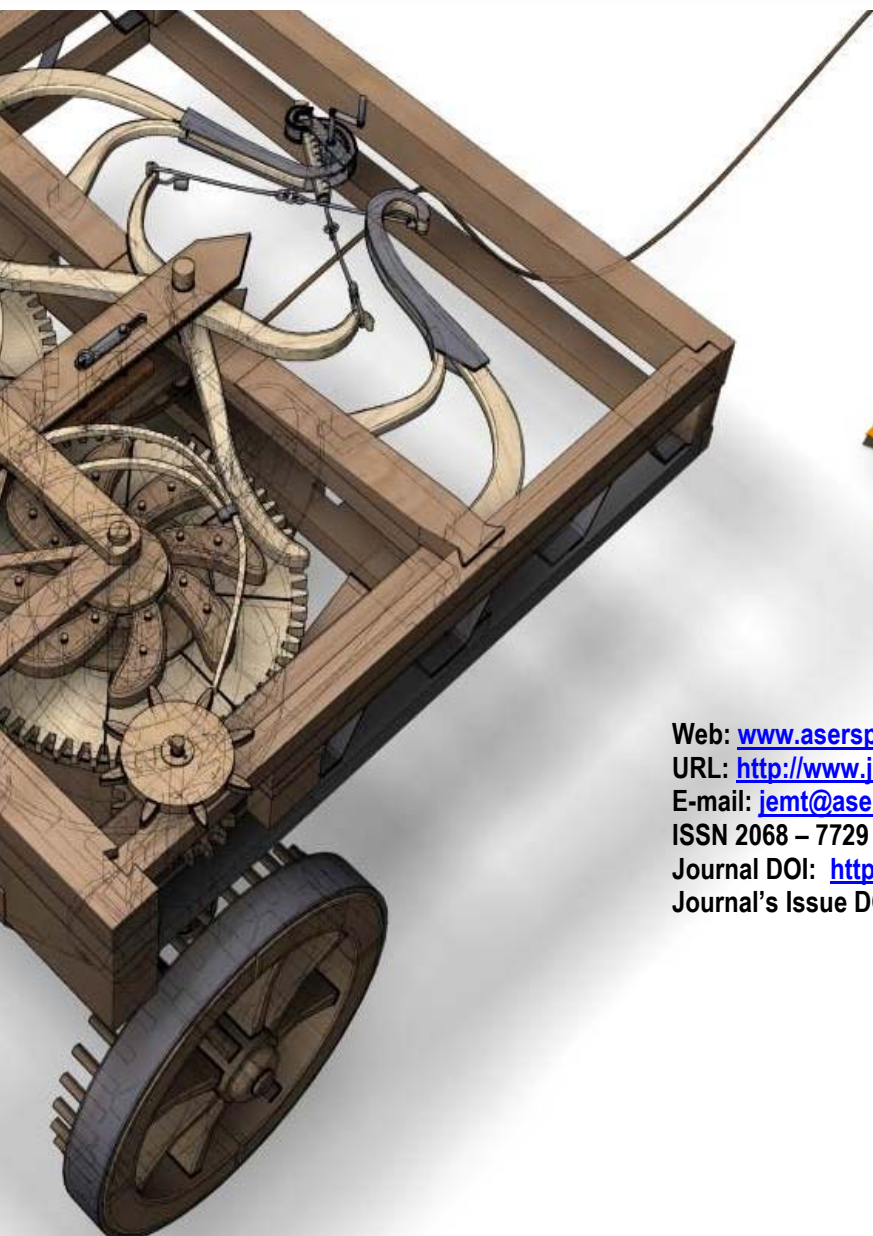
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ISSN 2068 – 7729

Journal DOI: <https://doi.org/10.14505/jemt>

Journal's Issue DOI: [https://doi.org/10.14505/jemt.v14.1\(65\).00](https://doi.org/10.14505/jemt.v14.1(65).00)