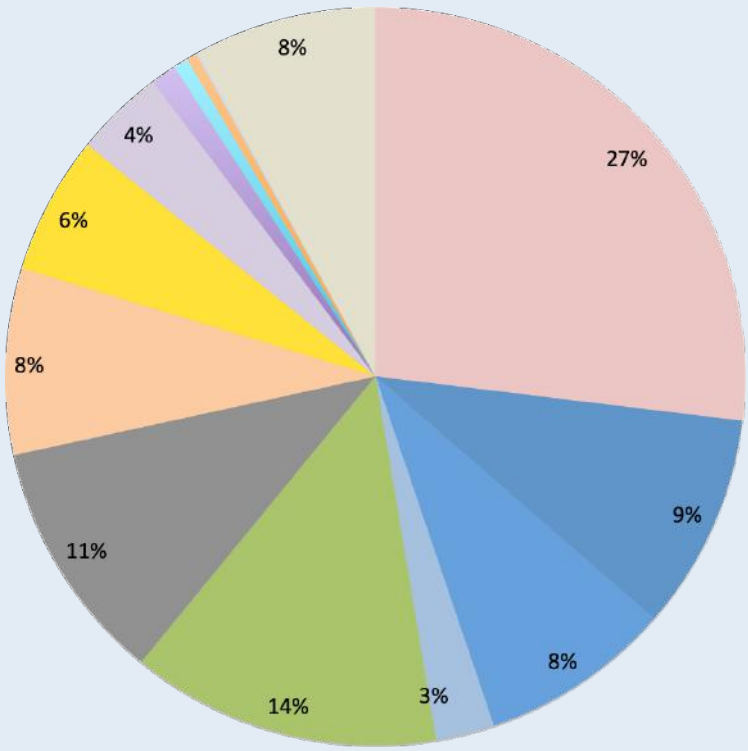
ECOSOUM

The Asia Foundation

WASTE COMPOSITION STUDY

DATA ANALYSIS REPORT



Written by **Pierre Guerber**, Ecosoum's Director
Validated by **Narantuya Gursed**, Ecosoum's President

AUGUST 2019

INTRODUCTION

Overall, data about waste composition in Mongolia is lacking, especially in rural soums. In Khishig-Undur, even though Ecosoum's team spent many hours in the local dumpsite to try and identify what kind of waste is mainly present, formal data about waste composition is virtually inexistent, like in the rest of the country.

As part of its waste management project in Khishig-Undur and thanks to the support of The Asia Foundation, Ecosoum has carried out in July 2019 a domestic waste composition study, in order to bring precisions to field observations and provide detail on how much of each type of waste is produced by average households in the soum.

This report aims to present data analysis results.

METHODOLOGY

51 households from Khishig-Undur soum-center volunteered to participate in the study after Ecosoum's team posted an announcement on Khishig-Undur's Facebook page, which is followed by almost all families in the soum.

However, only 36 households actually respected the main guidelines and provided Ecosoum with their sorted waste. Therefore, this study is based on a representative sample of 10% of Khishig-Undur soum-center's households (36 out of 367[1]).

Before the beginning of the study, all households were given precise instructions and sorting bags. They had to sort all the waste they produced over the course of one week (from Monday 22nd to Sunday 28th of July 2019) into 15 categories:

1. Paper;
2. Plastic bottles (PET);
3. Hard plastic (HDPE, LDPE, PVC);
4. Plastic bags;
5. Tetra pack;
6. Glass;
7. Metal (e.g iron, aluminum, copper);
8. Food;
9. Fabric, woven items, leather;
10. E-waste;
11. Batteries;
12. Toilet and sanitary items;
13. Ash (measured at household if possible);
14. Livestock dungs (measured at household if possible);
15. Other.

[1] Mongolian Statistical Information Service (http://1212.mn), 2018.

At the end of the sorting week, they brought their sorted waste to a dedicated collection point where everything was weighed by Ecosoum's team. In some cases, waste was collected by Ecosoum's team directly from their homes and weighed back at Ecosoum's headquarter. When relevant, livestock dung was estimated after weighing a representative sample directly at household's khashaa.

Each participating household was also given a questionnaire to fill. This questionnaire had 8 main questions related to topics that may have an impact on household's waste production and that could be used to interpret data.

The questions were the following:

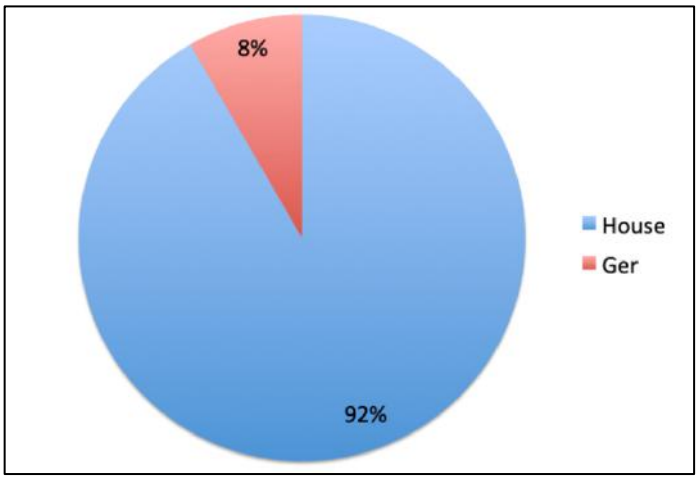
1. Does your household currently live in a house or in a ger?
2. Including yourself, how many people live in your home in Khishig-Undur soum-center?
3. Does anyone in your household perform a professional activity within your home/khashaa? If yes, precise what kind of activity.
4. What is the average annual income of your household?
5. How do you heat your home: electric, fire stove, other? If stove, what kind of fuel do you usually use in summer: coal, wood, livestock dung, other?
6. What heating system do you use to cook at your home: electric, fire stove, both electric and fire stove, other?
7. Do you have animals in your khashaa (dogs, livestock)?
8. If you have animals, do you usually give them your food waste to eat?

Data was processed and analysed in August 2019. Results are presented and discussed bellow.

CONTEXTUAL DATA FROM QUESTIONNAIRE

1. Type of housing

92% (33) of sample households turned out to be living in houses, while only 8% (3) was living in a ger.



Percentage of sample households living in houses and gers

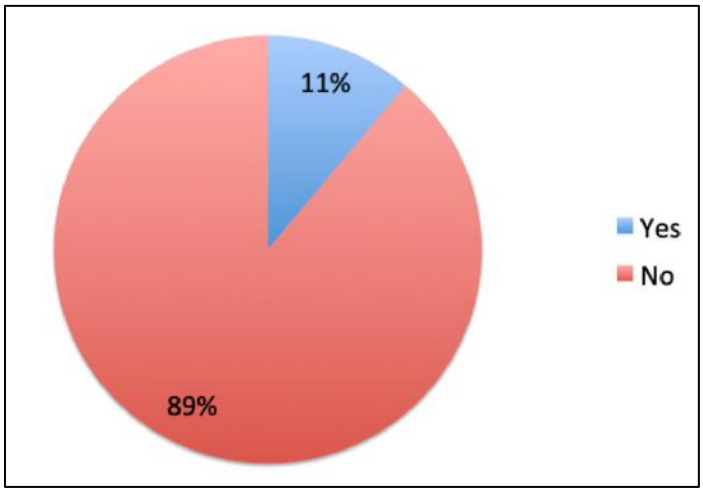
2. Number of people per household

On average, sample households comprise 3.9 people, including 2.4 adults and 1.5 children.

Average number of adults and children in sample households

3. Professional activity within khashaa

Only 11% (4) of sample households carry out a professional activity within their personal khashaa: one is breeding cows, one is breeding pigs and welding metal, one grows cucumbers in a greenhouse and one is a mechanic.



Percentage of sample households who carry out a professional activity within their khashaa

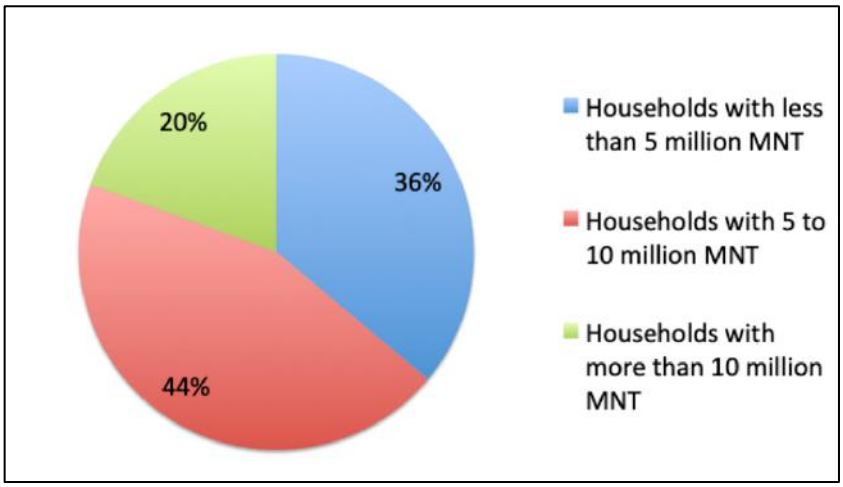
4. Average income

The average annual income among the sample population is 7.5 million MNT.

The average annual income per adult in each household is 3.5 million MNT.[2]

44% (16) of sample households have an income comprised between 5 and 10 million MNT. 36% (13) earn less than 5 million MNT per year, while remaining 20% (7) get over 10 million MNT.

[2] Annual income per adult was calculated for each household before to be averaged for the whole sample. If we simply divided the average annual income in sample households by the average number of adults in sample households, we found find an average income per adult of 3.1 million MNT.



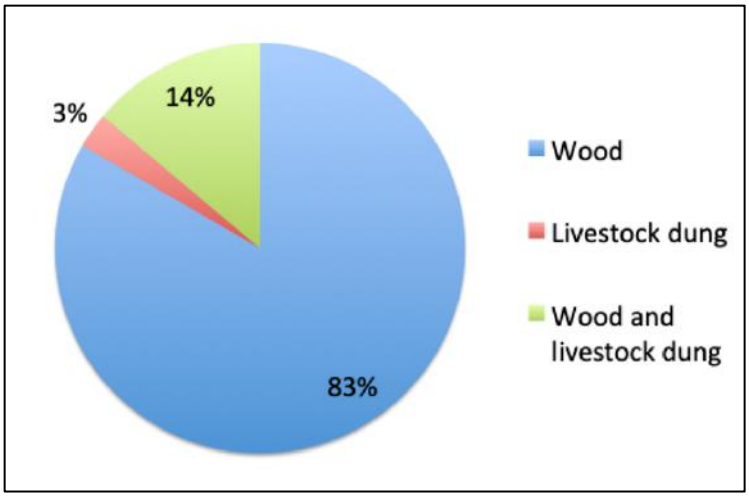
Percentage of sample households depending on their average annual income

5. Heating system

All 36 households usually heat their house thanks to a fire stove.

During summer, none of them fuel their stove with coal.

When they do light a fire, 83% (30) use only wood, 14% (5) use wood and livestock dungs, and 3% (1) use only livestock dungs.

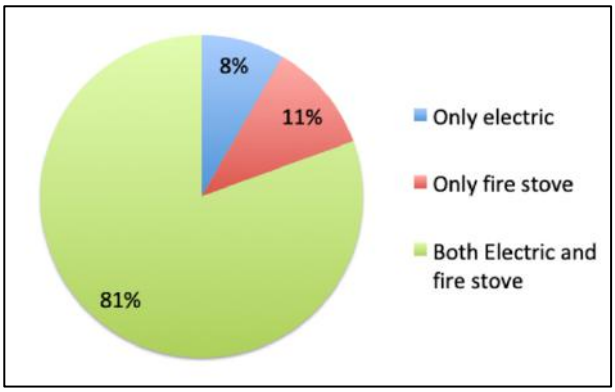


Percentage of sample households who use wood, livestock dungs or both to fuel their stove

6. Cooking system

81% (29) of sample household usually cook on either electric or fire stove.

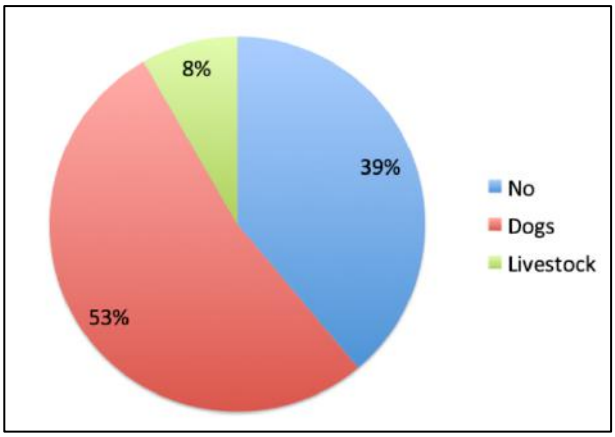
11% (4) use only fire stove while remaining 8% (3) use exclusively electric hotplate.



Percentage of sample households who use electric hotplate, fire stove or both for cooking

7. Animals within khashaa in summer

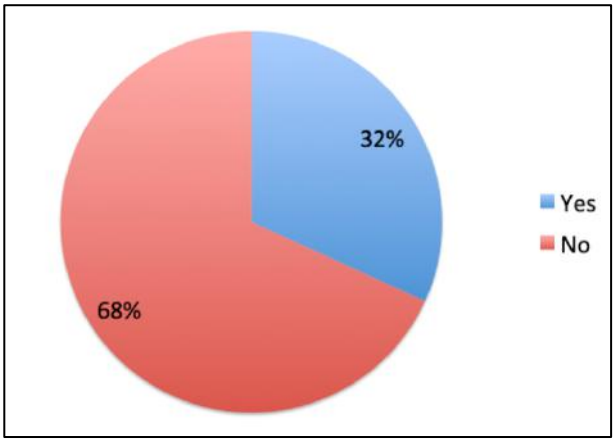
53% (19) of sample households claimed to have dogs while 8% (3) said they kept livestock in their khashaa during summer (2 of them have cows and the other have pigs). 39% (14) have no animal.



Percentage of sample households who have dogs, livestock or no animals within their khashaa during summer

8. Feeding food waste to animals

Out of the 22 households who claimed to have animals within their khashaa, only 32% (7) feed them with food waste.



Percentage of 22 households with animals who feed them with their food waste

WASTE COMPOSITION: RESULTS AND DISCUSSION

Livestock dungs

Livestock dung has a special status among our 15 categories. Only 3 households (8% of the sample) have livestock and produce dungs. The first one possesses 10 cows and weighing showed they produce about 140kg of dung each week. The second one owns 7 pigs that produced 70kg of manure. The last one has only 2 cows but our measurements showed they produced about 80kg of dung over the course of one week.

For these households, if dungs were to be considered as domestic waste like all other 14 categories, they would represent 97% of their total waste. Even if we took into account all 36 households of the sample (including 33 that don't have livestock nor dungs at all), we would find that dungs represent on average 70% of all waste. This consideration would make further analysis futile, as we should conclude that livestock dung is by far the main waste management issue in Khishig-Undur soum-center.

However, several important comments have to be made to put things into perspective and strongly minimize the importance of livestock dungs in Khishig-Undur soum-center's domestic waste composition – and even the relevance of classifying them as domestic waste in the first place.

First of all, it should be noticed that weighing dungs faces a very important time-related approximation: fresh dungs weigh obviously much more than dry dung. At the household who owns 10 cows, what they showed us to be produced by one cow in one day turned out to weigh about 2kg, while at the household who owns 2 cows the same alleged production (one cow in one day) was more than 3 times heavier (over 6kg). Since those dungs were supposed to have been produced roughly at the same time, it is hard to conclude which is the "right" weight.

Secondly, 2 of these 3 households (the one with 10 cows and the one with pigs) declared breeding animals was a professional activity, even though it was partially carried out within their personal khashaa. As such, dungs should not be considered as "domestic" waste, but rather as "professional" waste.

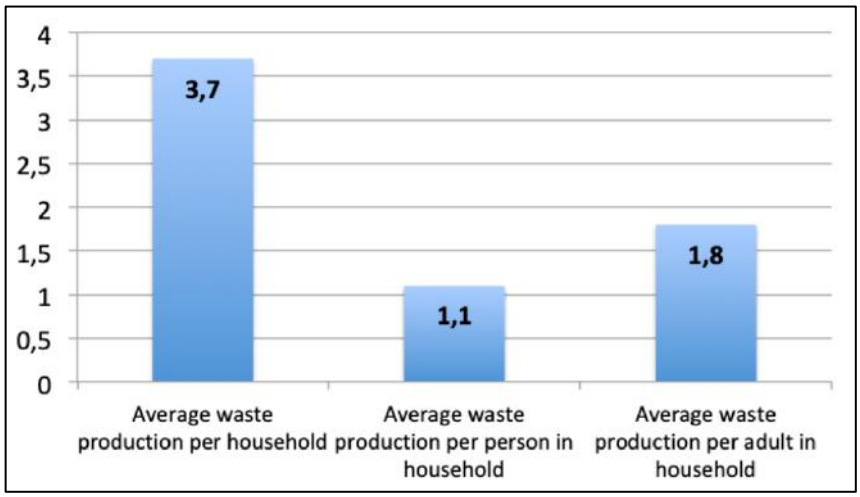
More importantly, most of cow dungs should not even be considered as "waste" at all. Indeed, Mongolian law defines waste as an "*article or item that the owner does not need anymore*"[3]. Since our households claimed to keep these dungs to dry them and fuel their stoves, they are not technically "waste". The household with 2 cows even collects dungs outside their khashaa to burn them, which proves they don't have enough of this alleged "waste".

In conclusion, since pig manure should be considered "professional" waste and cow dungs should not be considered as waste at all – and considering that including dungs in waste composition data makes it impossible to properly analyze domestic waste composition –, it seemed more relevant to exclude dungs from data analysis results and discussion in the rest of this report.

[3] Law on Waste, Art I, § 4.1.1, Ulaanbaatar, 2017, Mongolia.

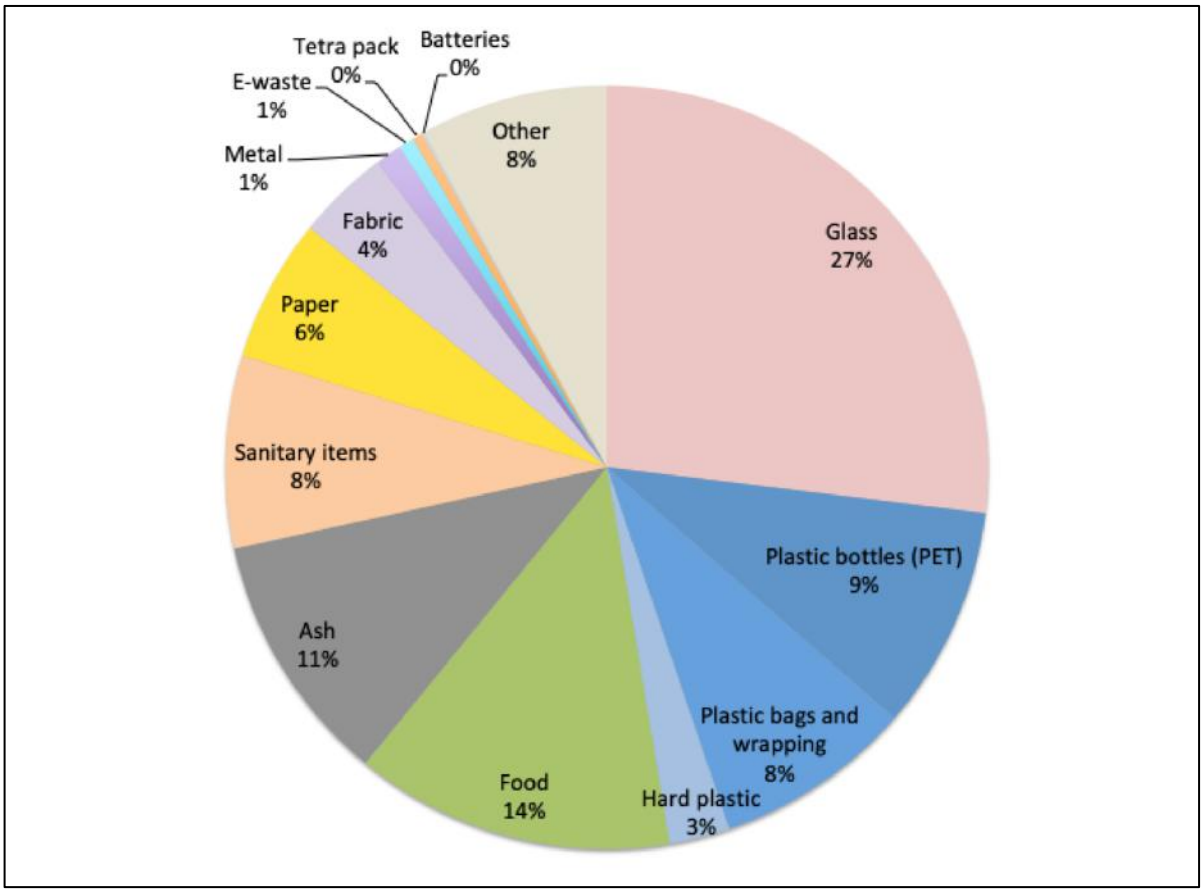
Domestic waste average weekly weight

Excluding livestock dungs, average domestic waste turned out to reach 3.7kg per household per week. In light of household compositions, average weekly domestic waste production is 1.1kg per person in household, or 1.8kg per adult in household.



Average weekly waste production per household, per person in household and per adult in household (kg)

Domestic waste average composition



Percentage of each category of waste among sample households (excluding livestock dung)

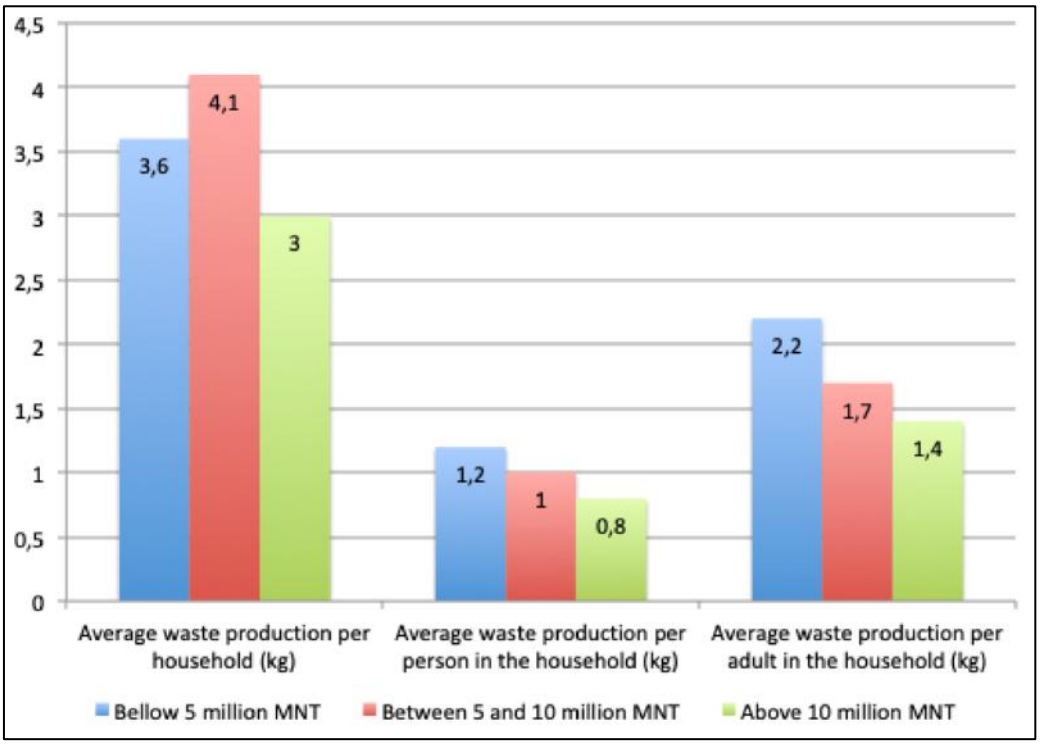
Excluding livestock dungs, glass appears to be the number one category of waste (in weight), accounting for more than one quarter (27%) of total domestic waste. Plastics represent the second main category (20%), with PET bottles making up almost half of them. Food waste comes next (14%), followed by ash (11%) and sanitary items '(8%). Paper (6%) and fabric (4%) are present in smaller quantity, while metal (1.1%), e-waste (0.7%), Tetra packs (0.4%) and batteries (0.1%) are almost absent. Waste that couldn't fall under any of the 15 specific categories (wood, mixed items, unidentified material, etc.) represents 8% of the total domestic waste.

A few additional comments can be made:

- Glass is the number one waste in weight, but due to its lighter weigh plastic waste appeared to be much more important in volume. This reality needs to be taken into account for waste management considerations, especially in remote soums when transportation costs (to urban recycling factories) are directly linked to the volume that can be put in a truck.
- Only 7 households (20% of sample) claimed to feed their animals with food waste, so figures presented here should be quite representative of actual food waste production.
- Ash proportion may be slightly underestimated as only one third (12) of sample households brought ash with their waste. When asked, many claimed they didn't light any fire during the sorting week (because most (89%) can cook on electric hotplate so they light fires only to warm up the house), but it is possible some of them actually did light fires and didn't tell us.
- Sanitary items also suffer approximations, which are more ambivalent. One the one hand, they may have been underestimated since one third (12) of sample household did not bring any sanitary item at all, which is not realistic if only regarding toilet paper use. On the other hand, sanitary items' weight may have been overestimated for some households as toilet paper came out very humid and heavy, which could be explained by the fact that it was store outside and was wetted by rain. For the 2 households who brought the heaviest bag of sanitary items (app. 3kg), it turned out to be mainly baby diapers. These diapers were in fact in the right bag so they don't impact the relevance of total sample results. But we can still stress that this fact tends to overestimate average sanitary waste for household who don't produce baby diapers (which represent 94% of our sample).
- Fabric waste was probably also slightly overestimated as one household brought over 2kg of old fabric that had probably be kept in the house for a long time (we suspect that household to have used the study as a reminder that they needed to get rid of that old fabric).
- Metal waste may be underestimated since scrap merchants frequently pass by Khishig-Undur to buy old metal, which makes it valuable even as "waste". In this context, the nearly absence of metal in sorted waste was expected.

Domestic waste production depending on income

In order to look for differences in waste production depending on households' income, we compared data for 3 categories of annual income: less than 5 million MNT, between 5 and 10 millions MNT, and above 10 millions MNT per year.



Average waste production depending on household's annual income

Regarding overall waste production, results show that waste amount tends to decrease as income increases. If we didn't take into account the number of households' members, households with 5 to 10 million MNT would seem to be producing more waste (4.1kg per week) than households bellow 5 million MNT (3.6kg per week) and households above 10 million MNT (3.0kg per week). But when we look at average waste production per person or per adult in households, it becomes clear that a higher income tends to a significantly lower waste production (see chart above).

As for waste composition (see table bellow), three main trends can be observed:

- Glass waste proportion tends to decrease as income increases (from 33% in households with less than 5 million MNT to 19% in households with more than 10 million MNT).
- Food waste proportion tends to increase with income (from 10% in households with less than 5 million MNT to 22% in households with more than 10 million MN).
- E-waste proportion tends to increase with income (from 0% in households with less than 5 million MNT to 4% in households with more than 10 million MNT).

Besides these trends, it is hard to identify specificities to each category of income, either because figures are quite similar from one to the other, or because the middle category (5 to 10 million MNT) is the one significantly higher or lower than the other two (which makes it impossible to identify a direct connection between income and waste production).

Finally, it can also be noticed that like in the whole sample, glass is the number one waste for households with incomes bellow 10 million MNT, but for households with more than 10 million MNT the number one category of waste is food.

Average annual income	Bellow 5 million MNT	Between 5 and 10 million MNT	Above 10 million MNT
Paper	6%	**7%**	5%
Plastic bottles (PET)	10%	8%	**13%**
Hard plastic	**4%**	2%	2%
Plastic bags	**11%**	6%	10%
Tetra pack	0%	**1%**	**1%**
Glass	**33%**	26%	19%
Metal	1%	1%	2%
Food	10%	13%	**22%**
Fabric	3%	**5%**	3%
E-waste	0%	0%	**4%**
Batteries	0%	0%	0%
Sanitary items	2%	**13%**	5%
Ash	**15%**	7%	14%
Other	7%	**11%**	1%

Average percentage of each category of waste depending on income

Domestic waste production depending on type of housing

We wondered if type of housing could have an impact on waste production and divided data depending on whether households lived in houses (3.7kg per household on average) or in ger (4.0kg per household on average). But since only 3 households (8% of the total sample) lived in a ger, results may not be very representative of all Khishig-Undur's households living in gers. With such a small "ger sample", it appears too approximate to identify trends and draw conclusions. Results are presented in the table bellow for information, but they should be treated cautiously.

Housing type	House	Ger
Paper	6%	4%
Plastic bottles (PET)	9%	12%
Hard plastic	3%	1%
Plastic bags	8%	10%
Tetra pack	0%	0%
Glass	26%	36%
Metal	1%	0%
Food	12%	27%
Fabric	4%	0%
E-waste	1%	0%
Batteries	0%	0%
Sanitary items	8%	6%
Ash	12%	2%
Other	9%	1%

Average percentage of each category of waste among households living in houses and in ger

CONCLUSIONS

This domestic waste composition study, conducted in Khishig-Undur in July 2019 with a representative sample of 10% of soum-center's households, highlighted several interesting information:

- Average domestic waste production is approximately 3.7kg per household per week, which means about 160 grams per person per day. Extrapolated to the entire soum-center of Khishig-Undur, it represents roughly 70 tons per year.
- Glass and plastic represent almost half (47%) of total domestic waste. As such, priority should be put on these two categories when it comes to improving waste management.
- Food waste accounts in average for only 14% of domestic waste, which is much less than in urban areas where it can represent 43% (Ulaanbaatar's Ger district) to 78% (Ulaanbaatar's Apartment district) of household waste.[4]
- In households who have infants, diapers represent by far the number one waste (in weight) with, in our study, approximately half of total household's waste.
- Ash doesn't appear to be major issue in summer as it represents only 11% of total domestic waste. In addition, summer ash is constituted exclusively of wood and dung ash, which are not pollutants compared to winter's coal ash (which was found in no household in this summer study).
- Livestock dungs are found in a very limited number of households (8%) and appear not to be "waste" at all since they are usually used as fuel for stove (at least cow dung). As such, they don't represent a real waste management issue in the soum-center, at least during summer.
- Waste production tends to decrease as income increases: households with an average annual income lower than 5 million MNT produce 50% more waste (1.2kg/person/week) than household with an average annual income higher than 10 million MNT (0.8kg/person/week).
- Households with a higher income tend to produce less glass waste but more food waste and e-waste than households with lower income. Such trends could not be found for other categories of waste.

[4] Batkhuyag (E.U.) and al., *Characteristics of Household Waste and Coal Ash in Ulaanbaatar, Mongolia*, 2016.