NJUBA CHILDREN RELIEF

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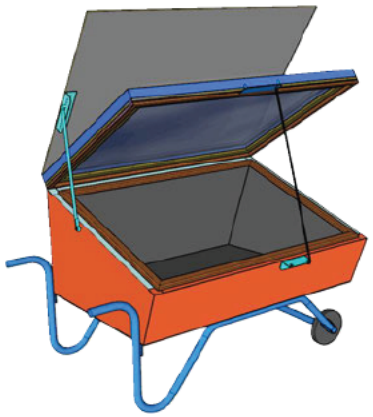
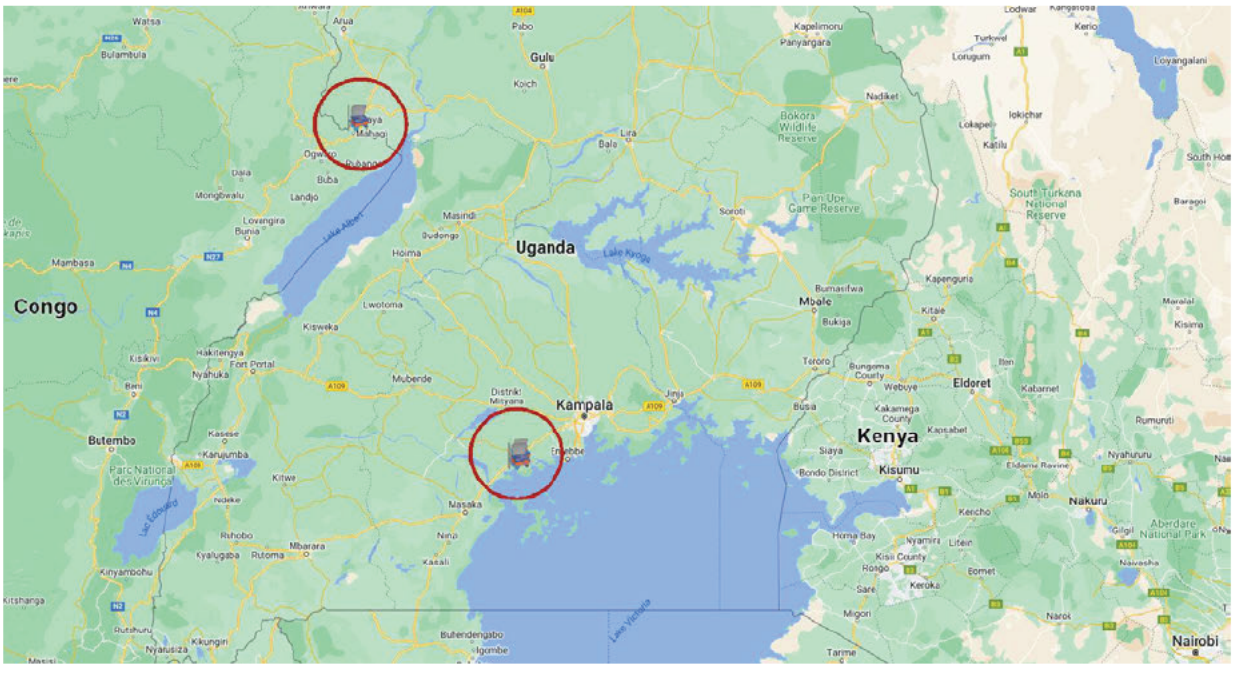
NJUBA SOLAR STOVE

SOLAR STOVE PILOT PROJECT

Field survey evaluation 2022/2023





NJUBA Children Relief

Located in: Kasubikamu, Mpigi District, Uganda

Daniel Plattner July 2023

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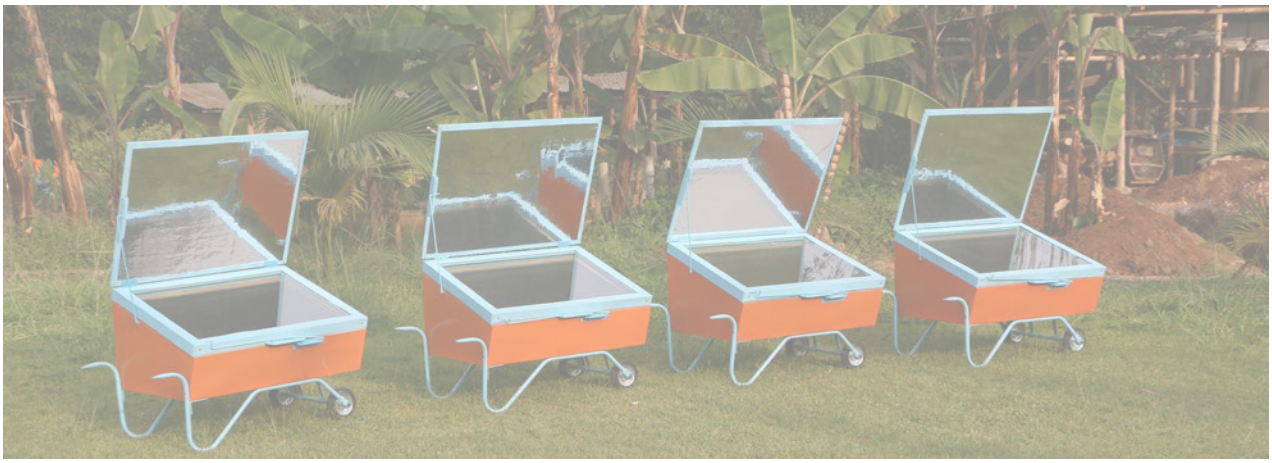

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Evaluation of the solar stove surveys 2022 /2023

Headquaters	Buwama	Mpigi District	Uganda
Number of participants	60 families	Adults 172	Children 217
Number of surveys	2 surveys	1 with firewood	1 with solarstove
Locations of the survey	Mpigi District	Zombo District	
Duration of the survey 1	60 days		
Duration of the survey 2	30 days		
Responsible person	Daniel Plattner	+256 779 51 70 83	pumi99@yahoo.com

How we approached it

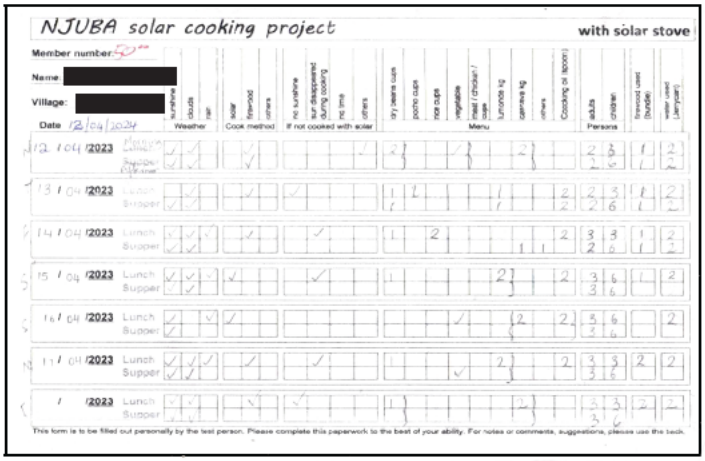
60 families were followed for a period of at least 60 to 90 days. The aim of this study was to find out more about the eating habits of local families. In this way, the needs of the families could be taken into consideration in the production of the solar stoves. This data was also helpful for the training in cooking with the solar stove, as well as for the production of the cookbook.

Despite Uganda's rich green landscape, the diet of Ugandans is rather simple. One of the most important basic foodstuffs, particularly in the rural areas, are beans, maize flour, cassava and sweet potatoes.

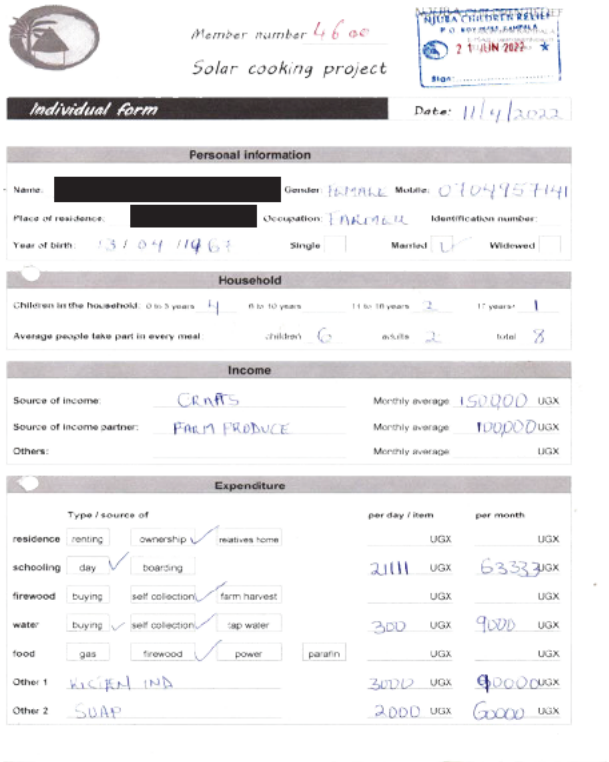
On the basis of the fact of the small variety of dishes we started our study. Each family was given a form to fill out daily during the survey period. They were accompanied several times a week by trained staff from NJUBA.

More than 720 forms have been filled out to get a better picture of Ugandan cooking behavior. The two regions we studied were in Central Uganda, Buwama in Mpigi District, and in Northern Uganda in Zombo District.

Since the solar stove also promises an improvement in the household budget, we also wanted to learn more about the general situation of the respective families. So each of the families filled out a personal form about their current situation. This gave us a rough idea of the size of the families and their current household budget.



Sample of a form to cook with solar stove



Sample form for family information

Evaluation of the cooking behavior with firewood stove

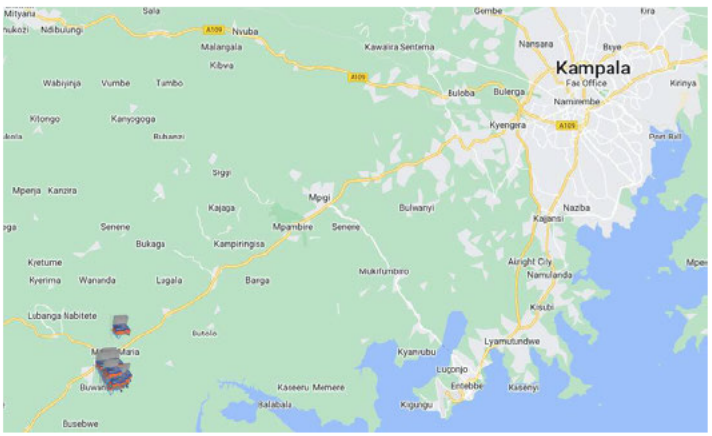
Buwama

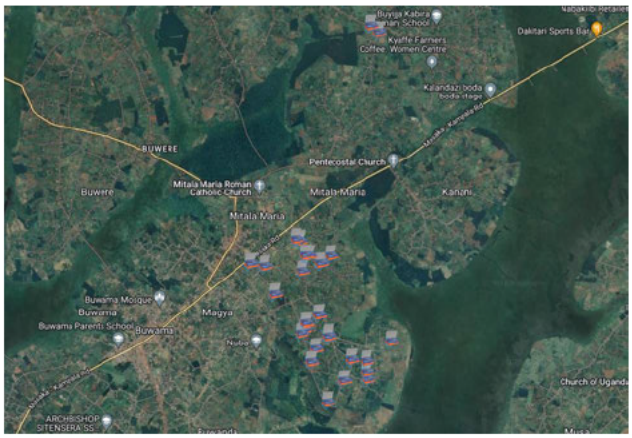
Mpigi District

Uganda

	Average over the test period								Total of food over the test period								
			Per meal			Per day											
	Days of evaluation	Cooking times	Adults	Children	Cooking with firewood %	Firewood bundles	Water (liter)	Cooking oil (liter)	Dry beans (kg)	Posho (kg)	Rice (kg)	Vegetable (kg)	Fish / meat (kg)	Sweet potatoes (kg)	Cassava / Millet (kg)	Matoke (kg)	Cooking oil (liter)
1	56	109	4.14	5.28	100%	1.69	37	0.09	75	51.5	48.5	37.7	6.17	24	43.5	43	10.2
2	35	70	2.84	5.36	100%	1	28	0.04	14.8	2.5	3.5	10.3	4	50	51	37	2.63
3	70	140	1.9	3	100%	0.6	13	0.02	41.5	14	15	14.7	11.5	23	26.5	57	3.43
4	63	126	2.84	1.75	100%	1	21	0.01	63.5	25.5	15	39.3	7.33	2	26.8	66.5	0.9
5	62	122	4.78	0.01	100%	1.14	28	0.01	76	30	23	35.8	7.83	15	34	50	0.93
6	63	125	2.24	5	100%	1.04	23	0.03	64.3	41.5	4.5	40	6	77	113	1	4.35
7	63	126	4.02	4.46	100%	1	28	0.02	51.5	14	12.5	11.7	9	14.5	221	44.8	2.97
8	63	124	4.96	4.35	100%	1.28	29	0.06	114	60.5	19.5	47	8.83	42.3	68.5	50.5	6.97
9	62	124	5.1	8.27	100%	2	58	0.06	62.3	53.3	81	32.3	5.5	147	97.5	32	7
10	56	112	2.55	8.26	100%	1	40	0.06	78	73	46	30.3	7.5	126	121	13	6.4
11	63	126	1	2	100%	1	19	0.05	44	20	22.5	44.8	11.8	17	46	32	6.67
12	62	120	1.75	3.14	100%	0.6	18	0.03	22.5	13.5	22.9	22.7	8.33	71.5	53.5	31	3.13
13	63	125	3	4	100%	1	20	0.06	49	25	33	69.3	15	33	31	30	7.7
14	49	98	4	2	100%	1	20	0.05	47.5	30	37	60.3	10.5	18	18	30	4.6
15	63	126	1	0.99	100%	0.5	19	0.03	26.5	8	7	38.7	3.83	18.8	17.8	25	3.28
16	63	126	3	3.89	100%	1	22	0.05	54	23.5	21.3	70	13.2	31	30	35	6.2
17	63	126	4	2.89	100%	1	20	0.05	60	29	38.3	80.3	14	31	29.5	42	6.07
18	63	126	2	5	100%	1	20	0.05	45.5	22	33.5	57.7	12.3	27	30	35	6.17
19	63	126	2	2.4	100%	1	18	0.05	45	27.5	39.8	51.3	13.5	21.5	30	33	6.43
20	63	70	2.93	7.24	100%	2.27	34	0.07	27.4	31.5	18	19.3	5	44	68	12	4.67
21	59	118	1	0	100%	0.5	12	0.03	36.8	18.3	13.9	31.9	5.33	5.5	6.75	13.8	3.27
22	63	67	2.42	0.94	15%	0.16	11	0.04	12.5	14.8	14	21.3	5.17	5.5	12.5	16	2.5
23	49	96	5.88	3.17	87%	1.61	36	0.06	63	8.25	61.3	27.7	7	99	91	33	6.17
24	49	97	2	6.13	100%	1	20	0.01	39	5	23.8	30	3.33	126	55	27	1
25	56	110	4.24	2.09	100%	1	20	0.01	24.8	12	15.5	19.3	8.17	42	85	21	1.63
26	63	126	2.01	0.55	100%	1	34	0.05	49	23	25.5	40.3	3.67	25.3	18.8	13.5	6.3
27	63	126	3.19	4.25	100%	1	20	0.04	71.5	39.5	30	43.7	8.92	29.5	31	45	4.53
28	70	133	2.11	5.83	100%	0.94	24	0.02	64.3	16.5	10	17.7	7.17	34.5	105	34	3.03
29	70	116	2	3	100%	1	20	0.05	42	4.5	14.6	9.33	10.2	56	82	60	5.48
30	56	112	0.98	2	100%	0.88	17.5	0.06	35.8	14	15.5	22.7	3.67	41	55	18	6.2

One unit of firewood corresponds to a bundle of firewood with about 4.5 kg of content.





Evaluation of the cooking behavior with firewood stove

Maliri

Zombo District

Uganda

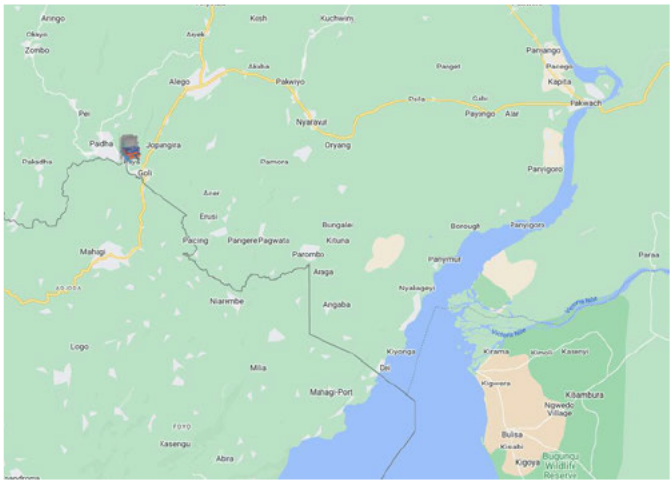
	Daily average per meal								Total of food over the test period								
			Per meal			Per day											
	Days of evaluation	Cooking times	Adults	Children	Cooking with firewood %	Firewood bundles	Water (liter)	Cooking oil (liter)	Dry beans (kg)	Posho (kg)	Rice (kg)	Vegetable (kg)	Fish / meat (kg)	Sweet potatoes (kg)	Cassava / Millet (kg)	Matoke (kg)	Cooking oil (liter)
1	49	98	3.4	2.4	100%	1.1	20	0 08	29	41	20	13	6	26	256	11	7.5
2	56	112	2.7	4.9	100%	1.1	23	0 09	35	42	25	17	9	22	366	24	9.6
3	56	112	3.5	4.0	100%	1.2	30	0 07	30	45	30	18	7	20	325	20	7.7
4	56	112	2.8	3.1	100%	1.3	20	0 08	29	36	31	14	7	29	329	14	8.4
5	63	126	3.9	3.8	100%	1.1	20	0 09	46	70	78	19	8	65	295	19	11.0
6	56	112	2.6	5.6	100%	1.1	25	0 09	31	33	51	15	9	46	350	13	10.4
7	56	112	3.6	4.0	100%	1.3	20	0 07	32	57	41	20	7	51	233	23	8.3
8	35	70	3.0	3.0	100%	1.0	20	0 07	25	28	35	11	5	29	188	12	5.0
9	28	56	3.5	5.0	100%	1.3	21	0 07	21	32	44	10	5	20	196	9	4.0
10	56	112	3.0	4.4	100%	1.3	20	0 08	31	57	48	17	8	12	307	9	8.5
11	56	112	2.0	5.0	100%	1.0	39	0 09	33	30	62	17	8	28	416	12	10.2
12	56	112	3.0	3.0	100%	1.3	20	0 06	33	64	60	16	6	37	262	24	6.9
13	56	112	3.0	4.0	100%	1.0	20	0 07	43	59	77	17	8	27	288	20	7.8
14	49	98	2.6	4.1	100%	1.1	20	0 08	24	42	46	16	6	12	271	24	7.8
15	49	98	1.6	3.4	100%	1.2	20	0 06	27	45	36	12	7	3	214	18	6.2
16	56	112	6.0	7.0	100%	1.0	40	0 14	37	28	22	24	8	17	263	33	15.5
17	56	112	2.0	2.0	100%	1.3	20	0 08	23	28	7	12	6	10	312	14	8.7
18	28	56	2.0	2.0	100%	1.3	20	0 08	11	21	6	7	4	0	135	13	4.5

In Zombo District it was more difficult to get a good evaluation because of several circumstances. One important point was the lack of support for the women's group during the test phase. As Zombo District is a 10 hour drive away from our head office, this made our supervision on the ground very difficult. Our partner organisation based in Zombo District were also unable to provide support.

According to our partner organisation, as well as our own experience, many of the women in Zombo District have little or no education.

These two main reasons made the evaluation in Zombo District difficult. Only 18 out of 30 women were able to fill out the forms.

Nevertheless, the evaluation gave us an impression of the household situation in Zombo District.



Evaluation of the average meal cooking with firewood

In the two Districts, the eating behavior is a little different. In Central Uganda, more maize flour and matoke is eaten, while in Northern Uganda, a lot of millet is consumed.

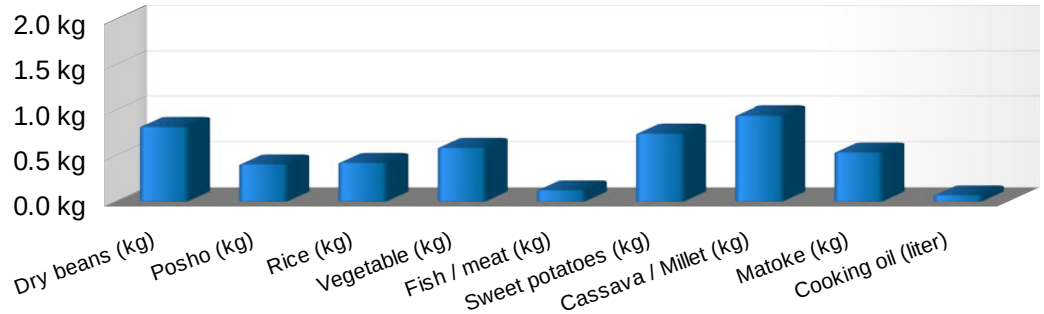
To know how the two Districts differ, we compared them. Due to this evaluation, we were able to optimize the solar stoves for both Districts. This data was also helpful for the training in cooking with the solar stoves, as well as for the production of a cookbook.

Many of the families in both Districts run a small farm, either as their main occupation, as a secondary income, or just for self-sufficiency. Therefore, many of the families do not have to buy all the food at the indicated prices.

Buwama / Mpigi District

Food total per day / household											
Dry beans (kg)	Posho (kg)	Rice (kg)	Vegetable (kg)	Fish / meat (kg)	Sweet potatoes (kg)	Cassava / Millet (kg)	Matoke (kg)	Cooking oil (liter)	Firewood (kg)	Water (liter)
0.832	0.415	0.433	0.599	0.134	0.756	0.955	0.548	0.079	8.907	46.81

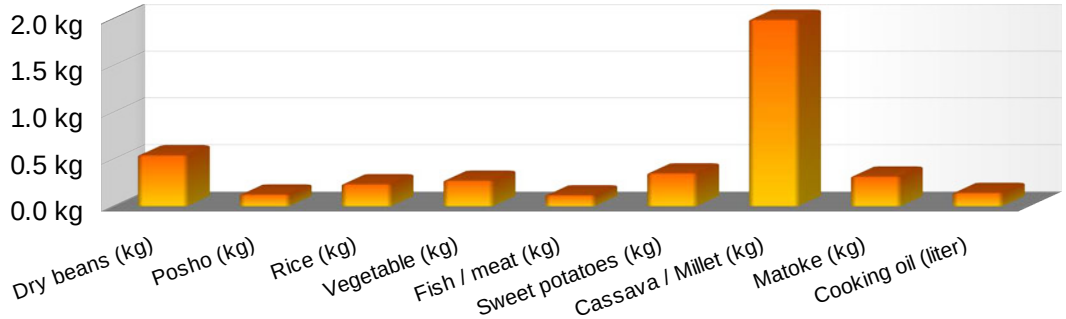
Food total per day / person											
Dry beans (kg)	Posho (kg)	Rice (kg)	Vegetable (kg)	Fish / meat (kg)	Sweet potatoes (kg)	Cassava / Millet (kg)	Matoke (kg)	Cooking oil (liter)	Firewood (kg)	Water (liter)
0.129	0.064	0.067	0.093	0.021	0.117	0.148	0.085	0.012	1.384	7.271



Maliri / Zombo District

Food total per day / household											
Dry beans (kg)	Posho (kg)	Rice (kg)	Vegetable (kg)	Fish / meat (kg)	Sweet potatoes (kg)	Cassava / Millet (kg)	Matoke (kg)	Cooking oil (liter)	Firewood (kg)	Water (liter)
0.552	0.134	0.243	0.282	0.126	0.361	2.19	0.326	0.152	9.196	43.91

Food total per day / person											
Dry beans (kg)	Posho (kg)	Rice (kg)	Vegetable (kg)	Fish / meat (kg)	Sweet potatoes (kg)	Cassava / Millet (kg)	Matoke (kg)	Cooking oil (liter)	Firewood (kg)	Water (liter)
0.084	0.02	0.037	0.043	0.019	0.055	0.333	0.05	0.023	1.4	6.684



Average attendance at meal / per meal

	Buwama	Maliri
Adults	2.9	2.8
Children	3.6	3.7
Total **per meal**	6.4	6.6

The majority of Ugandan families are large, especially the number of children is much higher than in Europe. In our evaluation, this is not so strong, because many of the participants are also elderly people whose children no longer live at home. Also, some of the children are only at home during the vacations because they are in boarding schools.

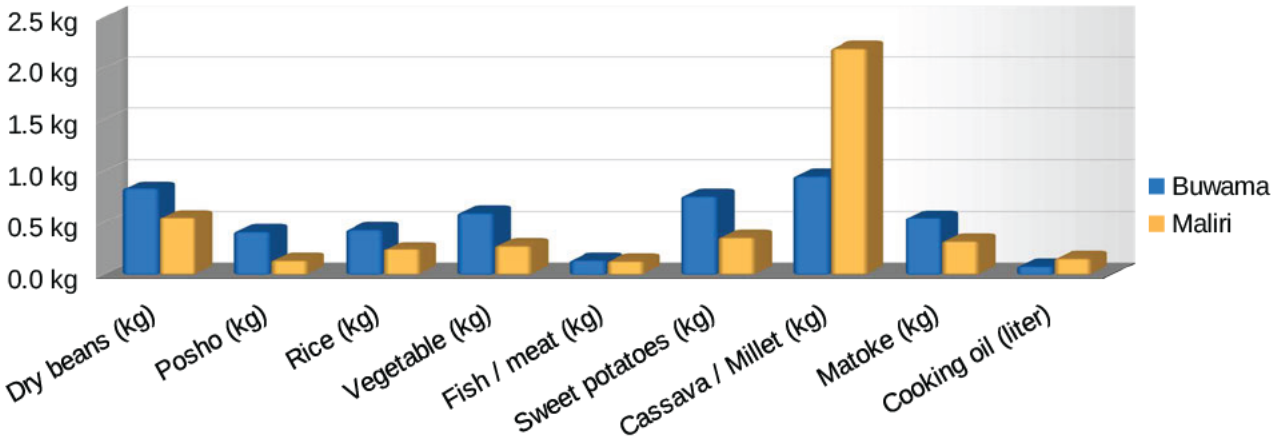
Direct comparison of eating habits Buwama / Maliri

Compared are the evaluated data from Buwama and Maliri in the year 2022. Whereby it must be noted, in Zombo the participation in the survey was not very high, also the two places were recorded in other months, the different months, the different seasons, can also have an impact on the eating behavior of the local people. Therefore, there may be deviations from reality.

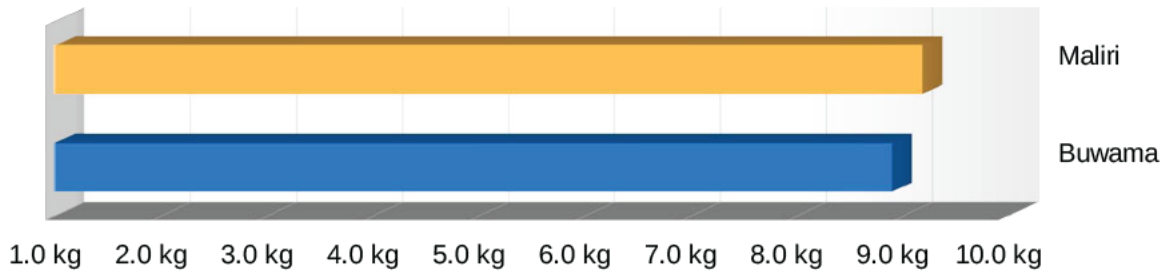
Food and firewood consumption per day and person

	Buwama		Maliri		Difference
Dry beans (kg)	0.13 kg	0.14 €	0.08 kg	0.11 €	0.05 kg
Posho (kg)	0.06 kg	0.06 €	0.02 kg	0.02 €	0.04 kg
Rice (kg)	0.07 kg	0.08 €	0.04 kg	0.04 €	0.03 kg
Vegetable (kg)	0.09 kg	0.02 €	0.04 kg	0.01 €	0.05 kg
Fish / meat (kg)	0.02 kg	0.05 €	0.02 kg	0.06 €	0.00 kg
Sweet potatoes (kg)	0.12 kg	0.06 €	0.05 kg	0.02 €	0.06 kg
Cassava / Millet (kg)	0.15 kg	0.08 €	0.33 kg	0.14 €	-0.18 kg
Matoke (kg)	0.09 kg	0.07 €	0.05 kg	0.04 €	0.04 kg
Cooking oil (liter)	0.01 liter	0.03 €	0.02 liter	0.06 €	-0.01 liter
Firewood (kg)	1.38 kg	0.12 €	1.40 kg	0.25 €	-0.02 bd
Water (liter)	7.27 liter	0.08 €	6.68 liter	0.09 €	0.59 liter
Total per day and person		0.79 €		0.83 €	

Food consumption per day and family Buwama / Maliri



Firewood used per day / person cooking with firewood only



The firewood units consist of a small bundle of about 4 to 6 kg each. The water is transported and stored with a 20 liter plastic container.

Comparison of food prices

Depending on the region, food prices can vary within a country. This can have an impact on eating habits and quality of life. Food prices are not always low where incomes are low. This seems to be the case in Zombo District. Food prices are on average slightly higher than in Mpigi District, but incomes in Zombo District are considerably lower. We are talking about differences in the range of cents, but even half a Euro makes a huge difference for the people in Uganda.

Average prices	*Stand of: July 2023*

	Buwama		Maliri		Difference
Dry beans (kg)	4'000 UGX	**1.05 Euro**	5'000 UGX	**1.32 Euro**	**-1'000 UGX**
Posho (kg)	3'500 UGX	**0.92 Euro**	3'500 UGX	**0.92 Euro**	**0 UGX**
Rice (kg)	4'500 UGX	**1.18 Euro**	4'000 UGX	**1.05 Euro**	**500 UGX**
Vegetable (kg)	1'000 UGX	**0.26 Euro**	800 UGX	**0.21 Euro**	**200 UGX**
Fish / meat (kg)	10'000 UGX	**2.63 Euro**	12'000 UGX	**3.16 Euro**	**-2'000 UGX**
Sweet potatoes (kg)	1'800 UGX	**0.47 Euro**	1'500 UGX	**0.39 Euro**	**300 UGX**
Cassava / Millet (kg)	2'000 UGX	**0.53 Euro**	1'600 UGX	**0.42 Euro**	**400 UGX**
Matoke (kg)	3'000 UGX	**0.79 Euro**	3'000 UGX	**0.79 Euro**	**0 UGX**
Cooking oil (liter)	10'000 UGX	**2.63 Euro**	10'000 UGX	**2.63 Euro**	**0 UGX**
Firewood (kg)	333 UGX	**0.09 Euro**	667 UGX	**0.18 Euro**	**-333 UGX**
Water (liter)	40 UGX	**0.01 Euro**	50 UGX	**0.01 Euro**	**-10 UGX**

Evaluation of the average living costs

Ugandan families living in rural areas have to manage on a very small budget. The whole family has to contribute to the household budget, even the children have to do their part, often with agricultural work on their own farm. According to all the evaluations and data about the income and expenses of the families, the calculation does not seem to add up, at least not on paper. No matter how hard one calculates at the limit, for hardly any of the families the balance turns out to be positive. It is hardly possible to record all the income of the families, since many of the families, as it's common in Uganda, still do small jobs and businesses on the side. These small, not really tangible, side businesses seem to be the decisive contribution to survival.

Average daily household expenses per day and family	CALCULATED

	Buwama		Maliri	
Average daily expenses for food	19'211 UGX	**5.06 Euro**	20'811 UGX	**5.48 Euro**
Daily average income of a family	14'000 UGX	**3.68 Euro**	12'000 UGX	**3.16 Euro**
Balance left for others	**-5'211 UGX.**	**-1.37 Euro**	**-8'811 UGX.**	**-2.32 Euro**

Without additional self-cultivation, many families would not make it financially.

Especially cassava, sweet potatoes and beans, most of the families in the rural areas harvest from their own garden, so they have no direct expenses for these food products. Also water and firewood are mostly fetched by themselves, although it is getting more and more difficult with the free firewood.

Average daily household expenses per day and family — REAL

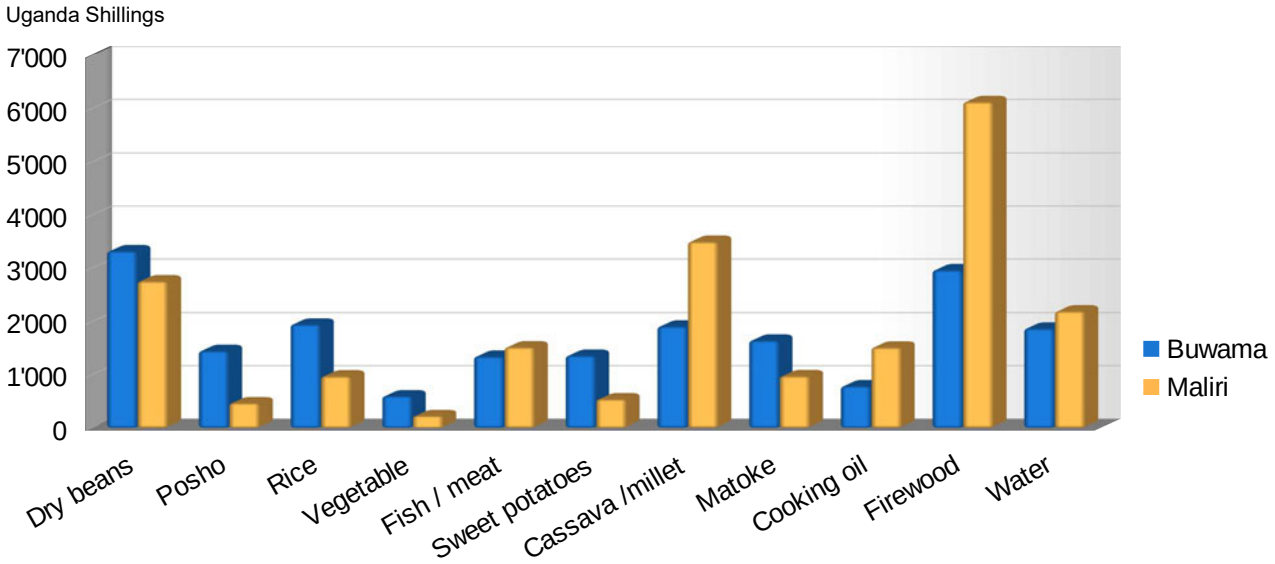
To get a more objective view of the household budget, the following products must be deducted from the expenses. Since most are growing this food themselves.

Food and firewood that can be grown at home.		Buwama		Maliri	
Items	**Quantity**	**Saving by self-cultivation**		**Saving by self-cultivation**	
Firewood	70 %	2'078 UGX	**0.55 Euro**	4'291 UGX	**1.13 Euro**
Water	90 %	1'685 UGX	**0.44 Euro**	1'976 UGX	**0.52 Euro**
Sweet potatoes	70 %	952 UGX	**0.25 Euro**	379 UGX	**0.10 Euro**
Cassava	90 %	1'720 UGX	**0.45 Euro**	3'153 UGX	**0.83 Euro**
Matoke	70 %	1'151 UGX	**0.30 Euro**	684 UGX	**0.18 Euro**
Balance left for others		2'375 UGX	**0.63 Euro**	1'673 UGX	**0.44 Euro**

This calculation is only an assumption and is based on experience. For each family this will be different. The estimate refers only to the household budget, additional costs such as school fees, apartment rent, medical expenses or other out of pocket expenses have not been taken into account.

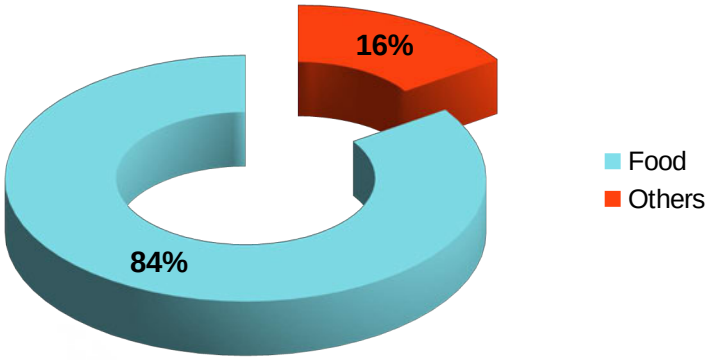
Daily household expenditure per day and family — Buwama / Maliri

These daily expenditure in Uganda shillings are calculated without self-sufficiency.



Expenditure ratio — Buwama / Maliri

Savings in the household budget are almost the only savings that a family living at subsistence level can make. Almost the entire income of a family is spent on food.



Comparison on average in one day — Firewood / Solar

Buwama Mpigi District Uganda	Firewood							Solar							Saving a day		
	Days in evaluation	Cooking times	per meal Adults	per meal Children	Firewood (kg) /day	Water liter	Oil liter	Days in evaluation	Cooking times	per meal Adults	per meal Children	Cooking wit solar	Firewood (kg) /day	Water liter	Oil liter	Firewood (kg)	Water liter	Oil liter
1	56	109	4.1	5.3	14.8	73	0.2	14	28	3.5	5	**27%**	6.9	30	0.0	**7.9**	43	0.2
2	35	70	2.8	5.4	9.0	55	0.1	35	66	2	6	**30%**	8.2	45	0.1	**0.8**	11	0.0
3	70	140	1.9	3.0	5.4	25	0.0	28	49	1	3	**29%**	1.9	10	0.0	**3.5**	15	-0.0
4	63	126	2.8	1.8	8.7	43	0.0	7	14	3	9	**13%**	8.4	60	0.1	**0.3**	-17	-0.1
5	62	122	4.8	0.0	10.1	54	0.0	9	18	3	2	**42%**	4.3	40	0.1	**5.8**	14	-0.1
6	63	125	2.2	5.0	9.3	45	0.1	Got the stove too late										
7	63	126	4.0	4.5	9.0	57	0.0	24	47	3	9	**12%**	8.2	60	0.1	**0.8**	-3	-0.1
8	63	124	5.0	4.4	11.3	58	0.1	Got the stove too late										
9	62	124	5.1	8.3	17.9	116	0.1	12	24	5	5	**36%**	18.0	122	0.0	**-0.1**	-5	0.1
10	56	112	2.6	8.3	8.8	81	0.1	35	68	2	7	**23%**	7.1	79	0.0	**1.7**	2	0.1
11	63	126	1.0	2.0	9.0	38	0.1	Got the stove too late										
12	62	120	1.8	3.1	5.2	35	0.1	20	34	2	3	**24%**	4.1	33	0.0	**1.1**	2	0.0
13	63	125	3.0	4.0	8.9	40	0.1	14	28	2	4	**33%**	7.2	27	0.1	**1.7**	13	0.1
14	49	98	4.0	2.0	9.0	40	0.1	14	28	4	1.5	**37%**	3.4	40	0.1	**5.6**	0	0.0
15	63	126	1.0	1.0	4.5	38	0.1	Got the stove too late										
16	63	126	3.0	3.9	9.0	44	0.1	28	56	2	2	**11%**	8.4	20	0.1	**0.6**	24	-0.0
17	63	126	4.0	2.9	9.1	40	0.1	28	56	2	3.5	**39%**	3.4	20	0.1	**5.7**	21	0.0
18	63	126	2.0	5.0	8.9	40	0.1	35	70	2	4	**25%**	5.1	35	0.1	**3.8**	5	0.0
19	63	126	2.0	2.4	9.4	37	0.1	28	56	2	1	**29%**	4.9	24	0.1	**4.5**	13	0.0
20	63	70	2.9	7.2	11.4	37	0.1	21	34	2	6	**40%**	7.7	32	0.0	**3.6**	6	0.0
21	59	118	1.0	0.0	4.5	23	0.1	14	28	5	2	**28%**	2.7	26	0.0	**1.8**	-3	0.0
22	63	67	2.4	0.9	0.8	12	0.0	moved to another area										
23	49	96	5.9	3.2	14.2	70	0.1	14	22	3	4	**20%**	5.6	39	0.0	**8.6**	31	0.1
24	49	97	2.0	6.1	8.8	40	0.0	20	40	3	4	**29%**	6.8	92	0.1	**2.0**	-52	-0.1
25	56	110	4.2	2.1	8.8	39	0.0	24	48	2	3	**23%**	5.0	77	0.1	**3.9**	-37	-0.0
26	63	126	2.0	0.5	9.3	69	0.1	39	78	1	0.3	**21%**	4.8	16	0.1	**4.5**	53	-0.0
27	63	126	3.2	4.2	8.9	40	0.1	49	98	3	4	**30%**	6.6	34	0.1	**2.4**	6	-0.0
28	70	133	2.1	5.8	8.0	46	0.0	28	56	3	6	**20%**	7.7	39	0.0	**0.3**	8	0.0
29	70	116	2.0	3.0	7.5	33	0.1	13	26	2	4	**22%**	8.5	38	0.0	**-1.0**	-5	0.0
30	56	112	1.0	2.0	7.9	35	0.1	Got the stove too late										

The two test phases are a few months apart, and in some of the families there have been some changes, especially with regard to the size of the family. The families were also made more aware of the need to save firewood by using the solar stoves. So these results are not too exact. but these data can be used as a reference.

Maliri Zombo District Uganda	Firewood							Solar								Saving a day		
	Days in evaluation	Cooking times	per meal		Firewood (kg) /day	Water liter	Oil liter	Days in evaluation	Cooking times	per meal		Cooking wit solar	Firewood (kg) /day	Water liter	Oil liter	Firewood (kg)	Water liter	Oil liter
			Adults	Children						Adults	Children							
1	49	98	3.4	2.4	5.1	20	0.1	42	84	5.3	4.8	**57%**	2.6	40	0.02	**2.5**	-20	0.1
2	56	112	2.7	4.9	5.1	23	0.1	42	84	4.3	3.0	**56%**	2.5	40	0.03	**2.6**	-17	0.1
3	56	112	3.5	4.0	5.3	30	0.1	42	84	2.8	2.6	**57%**	2.6	36	0.01	**2.7**	-6	0.1
4	56	112	2.8	3.1	6.0	20	0.1	42	83	2.7	2.6	**50%**	2.4	37	0.02	**3.6**	-17	0.1
5	63	126	3.9	3.8	5.0	20	0.1	42	83	3.2	3.1	**57%**	2.4	40	0.02	**2.6**	-20	0.1
6	56	112	2.6	5.6	4.9	25	0.1	42	84	2.1	2.1	**59%**	1.4	36	0.04	**3.5**	-11	0.1
7	56	112	3.6	4.0	5.9	20	0.1	42	83	4.1	3.7	**51%**	3.5	40	0.05	**2.4**	-20	0.0
8	35	70	3.0	3.0	4.5	20	0.1	42	83	5.6	4.7	**54%**	3.2	40	0.05	**1.3**	-20	0.0
9	28	56	3.5	5.0	6.0	21	0.1	42	84	2.1	3.0	**55%**	4.1	34	0.04	**1.9**	-13	0.0
10	56	112	3.0	4.4	6.0	20	0.1	42	83	2.7	2.1	**55%**	4.4	36	0.03	**1.6**	-16	0.1
11	56	112	2.0	5.0	4.5	39	0.1	35	69	2.1	4.8	**53%**	2.6	37	0.01	**1.9**	2	0.1
12	56	112	3.0	3.0	6.0	20	0.1	42	84	1.6	6.5	**59%**	2.2	33	0.02	**3.8**	-13	0.0
13	56	112	3.0	4.0	4.7	20	0.1	42	84	2.1	3.5	**58%**	2.2	40	0.03	**2.5**	-20	0.0
14	49	98	2.6	4.1	5.1	20	0.1	42	84	2.0	2.3	**57%**	4.1	40	0.03	**1.0**	-20	0.0
15	49	98	1.6	3.4	5.4	20	0.1	41	80	2.2	4.5	**57%**	2.4	41	0.02	**2.9**	-21	0.0
16	56	112	6.0	7.0	4.5	40	0.1	42	84	1.5	3.4	**59%**	1.6	39	0.02	**2.9**	1	0.1
17	56	112	2.0	2.0	6.0	20	0.1	42	83	1.0	2.0	**58%**	1.5	28	0.03	**4.5**	-8	0.1
18	28	56	2.0	2.0	6.0	20	0.1	42	83	1.5	2.9	**57%**	1.9	36	0.03	**4.1**	-16	0.0
19								34	70	3.6	4.6	**51%**	3.3	47	0.05			
20								42	83	2.1	2.7	**56%**	1.3	29	0.02			
21								42	84	4.9	3.8	**57%**	2.9	40	0.03			
22								42	84	4.2	4.8	**59%**	2.5	40	0.03			
23								42	83	1.9	2.6	**59%**	4.1	33	0.03			
24								42	84	3.9	4.8	**57%**	2.5	40	0.03			
25								42	84	3.0	5.0	**59%**	2.7	40	0.05			
26								42	84	2.5	1.6	**56%**	4.1	32	0.02			
27								42	84	1.5	3.1	**59%**	1.7	32	0.02			
28								42	84	4.0	3.3	**59%**	2.3	39	0.03			
29								42	84	1.6	6.9	**57%**	2.3	39	0.03			
30								42	84	3.4	5.0	**57%**	2.6	40	0.00			

In the second part of the study (cooking with the solar stove), the participation of people in Maliri was much better.

Comparison of firewood to solar cooking

After receiving the solar stoves, the families in Buwama and Maliri were evaluated over a period of 41 days. The main goal was to evaluate how much firewood could be saved with a solar cooker. Water consumption and oil consumption were also monitored. Unfortunately, the weather conditions were and are not good for solar cooking. In other regions, the evaluation would certainly be different. Consequently, these data are, with certainty, the minimum differences.

Weather conditions during the evaluation period of solar stoves

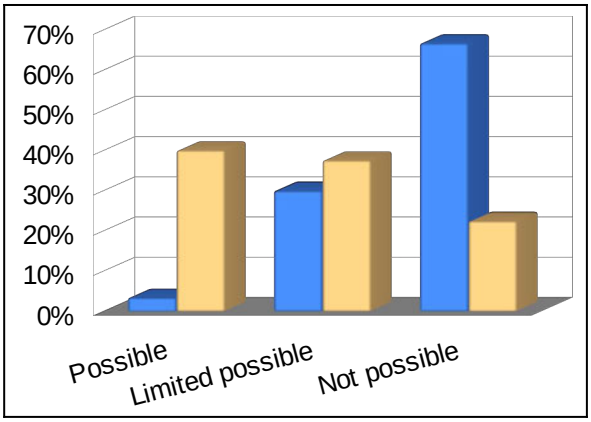
The weather is not the same everywhere in the country, so it is interesting to compare the two different regions, Central and Northen Uganda. Comparisons were made from 29. May. 2023 to 9. Jul. 2023

This diagram shows how often cooking with solar energy was possible based on weather conditions.

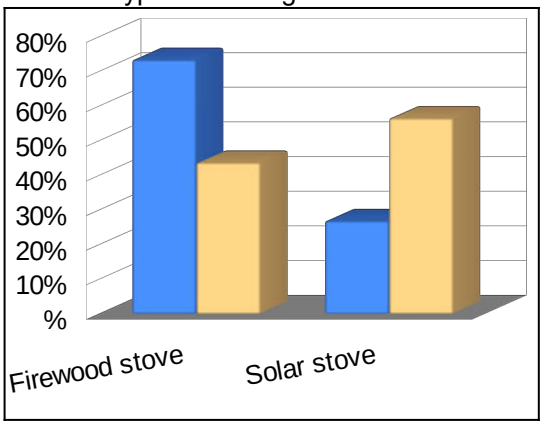
Possibilities to cook with the sun	Buwama	Maliri
Possible	3%	40%
Limited possible	30%	38%
Not possible	67%	23%

Type of cooking used	Buwama	Maliri
Firewood stove	73%	44%
Solar stove	27%	56%

Possibilities to cook with the sun



Type of cooking used



Example of the calculation of the solar incidence

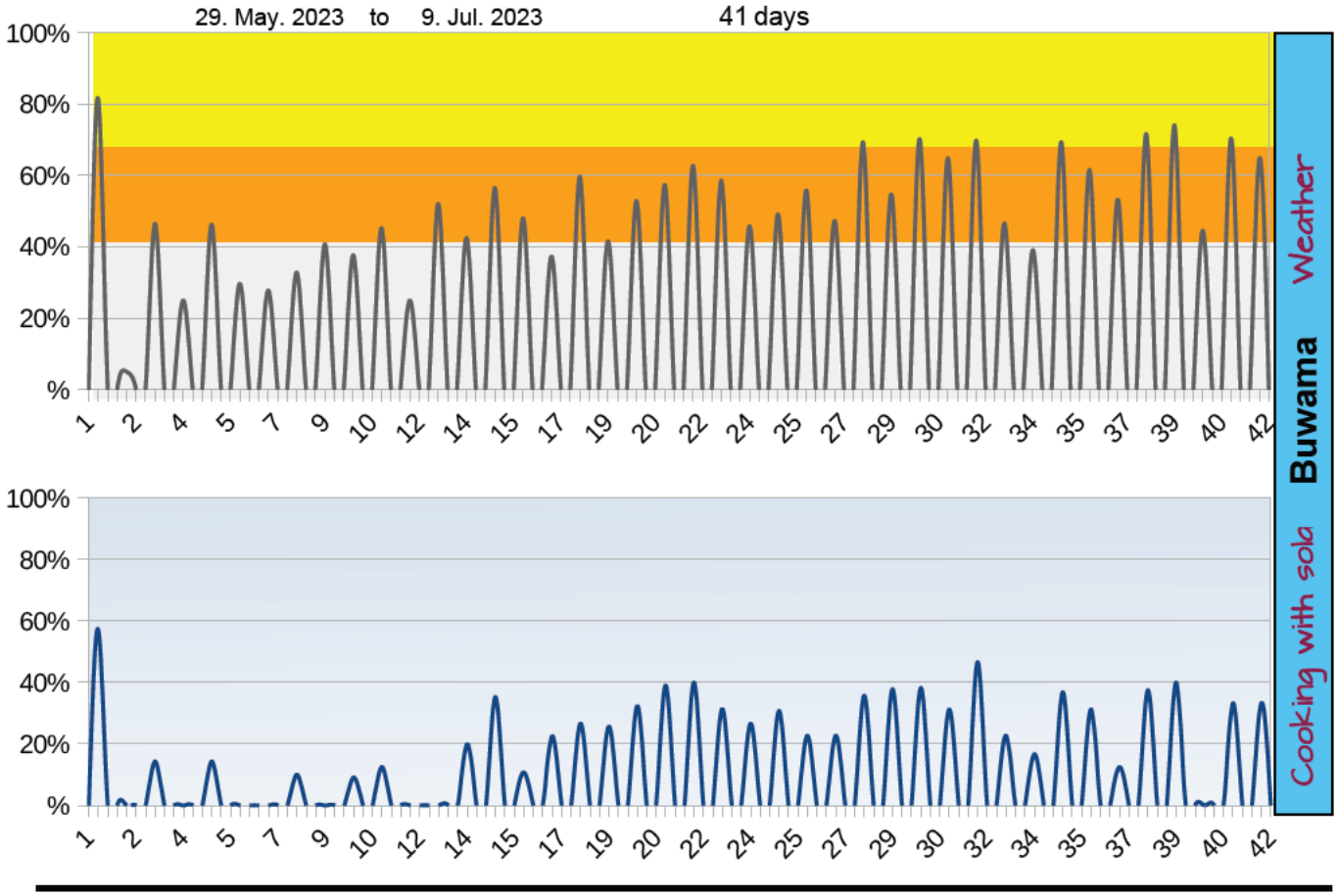
	sunny	cloudy	rainy	Possibility to use the sun		sunny	cloudy	rainy	Possibility to use the sun	
Morning	√			100%		√			100%	
Afternoon	√			100%	100%			√	0%	50%
Morning	√			100%		√	√		63%	
Afternoon		√		25%	63%		√		25%	44%
Morning		√		25%		√			100%	
Afternoon		√		25%	25%	√	√		63%	81%

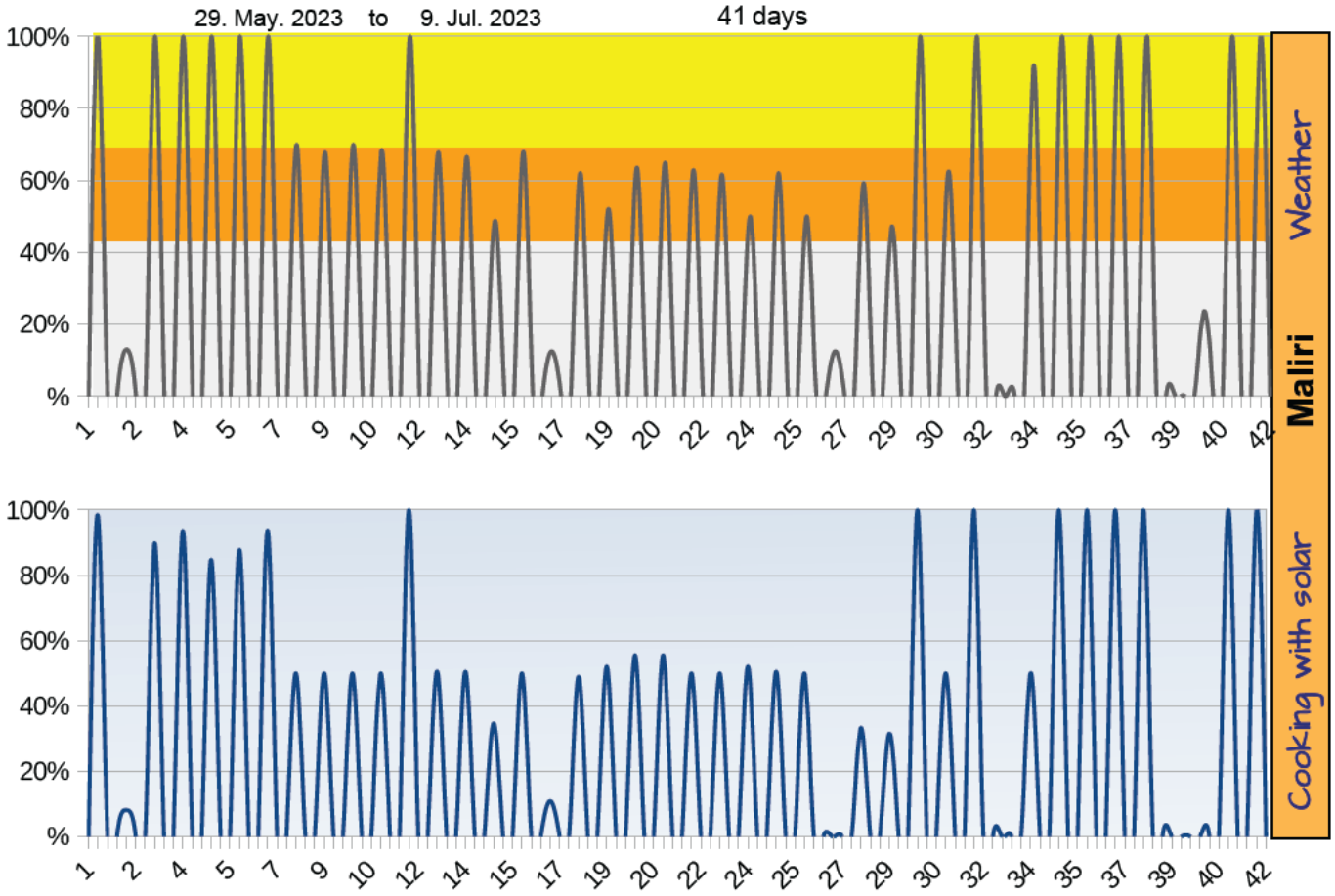
Example of the calculation of cooking with sun

	Firewood	Solar	Cooked with solar		Firewood	Solar	Cooked with solar	
Morning	√		0%		√		0%	
Afternoon	√		0%	0%		√	100%	50%
Morning	√	√	50%		√	√	50%	
Afternoon	√	√	50%	50%	√		0%	25%

Solar irradiation during the test phase

Possible to cook with solar | Limited possible to cook with solar | Not possible



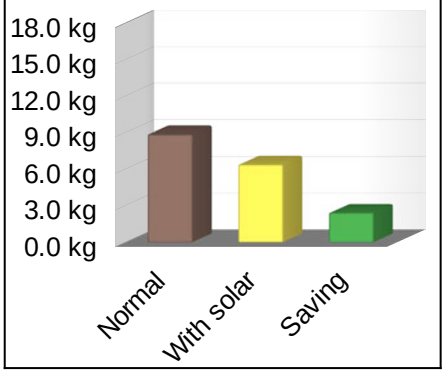


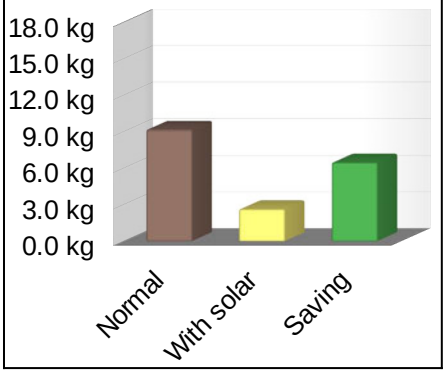
Firewood used by cooking

By evaluating before receiving the solar stoves and after, the difference in the consumption of firewood could be recognized well. During the test phase, despite the bad weather, especially in Buwama, a lot of firewood could be saved. No major changes could be noticed in the consumption of cooking oil and water. Especially for the reduction of cooking oil, further sensitization is needed. The accompanied families have used the expensive palm oil despite the solar stove, because they believe that without it the food would have less taste.

Average consumption of a family in a day

	Buwama			Maliri		
	Normal	With solar	Saving	Normal	With solar	Saving
Firewood per day	**8.9 kg**	6.4 kg	2.5 kg	**9.2 kg**	2.7 kg	6.5 kg

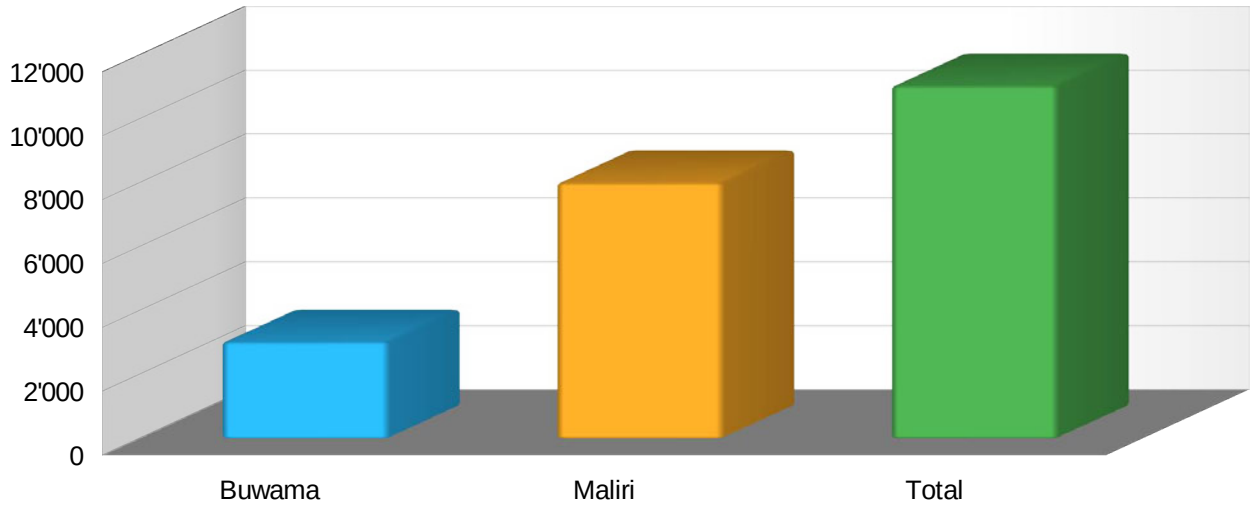




Average consumption of a family in a month

	Buwama			Maliri		
	Normal	With solar	Saving	Normal	With solar	Saving
Firewood per month	**267.2 kg**	193 Kg	74. kg	**275.9 kg**	80 Kg	196. kg

Firewood savings over the entire test period of one month



During the test period of 41 days, approximately 11 tons of firewood could be saved.

The savings of firewood in Maliri was quite large, although it must be said that in Maliri each of the test persons already had an energy saving stove. Perhaps they used the energy saving stoves more than in the first survey (cooking with firewood).

Reasons for non-cooking with solar

One of the biggest challenges was certainly the weather. In Uganda, the weather seems to have changed drastically in the last few years. Many whole rainy days with light rain and cloudy days are currently the case. The dry season has also been absent the last few years. Basically, the amount of rain seems to decrease in Uganda, because the momentary rains are rather mild and long, earlier there were very heavy rain showers with a lot of rain, but it was sunny before and after the rain.

Summary

The research participants had a great willingness to handle the solar stoves, and they also learned very quickly how to use the solar stove and cook with it. Even when the weather was bad, they put the solar stoves out and hoped for sunshine, although they had to bring the stove back in a few hours later, undone. In this way, even in bad weather, they were able to save firewood. Certainly, cooking with the solar stoves also raised awareness of the issue of saving firewood, so firewood was also saved as a result.

The hoped-for savings in cooking oil were rather modest. First of all, because the majority of the cooks believe that in a good meal belongs as much cooking oil as possible. On the other hand, for many of the participants it was also due to the filling out of the forms, the point with the cooking oil was very often neglected.

Savings with the water were also none to be registered. The main reason will be, almost all of the participants do not differentiate between the water for the kitchen and the rest of the household, which means if water could be saved in the kitchen, more water was used in the evening for the body hygiene, cleaning and washing. In this way, no water was saved, but perhaps the health of the participants was improved through better hygiene.

All in all, it was a success. The women were very eager and enthusiastic about their work with the solar stove. Despite very bad weather conditions, firewood was saved. Based on the data obtained, it is now possible to determine how much firewood can be saved in sunny weather. Some of the stoves have already been in use for a year without needing repair.

We are very confident that these solar stoves have a future and can save a lot of firewood. More such solar stoves should be built and distributed in places where the sun is more bright!

The Sun does not forget a village just because it is too small!

African Proverb