

The water use efficiency (WUE) in peri – urban and rural water supply systems based on socio – economic (SEC) factors

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Water use



- Several people use more water than is necessary for health and well – being.
- Excessive water use

Excessive water use ->

water use

water demand

water use efficiency (WUE)

Water needs

- In some regions, mainly in global south countries.
 - Water suppliers cannot fully meet basic water needs.
 - Availability and access to personal hygiene, and food is limited in some regions.

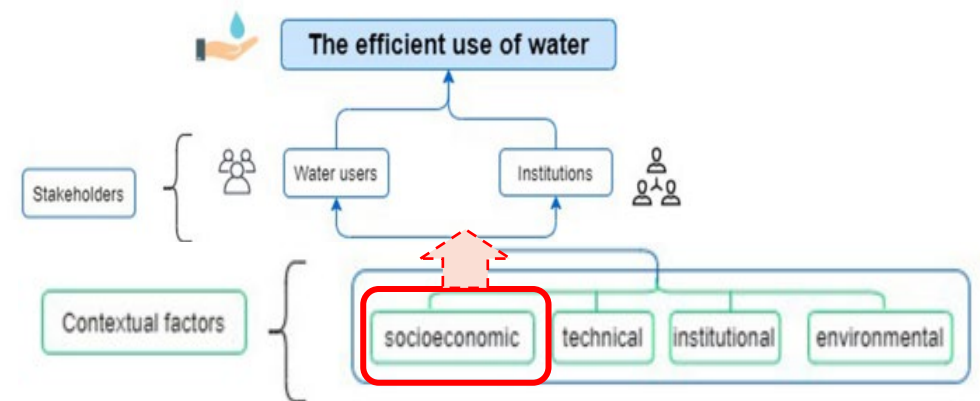
Water use behaviour

Behaviour = actions, habits



Water use behaviour

Conceptual model
to understand water use



Adapted from: Callejas, M., D., C., Pande, S., Rietveld, L., 2021

What socio – economic (SEC) factors affect the efficient use of water?



Framework

➤ Water use

- Water supply systems
- Domestic use
- Rural and peri – urban zones

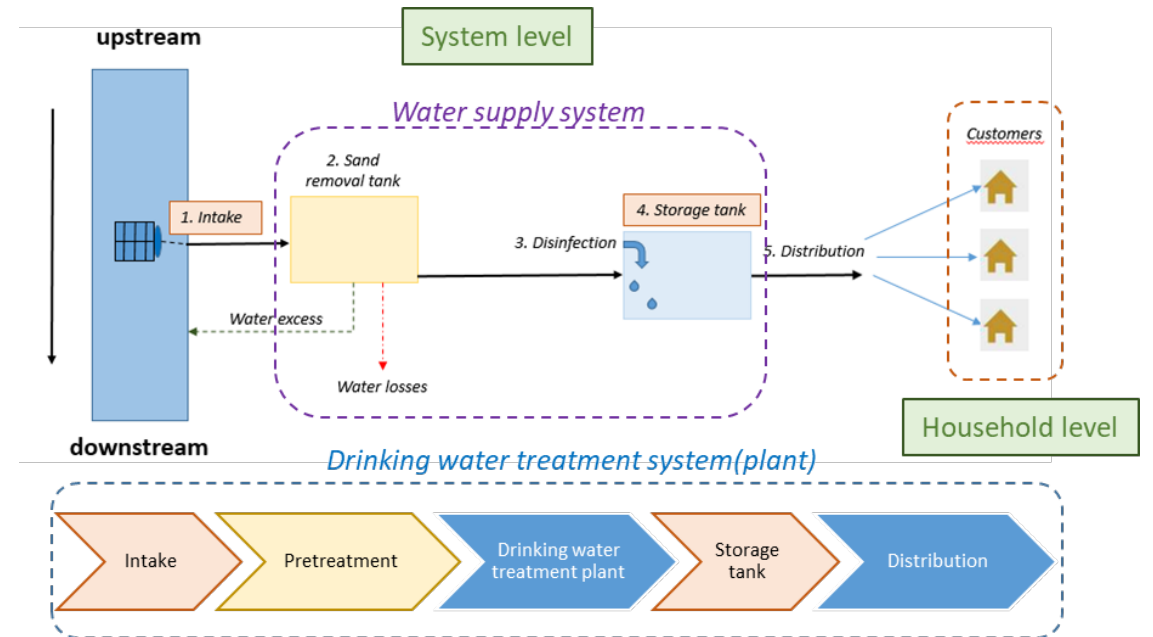
➤ Stakeholders

- Users - household scale
- Water suppliers - water user's associations (WUA) -> institution local scale

➤ Water use efficiency concepts

- Water use behaviour
- Curtailment
- Water use efficiency (WUE)

➤ Water supply system



Case study

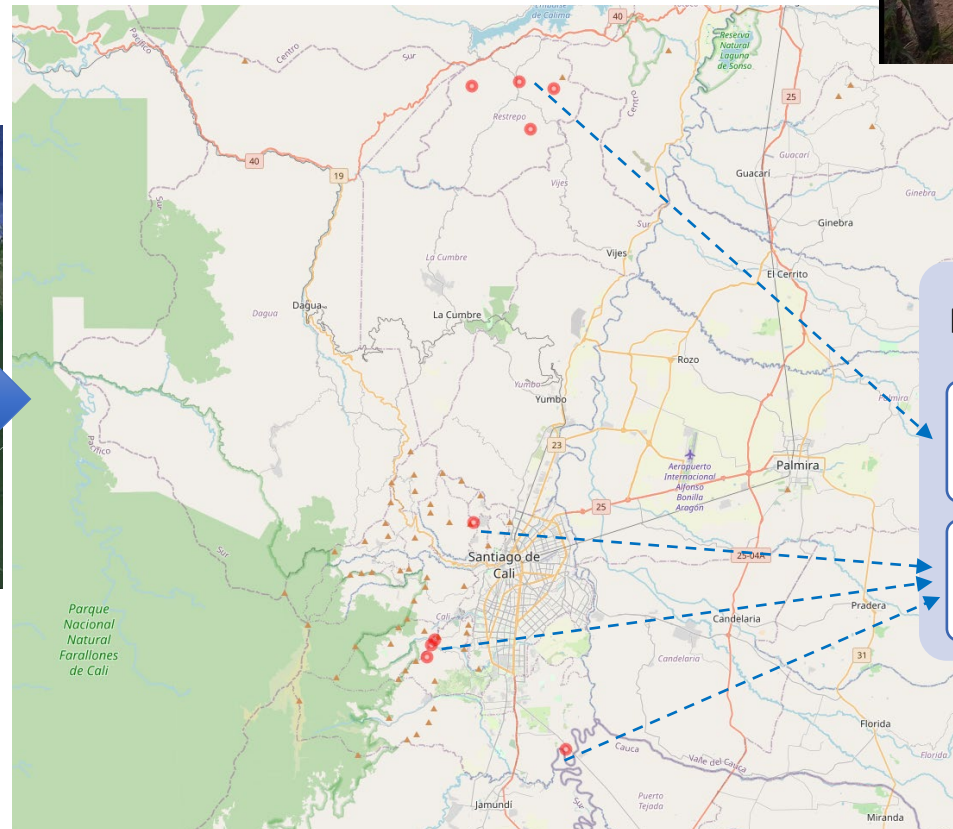
- Country: Colombia
- Province: Valle del Cauca Province
- Capital : Cali
- Population: 2.228 million (2018)
- 2 Municipalities



Water supply system “Las Palmas”, rural Cali



Source: Garcia, et al., 2018

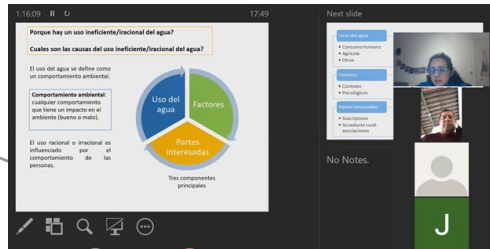


Municipality	Distance from Cali	Population
Restrepo	~ 100 Km from Cali	4172 (Dane,2018)
Rural Cali	Country side	8983 (Dane,2018)

Methodology

November 2020 – December 2021

Interviews leaders of associations



Questionnaire design, review and test



2023



Conducting surveys

2022

Processing information

Results (in progress)

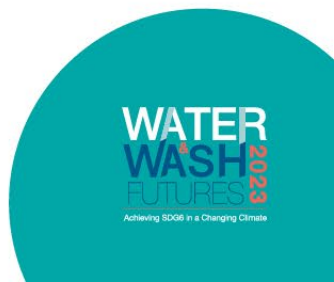
Summary of data collected and characteristics WSs

Municipality	Water supply systems	Number of surveys	Sample size	Total	Type of water source and number of sources	Water metering	Water treatment plant
Restrepo - R (Rural)	1R	107	23%	191	Surface (2)	Yes*	Yes*
	2R	43*	50%*		Surface (2)	No	No
	3R	17*	50%*		Surface (1)	No	No
	4R	24	100%		Surface (1)	No	No
Cali (Peri urban)	5C	61	23%	774	Surface (1)	Yes	Yes
	6C	390	20%		Surface (5)	Yes	Yes
	7C	181	23%		Groundwater (1)	Yes*	Yes*
	8C	142	23%		Surface (2)	Yes	Yes
				965			

Results

- Socio – economic factors by zone

zone	peri-urban				rural			
	mean	sd	skew	kurtosis	mean	sd	skew	kurtosis
SEC factors								
People per household	3.76	1.35	0.00	-0.74	3.43	1.47	0.17	-1.07
Age	44.42	14.22	0.02	-1.11	49.19	15.72	-0.18	-1.28
Residence time (years)	22.48	16.44	0.79	0.07	24.18	21.12	0.86	-0.16
Income (Euros)	383.91	179.81	0.58	-1.03	213.25	65.06	3.43	15.55

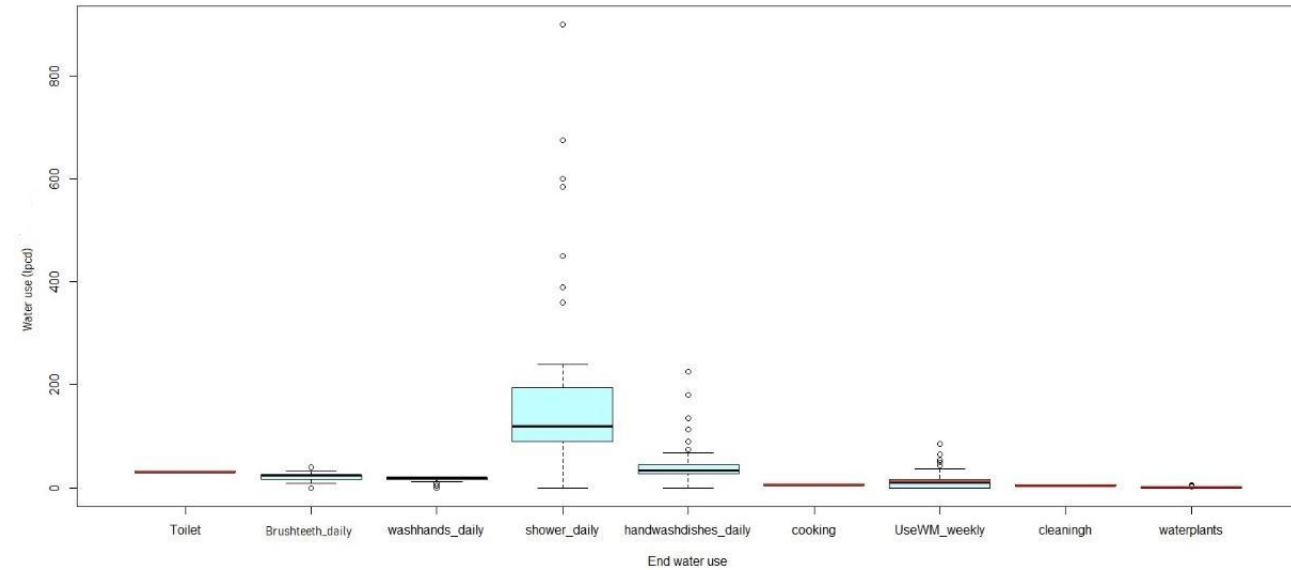
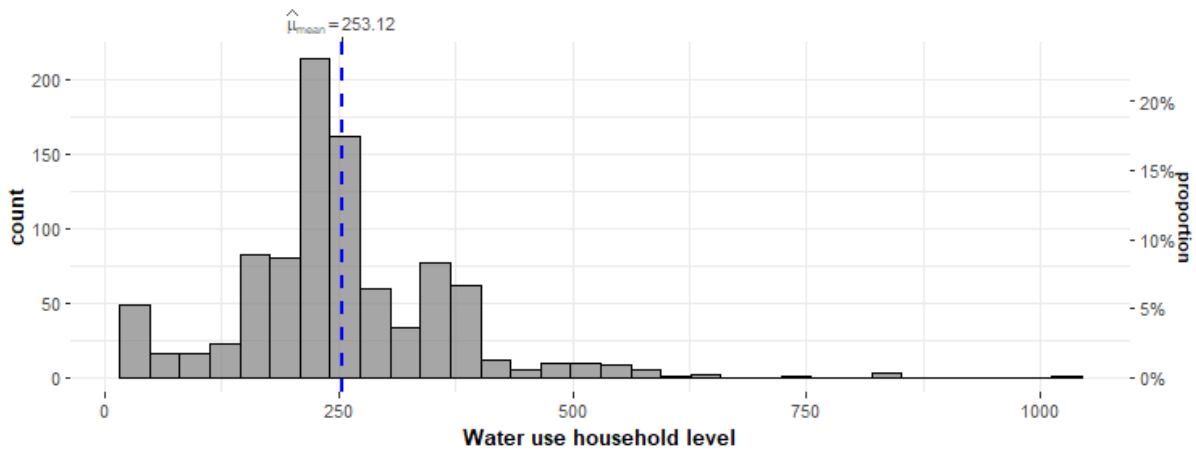


Results: water use at household level

- Distribution of water use (litres per person per day -lpcd)

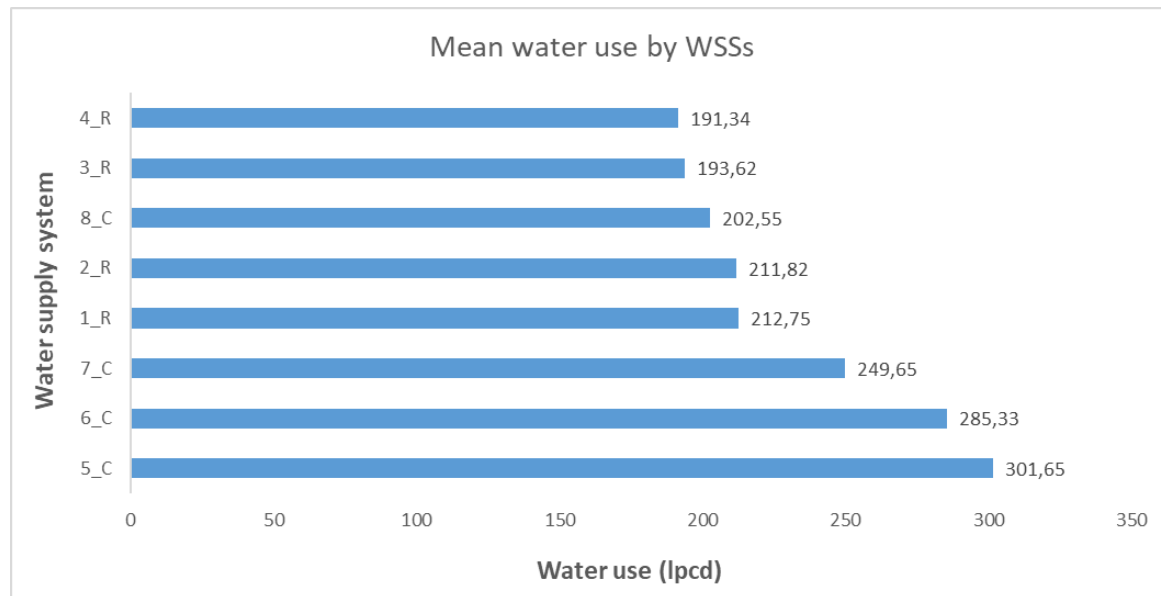
user's perceptions

- Domestic water use (indoors) based on user's perceptions

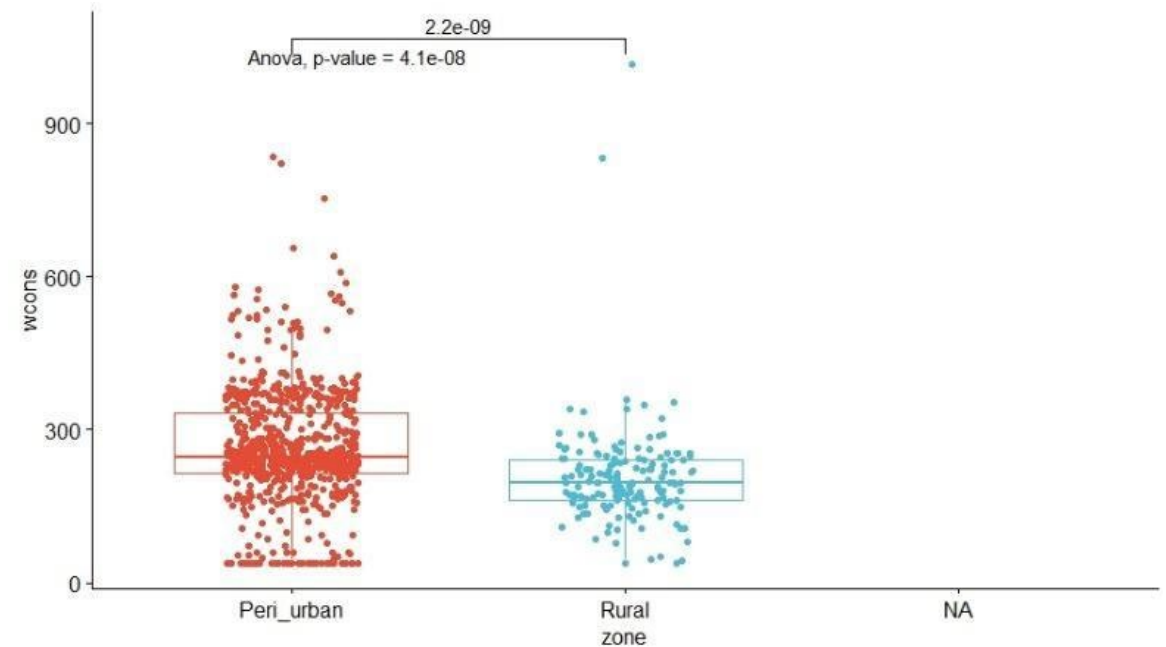


Results

Mean water use per each water supply system



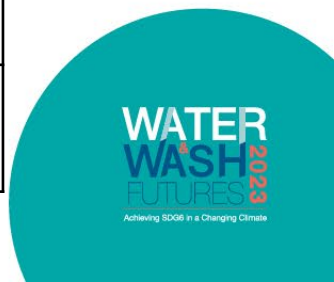
ANOVA and post hoc analysis by WSSs



Results

Zone	WSs	water produced			total water loss
		Qtotal	Water supply		(%) ¹
		(m ³ /day)	(litres/person.day)		
			min	max	
Restrepo (Rural)	1_R	949	571	643	47-55
	2_R	471	-		-
	3_R	449	-		42-47
	4_R	97	806	1151	70-89
Cali (Peri-urban)	5_C	304	358	594	-
	6_C1	983	-		56-59
	6_C2	1085	-		50-54
	7_C	955	-		-
	8_C	296	-		49-62

(Adapted from Karamountzos, 2022)



Conclusions

- From overall end water uses, the highest use was for showering, (54.8%), and 60% of participants reported spending 8 min per shower.
- At the system level, the per capita water supplied (lpcd) in each peri-urban system is lower in comparison with WSSs located far from main cities.
- The self-reported water use is higher than the end water uses ABC and REAL (Crouch et al., 2021), and the water use estimated from studies in rural areas from other global south countries.
- High water losses may be explained because WSSs are intermittent systems and assumption of constant flow during measurements.
- To improve the understanding of water use at household and system scales in WSSs, more measurements are required to obtain accurate results
- Integration of social measures means the behaviour of water users, water balance, and the hydraulics of the WSSs are crucial to understanding water use in water supply systems.

"We persist in exploiting freshwater as if it were abundant, even as we recognize its scarcity"

Edward B. Barbier, 2019

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