Water & Environment Centre (WEC) Sana'a University - www.wec.edu.ye
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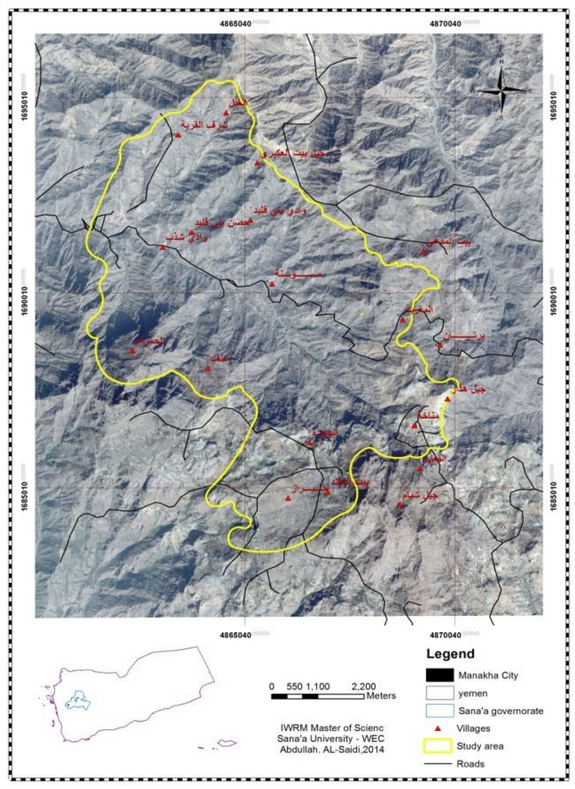
Potential of Rooftop Rainwater Harvesting Systems

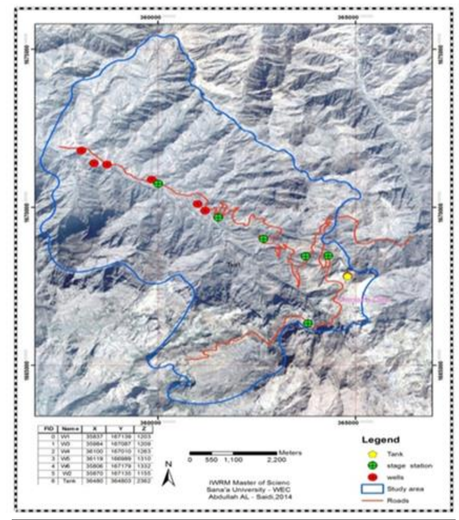
MSc Research

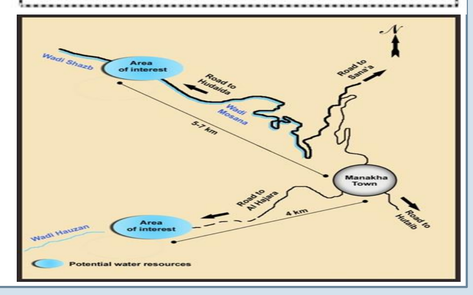
Problem statement and Objectives

This study was conducted in Manakhah town which suffers from water shortage and scarcity. Manakah is located at 2,353 meters above the Sea Level and served by only a public water system. The water source is located in Wadi Mousna, located at an elevation of 1,245 m.a.s.l. The distance between the wells and the town is nearly seven kilometers, and the water needs to be lifted over a depth of 1,000 meters increasing the already enormous costs of operation and maintenance.

The goal of the research is to analyze the potential of Rooftop Rainwater Harvesting Systems to supply Manakha area with water; through assessing the technical, economic and social feasibility, and introducing these systems to meet domestic water needs and reduce the pressure on groundwater resources and households' financial resources.







Methods

1

Socioeconomic survey methodology:

⇩ Literature review

⇩ Interviews

⇩ Households

⇩ Existing RTRWH

⇩ Public buildings

⇩ Data analysis using SPSS program

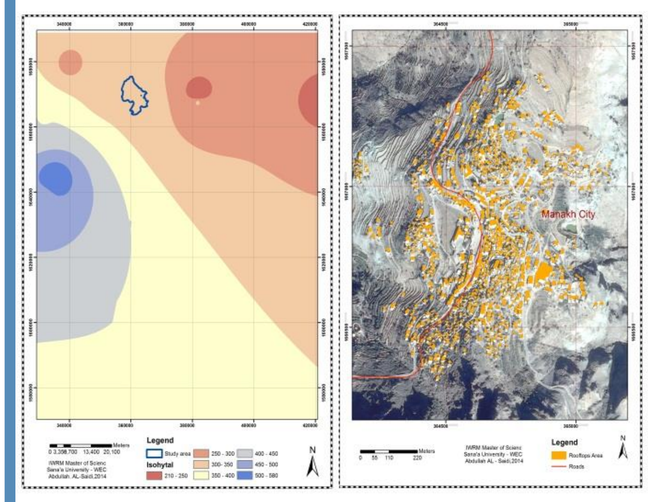
2

Potential harvested rainwater quantity methodology

Digitizing ⇩ Satellite image ⇩ Isohyets map

Zoning ⇩ Roof area ⇩ Water quantity (isohyetal method)

ArcGIS



Results

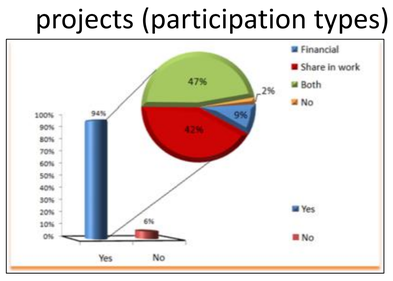
- Water Demand in Manakha

Parameter	Year	Population	demand L/c/d	Q m3/year	product ratio %(service coverage)	Harvested Water (CM/year)	Harvested Water Coverage water demand ratio
Water production m^3 yr^{-1}	2010	15000	15.30	83757	100%	31092.67	21%
max demand m^3 yr^{-1}	2010	15000	50.00	273750	31%		
avg. demand m^3 yr^{-1}	2010	15000	26.67	146000	57%		

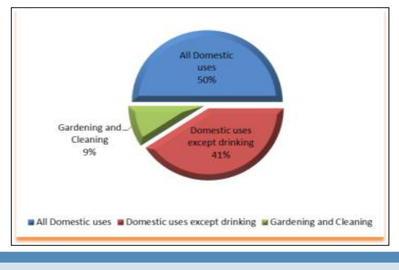
- Potential of harvested water quantity and cost

Area Name	Annual Rainfall (mm/year)	Rooftops Area (km^2)	Harvested Water (CM/year)	Water value M3/real By fonder	Total RWH value R / year
Manakha	300-350	0.138	31092.67	2.666	82,913,786

- Willingness and ability to participate in RTRWH projects (participation types)



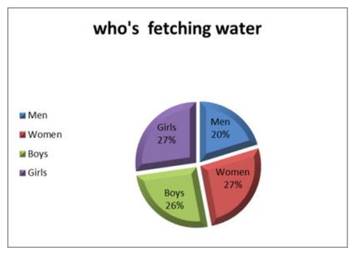
- Different local uses of rainwater in RTRWH projects



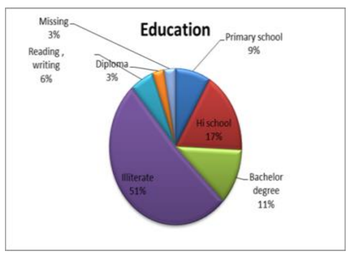
• Per capita consumption	28-30 liters/day
• Volume of water losses by public network (m^3/year)	30,196
• Average per capita water consumption / day from NWSA wells	15.30 L /day
• Cost of public water unit (tarfa)(by NWSA)	400YR/M^3
• Cost of public water unit(without subsidence)	1225YR/M^3
• The range of cost estimation for an ideal system	614100 YR (28565) 90
•Cost of rainwater unit(m^3)	186 YR/M^3

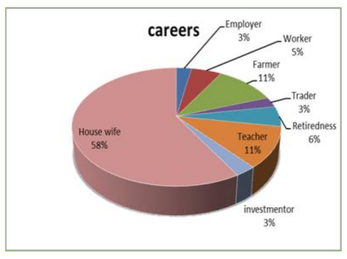
All stakeholders (households, public buildings, NGOS, and NWSA) have agreed to manage, operate and maintain such projects, ensuring their sustainability, downgrading water depletion and the pressure on ground water, and supplying Manakha town with water.

- most women (54%) are fetching water and making an effort to supply water from a long distances (5 km)



- Many women in the area are educated and have careers in their communities.





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Project Partners

NICHE nuffic Netherlands organization for international cooperation in higher education WEC Water and Environment Centre