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HOUSEHOLD WATER SECURITY IN THE RAINIEST PLACE ON THE EARTH - CHERRAPUNJEE: NATURAL CONSTRAINTS OR SOCIAL CONSTRICTIONS

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Abstract: *The area between Cherrapunjee and Mawsynram receives the highest amount of orographic rainfall in the world. Though average annual rainfall in Cherrapunjee is 11,870 mm (1980 to 2010), such high atmospheric availability does not guarantee household water security, for many households suffer from acute water shortage. This water shortage is more pronounced in the dry/lean season, i.e., from November to February when almost no rainfall is recorded. Water shortage varies from time to time, place to place and household to household. Surprisingly, there are a few households having surplus quantity of water during the whole year. The geomorphic zones in which the settlements are located determine the scope and constraints to the type of sources and amount of water that can be accessed by the households. Access to safe and reliable sources is very essential for attaining water security at the household level. On the other hand, households located either in the urban centre of Cherrapunjee town or in the rural settlements display inter and intra variations in water shortage or water surplus pattern raising critical questions. To what extent does the natural environment determine the attainment of water security at the household level? At what level does the socio-economic set-up and political environment influence household water security? Which of the two major factors is most important? The present study has tried to answer these questions by looking into the water collection pattern among the households situated in the different geomorphic zones of plateau, mid-slope and valley. These geomorphic zones contain the urban centre of Cherrapunjee and the selected six rural settlements that have been selected for the present study. Data were collected in both the water surplus season, i.e., monsoon (June to October) and the water deficient season, i.e., lean season (November to February). The present study is an attempt to assess whether in a naturally water surplus environment the physical environment is the all pervasive factor or the socio-economic and political factors get superimposed on the natural setting and influence the attainment of household water security.*

Key Words: *Cherrapunjee, household water security, lean season, geomorphic zones, water surplus-water shortage.*

1. Introduction:

The prime functions of water is to first meet the basic human needs, i.e., drinking, cooking, sanitation and protecting valuable ecosystems [1] and then to use the remaining water to satisfy other human needs efficiently, equitably and productively [2]. Since the Mar del Plata Conference of 1977 the issue of minimum water for human consumption has been vigorously highlighted. The United Nations Committee on Economic, Social and Cultural Rights declared that "the human right to collect water entitles everyone to sufficient, safe, acceptable, physically accessible and affordable water for personal and domestic use" [3]. The Indian 8th Five Year Plan (1992-1997) states that, "Safe drinking water and basic sanitation are vital human needs for health and efficiency (given that) death and diseases, particularly of children and the drudgery of women are attributable to the lack of these essentials" [4]. This has been reiterated in the National Water Policy of India – 2002 where provision of drinking water is given primacy over all other consumption [5]. However, globally there are around 900 million

people who do not have access to clean water and more than 2.6 million people are derived of basic sanitation. Most of the countries in the Near East and North Africa as well as countries such as Mexico, Pakistan, South Africa and large parts of China and India are facing problems of acute water scarcity [6]. In India there are still 37,000 'uncovered' habitations while the previously 'covered' had started to become 'uncovered' [7]. Scarcity/shortage of human consumption may have overarching macro causal factors but the effects are felt by individual households. Also in addition to macro factors households experience specific micro factors that determine water demand, collection and use. Household water security addresses these concerns.

Household water security in very simple terms can be understood as the provision of reliable and safe water supply of sufficient quantities accessible within home [8]. This water is required to fulfil the various domestic needs that go beyond the provisions of simple Basic Water Requirements (BWR) that includes all the usual domestic activities including bathing, consumption and food preparation [1, 9]. It also includes the various productive uses which includes water required for backyard gardening, household livestock, beer brewing [10, 11] that could help in the income generation and improvement in the status of the household [12, 13]. The attainment of household water security does not only lead to the achievement of a healthy and productive life but also of a sustainable livelihood [14]. Household water security is multi-faceted and it encompasses the issues of water availability, accessibility, usage and water quality [15]. Availability treats water as a natural endowment that has to be harnessed and equitably distributed while accessibility considers water as a commodity over which the household can achieve greater control through proximity of location and timely availability. Usage, on the other hand, relates to entitlement rights of households for satisfying the basic needs and water quality is essential so that households are secure from water borne and water related diseases [14, 15]. Household water security require a comprehensive understanding of the multiple characteristics and functions of water where the potential solutions comes not from an analysis of each function separately but by focusing on net effects, achievement or otherwise of household water security [14].

The position of Cherrapunjee as the area receiving the highest amount of rainfall may have been usurped by Mawsynram which is located 16 km to the west, but it is still among the heaviest rainfall receiving region in the world. During the period 1980-2012 Cherrapunjee received an average annual rainfall of 1140.24 cm. However, at the same time the people in the area suffer from severe shortages of domestic water [16]. In 2010, because of the drinking water crisis in Cherrapunjee, the Public Health Engineering Minister Prestone Tynsong inaugurated the Greater Sohra Water Supply Scheme at a cost of Rs. 4.13 crore (Rs. 41.3 million) with the aim of providing drinking water to about 25,000 families in *Sohra*/Cherrapunjee [17]. However, shortage of domestic water persists with households in the area getting drinking water only once in three days. This paper has the aim of studying this paradoxical situation of scarcity in plenty by looking at, (i) availability of domestic water at the household, i.e., whether the households have been able to attain household water security, and (ii) identifying the factors governing household water security, i.e., what are the factors that govern the attainment of household water security at various spatial levels. Is it the geo-environmental setting that has proved to be decisive in creating the conditions of water shortage/scarcity or is it the inability of the households to achieve household water security a result of the socio-economic status. These are the issues that this study endeavours to investigate.

2. Materials and Methods:

The study area, Sohra Syiemship, has 75 villages and the urban area of Cherrapunjee town. The town of Cherrapunjee along with 22 villages is located on the plateau surface, 45 villages are situated on the mid slope and seven (7) villages are found in the valley. Two villages each were selected from the geomorphic zones: Mawkma and Mawrah from plateau, Kongthong and Mawkliaw from the mid slope and Dharambasti and Umdud from valley; while the town of Cherrapunjee was taken separately for being an urban area. For determining the size of the households from the selected sample settlements, disproportional sampling technique was used for the rural settlements where the size of the sampled households was taken to be 30 from each settlement irrespective of the sizes of the settlements. In case of the urban settlement of Cherrapunjee the proportional sampling method was used where the size of households to be taken for investigation was found out by taking sample sizes proportional of the size of the localities to the total household population of the Cherrapunjee town. Since the three localities of Mawmluh, Mawsmai and Saitsohpen fell outside the jurisdiction of the *Sohra Syiemship*, only the remaining localities of Khliehshnong, Mawkisyiem, Nongrim, Nongsawlia, Pdengshnong, Pomsohmen,

Maraikaphon and Kutmadan were taken for study. The sample size to be taken from Cherrapunjee town is 10 per cent of the total household population which is 180 households (1805 households according to the 2001 census). The total sample size thus, is 346 households spread over three geomorphic zones of plateau, mid slope and valley constituting about 6.31% of the total size of the household population of the study area, i.e., *Sohra Syiemship*.

For the collection of data on household domestic water availability a household schedule was prepared which consists of questions regarding the different sources of water the people depend on, their ownership and their reliability. The accessibility to the source in terms of time taken was also a part of the household schedule. Of great importance was the amount of domestic water collected from different sources and the uses they are put to. Since the area suffers from water shortages, questions were also included about the different coping strategies that the people adopt to cope with the problem of water shortage, their perception of wastage from different domestic activities and their awareness about water saving and conservation measures. In order to find out the amount of water that the households collect for domestic consumption, they were asked about the number of trips they make to the sources to collect water and the water holding capacity of the utensils in which they collect water.

Socio-economic status (SES) index is used to account for the differential positioning of a person in the social hierarchy. There are two ways of doing it, viz., subjective – people are asked about others' and self relative position in society; and objective – data obtained from each individual are compared to the total sample and a status position of the person's relative standing within the sample is determined [18]. But according to some scholars SES should reveal the total position of the individual in the society that includes not only the personal gain but also the evaluation by others. Such a view, thus, calls for a holistic perspective, subjective as well as objective. Though such a composite approach is highly appealing, most researchers chose to opt for the objective approach. For example, information on household construction and the number of rooms were used for determining the (socio) economic status of the households among a rural community in Bolivia by Clasen *et al*. [19] in investigating the efficacy of a water quality improvement intervention scheme. Investigating into the water availability and water use in the Indian urban centres of Kanpur, Delhi, Kolkatta, Ahmedabad, Mumbai, Hyderabad and Madurai, Shaban and Sharma [20] categorised the sampled households into different (socio) economic classes based on their assets availability. Similarly the present study has used the objective approach of constructing the composite index for assessing the socio-economic status (SES) of the households in the Sohra Syiemship and establishing its relationships with household domestic water availability. The variables utilized for the construction of the SES index are education attainment, occupation, housing status, fuel used and household assets availability. The significance of the results obtained was assessed using parametric, ANOVA and non-parametric tests of significance, Kruskal Wallis and Chi Square.

3. Results and Discussion:

3.1. Socio-economic status (SES) and household per capita availability of domestic water:

Because of the influence of power, politics and money, natural scarcity of water does not imply deprivation, nor does natural abundance imply affluence [2]. A very important factor that determines access to adequate and safe amount of domestic water is the social position and economic status of the households'. It is mostly seen that the poor are the most vulnerable population group in terms of water insecurity [3]. Hence, for the present study, a socio-economic status (SES) composite index was constructed to assess the capacity of the different socio-economic categories in achieving access to adequate amount of domestic water for the different household activities. Studies on water demand, collection and use have shown than there is a definite link between household water security and the socio-economic status of the people. Similar pattern is noticed in the study area of Sohra Syiemship during both the rainy and lean seasons.

In the lean season the High SES households have a comfortable average per capita availability of 117 lpcd which in the rainy season increases to about 300 lpcd. Medium SES households, on the other hand, are able to achieve an average per capita availability of 46 lpcd in the lean season which is marginally above the minimum per capita availability of 40 lpcd for rural areas, i.e., the households in this category are still vulnerable to household water insecurity. The situation improves in the rainy season, when the per capita availability improves to 146 lpcd. However, it is the Low SES that is suffering from household water insecurity not just in the lean season (average per capita availability of 29 lpcd) but also in the rainy season (average per capita availability of 62 lpcd). Though the average per capita availability is more than the prescribed minimum amount of 40 lpcd for

rural areas, it is still less than the prescribed minimum amount of 70 lpcd meant for urban areas. This clearly demonstrates the advantages that higher SES households enjoy in terms of domestic water accessibility. These advantages are all the more crucial during the lean season when the households belonging to the lower SES suffer from severe water stress. Establishing a relationship is important but more crucial to the understanding of the link between household domestic water availability and socio-economic status is the understanding of the processes that govern this relationship. In other words, what are the advantages that high SES households enjoy over the lower SES households? This can be revealed only by an in depth analysis of the individual factors that affect domestic water collection.

Table 1 Relationship between the SES and average per capita availability of domestic water in the high, medium and low SES households of the Sohra Syiemship in the rainy and lean season

SES Category	Mean	STDEV	Levene's Test#		ANOVA		Kruskal Wallis	
			F	Sig.*	F	Sig.*	χ^2	Sig.*
Lean season								
High	117.19	215.43	14.991	.000	13.733	.000	42.710	.000
Medium	45.77	59.12						
Low	29.29	24.54						
Rainy season								
High	299.82	317.12	18.990	.000	21.001	.000	62.441	.000
Medium	146.20	194.81						
Low	62.32	48.37						

* Significance level at 0.05
# Levene' test of equality

In the present study seven factors have been chosen to assess their influence on the household domestic water availability among the households belonging to the different socio-economic status categories in the lean and rainy season. The factors chosen are, viz.

i. Household size,
ii. ratio of household members below 15 years of age/children,
iii. main source of domestic water (piped water supply versus un-piped water supply),
iv. distance to the main source of domestic water,
v. duration of piped water supply,
vi. ownership of the main source of domestic water (communal or private), and
vii. household domestic water storage facilities.

All these factors influence household domestic water availability by either encouraging high accessibility consequently leading to household water security or restricting accessibility resulting in household water insecurity. The high SES households will enjoy household water security because all these factors are found to operate in a manner which improves accessibility to adequate amount of domestic water. For example, the high SES households will depend more on piped water supply (esp. individual piped connection), their domestic water sources will located at convenient distance, the water supply will be reliable (i.e. greater duration and consistent), etc. On the other hand, the lower SES households will suffer severe disadvantages in their attempt to collect the adequate amount of domestic water. They will be greatly dependent on communal non-piped sources which are located far from their homes and have less household storage facilities that would greatly expose them to the problems of household water insecurity.

3.2. Factors influencing household domestic water collection:

3.2.1. Household size:

One of the most fundamental factors that affect household domestic water collection is the size of the household. As the size of the household increases, the amount of domestic water required also increases, i.e., higher demand, necessitating greater collection. Water collection is a highly physically strenuous activity especially in hilly regions because of the uneven topography. It consumes a lot of time ensuing in high opportunity costs. For poor households this can have a damaging impact on their livelihood earning opportunities by limiting the amount of time that can be given to productive activities, especially for the females [3, 4, 9, 11, 14, 15, and 21]. The problems are exacerbated during water stress seasons when the nearby sources begin to dry and distance and time taken to collect domestic water increases. In such a situation, the households have to decide between the time allotted for water collection and other productive activities. When the need of the latter is more pressing, especially for the poor households', domestic water collection suffers leading to household water insecurity.

In the study area, surprisingly, the high SES households have the highest average household members of seven, which declines to six members in the medium SES households and finally to five members in the low SES households. Generally, it has been observed that households belonging to the lower socio-economic status have more household members. This is mainly due to high fertility rate because of lack of education and awareness. Also since household members in poor families start earning from a very young age, the desire to have more children is also more acute in this socio-

economic group. This rather unexpected outcome, decreasing household size with improving socio-economic status, is because the low SES households are nuclear families while the medium and high SES households have nuclear as well as joint family types. Consequently the household members are found to be more in the medium and high SES households. In many cases, only a single member is found in the low SES households in the study area.

Table 2 The pattern of household size (in persons) among the high, medium and low SES category households in the Sohra Syiemship

SES Category	Mean	STDEV	Minimum	Maximum
High	7.08	2.81	1.00	17.00
Medium	6.38	2.64	1.00	15.00
Low	5.03	5.03	1.00	11.00

Since the household size increases as the socio-economic status improves, the amount of domestic water required (demand) is highest for the high SES households and lowest for the low SES households. While this is true for the absolute amount of domestic water required, but when assessed in terms of per capita availability, adequacy of amount (i.e., should fulfill the required norm) is important rather than the absolute amount. In this regard it is seen that high SES households have always been able to collect more than the required amount of domestic water whether residing in the urban area or the rural area and during the monsoon/rainy as well as the lean season. Medium and low SES households, on the other hand, face difficulty in collecting the required amount of domestic water especially during the lean season. Thus, the fact that high and medium SES households' with larger household sizes are able to collect the required amount while low SES households with smaller household size are not able to do so suggests that there are factors other than the household size that affects domestic water collection.

3.2.2. Ratio of household members below 15 years of age/children:

In a household that has a high number of children there is greater pressure of water collection on the adult member of the family especially the working members. In Maestranza in Manila, Phillipines, around 65% of the household's members who had the responsibility to collect water were adult males and belonged to the working population of Phillipines [12]. This entails a high opportunity cost that can have a severe impact on the livelihood of the especially, poor households. The higher the ratio, the higher is the water collection burden. In such a scenario, time constraints for the livelihood earning members, adult, forces them to either compromise on their livelihood or domestic water collection. Acute constraints on both the fronts for the adults force the younger members of the household to assume the responsibility for domestic water collection. This has a severe impact on school and playing time of the children apart from the physical injuries that it incurs. The strenuous activity of fetching water from far distance, can lead to extreme exhaustion, injury, headaches, general fatigue, and pains in the chest, neck, back and waist [11, 21, 22].

In the study area, it is found that though the household size of the high SES households is higher than the medium and low SES households the ratio of children is the lowest, 0.25 or 25%. In this case, the responsibility of domestic water collection can be shared without any additional burden on any single household member. In case of high ratio, high SES households because of their financial capacity can delegate the responsibility of domestic water collection to non-household member private individuals. This practice is observed in some of the households in the urban centre of Cherrapunjee and is also very common in Shillong. On the other hand, households with lesser financial capacity, medium and especially the low SES households cannot afford to outsource domestic water collection. Here the burden falls solely on the household members especially the elders and in a worst case scenario, the children. Therefore it is very distressing to find that in the medium and low SES households the burden is higher as about 1/3rd of the household is composed of children (ratio of 0.36 and 0.37 respectively). This puts great pressure on these households to balance their livelihood activities and water collection. Of the two, the need to assure the former is much more acute; hence, domestic water collection suffers especially in the lean season.

3.2.3. Main source of domestic water:

In many cases it is the type of sources of domestic water that determines the amount of household domestic water collection. In their pioneering work '*Drawers of Water: Domestic Water Uses in East Africa*' White *et al.*, [23] studied domestic water collection by dividing the households into piped and un-piped households. Expectedly, piped households were found to enjoy higher household domestic water availability as compared to the un-piped households. In the follow-up study 30 years later, Thompson [11] found this to have remained true. Connection to a piped domestic water

supply is considered to be the primary means of improving household water security [24]. But in most of the developing countries, particularly in the rural areas, piped domestic water is conspicuous by its absence. In the study area, Dharambasti and Umdud located in the valley geomorphic zone have no public water supply system (i.e., common standpost) and they depend on non-piped sources. But piped domestic water in the study area, from the common standposts, has been found to be unreliable, especially in the lean season, when the need is most acute. The types of sources from which the households collect domestic water, therefore, become very critical in determining household domestic water collection.

Households in the study area collect domestic water from multiple sources. However, in order to understand the relationship of SES to domestic water sources only the most important source in terms of quantity and quality is taken. It is found that in agreement with White *et al.* [23] and Thompson [11], households in the study area with higher household domestic water availability (i.e., high and medium SES households) depend primarily on the piped domestic water supply whether it is in form of private piped domestic water connection to the households or collection from the common standposts.

Table 3 The pattern of the ratio of household members below 15 years of age among the high, medium and low SES category households in the Sohra Syiemship

SES Category	Mean	STDEV	Minimum	Maximum
High	.25	.22	.00	.75
Medium	.37	.23	.00	.78
Low	37	.25	.00	.80

Table 4 The sources of domestic water among the high, medium and low SES categories of Sohra Syiemship in the rainy and lean season

SES Category	Sources of domestic water (% of households)						
	Common Tap	House Connection	Pond	Rainwater	Spring	Stream	Tube Well
Rainy season							
High	33.3%	46.0%	4.8%	1.6%	11.1%	.0%	3.2%
Medium	40.4%	17.9%	17.4%	.9%	10.6%	3.2%	9.6%
Low	46.6%	1.7%	31.0%	.0%	8.6%	6.9%	5.2%
Lean season							
High	31.7%	41.3%	.0%	7.9%	12.7%	3.2%	3.2%
Medium	33.5%	16.1%	.5%	22.5%	13.3%	7.3%	6.9%
Low	41.4%	1.7%	.0%	31.0%	13.8%	10.3%	1.7%

In the rainy season, 79 % of the high SES households are found to collect water from the piped water sources with more than half of them having their individual private connection. In this season, piped water sources are important for the medium as well as the low SES households (58.3% and 46.6% respectively). What is significant is that non-piped water sources - pond, rainwater, spring, stream and tube well, are the most important sources of domestic for water more than half of the low SES households. This figures increase to almost 60% in the lean season when water stress is very high. For the medium SES households the dependence on piped and non-piped water sources in the lean season is almost equal but it is very low for the high SES households (27% of the households).

The type of domestic water sources, thus, is very important in determining the amount of domestic water collection. The piped water sources of private piped water connection (especially in the urban settlement of Cherrapunjee) and common standposts (in urban as well as rural settlements) ensures higher collection during monsoon as well as lean season for the high and medium SES households. But for households (low SES) who collect domestic water mainly from the non-piped domestic water sources of stream/river, tube well, pond and spring domestic water collection suffers. In many cases they are even not able to collect the minimum required amount of 40 lpcd. But the occurrence of low SES households collecting domestic water mainly from the piped domestic water source of common standposts indicates that only the type of domestic water sources is not the only factor determining household domestic water collection.

3.2.4. Distance to the main source of domestic water:

Another very important factor in governing household domestic water collection is the time taken for collecting domestic water from the source, which is dependent on the distance to the source. Except for households that have an in-house water supply arrangement, e.g., private piped water connection,

most households transport water from outside. This makes distance to the source an important factor in determining household domestic water collection [e.g., 9, 10, 15, 22, 23, 24, 25, 26]. In the study area, it is found that only the high SES households and the few households belonging to the medium SES category have private piped water connection. The rest of the households collect water from sources outside the premises of the household's residence. In such a scenario, the distance to the source of domestic water becomes very crucial. For the purpose of analysis, time has been taken as a proxy for distance because of the differing distances (to the source of domestic water) for each individual household. Households are also not able to provide the accurate distance measurement to the sources, especially if they are located far from their homes. In such a scenario, time is found to be a suitable proxy. Distance is after all the time taken to travel from one point to another.

Table 5 The distance (in minutes) to the source from the households belonging to the high, medium and low SES households of the Sohra Syiemship in the lean and rainy season

SES Category	Mean	STDEV	Minimum	Maximum
Lean season				
High	4.06	7.80	.00	30.00
Medium	7.84	10.54	.00	60.00
Low	10.98	10.49	.00	30.00
Rainy season				
High	1.54	3.55	.00	20.00
Medium	2.95	5.141	.00	30.00
Low	6.72	8.72	.00	30.00

Significantly, it is found that there is a perceptible trend of decline in the distance to the sources of domestic water as the SES improves, i.e., the sources of domestic water are farthest for the low SES households and nearest for the high SES households with the medium SES households falling in between. It is found that the distance to the source of domestic water for the high SES households is only just over a minute in the rainy season and only four minutes in the lean season, within a distance of 100 metres. For the medium SES households the distance to the source is around three minutes in the monsoon season (within 100 metres) and about eight minutes in the lean season (just over 100 metres). But it is the low SES households who suffer from the lowest accessibility as they have to travel more than ten minutes in the lean season and around nine minutes in the rainy season (source distance of more than 100 metres) to collect domestic water.

In general the pattern is that of decreasing distance to the sources of domestic water with improvement in the SES of the households. Also, the distance to the sources improves from the lean season to the monsoon season but for the low SES households the sources are still located at more than 100 metres away. Thus, the distance to the source of domestic water does seem to greatly influence household domestic water collection; collection of domestic water improving for households whose sources of domestic water are located at a distance of within 100 metres, but worsening for households who collect from sources of domestic water more than 100 metres away.

3.2.5. Duration of piped water supply:

From the above discussion it is clear that the type of domestic water sources, especially the availability of piped water supply, is an important factor in determining household domestic water collection. Households having access to piped domestic water sources are found to be in a comfortable position regarding household domestic water availability compared to households who do not. However, access to a piped domestic water source is not enough. Duration of supply is also very important. The issue of reliability of water supply, considered by Howard and Bartram [9] to be one of the factors determining domestic water consumption, deals with the duration as well as the predictability of the supply hours. For e.g., less supply hours was found to be an important factor governing water use among the urban poor in Mumbai [27]. Therefore, the effect of the duration of piped water supply (from common standpost and private piped water connection) on household domestic water collection is investigated. A supply of less than six hours is considered unsatisfactory, six to 12 hours satisfactory and more than 12 hours highly satisfactory.

It is highly surprising to find that during the lean as well as rainy season, a higher proportion of low SES households' report of the piped water supply being of highly satisfactory nature (72% and 78.6% of the households respectively) compared to the high and medium SES households. Though a significant proportion of the medium and high SES households' report of highly satisfactory piped water supply, a significant proportion of them also report of unsatisfactory piped water supply (more than 30% of the households of both the SES categories and in both the seasons).

Table 6 The status of the duration of piped water supply among the high, medium and low SES

households of the Sohra Syiemship in the lean and rainy season

SES Category	Status of duration of piped water supply (% of households)		
	highly satisfactory	satisfactory	unsatisfactory
Rainy season			
High	42.0%	24.0%	34.0%
Medium	50.0%	19.0%	31.0%
Low	78.6%	7.1%	14.3%
Lean season			
High	37.0%	21.7%	41.3%
Medium	42.6%	15.7%	41.7%
Low	72.0%	8.0%	20.0%

This suggests two things: first, the duration of water supply is not an important factor in determining the amount of household domestic water collection; secondly, rather it is the efficiency of the water supply network that is more important. Many households have complained of the common standposts running dry for at least three to four days in a week. Breakage of pipelines (sometimes due to deliberate pilferage) is a common problem. The pressure of water is also found to be very low in many of the common standposts. In effect, very less water can be collected.

The importance of efficiency over duration of water supply is further established by the pattern of the duration of piped water supply and household domestic water availability in the monsoon. This season, being the water surplus season, even for the households who do not enjoy 24 hours water supply household domestic water availability is very high. Also in the rainy season it is availability and collection of rainwater that enables the households to collect adequate amount of domestic water. This incontrovertibly demonstrates that it is the efficiency of the water supply network which determines household domestic water collection instead of the duration of water supply.

3.2.6. Ownership of the main source of domestic water:

The ownership status of a source of domestic water plays a very important part in determining household domestic water collection. Ownership gives power to the group wielding it to either encourage but mostly restrict the use (collection of domestic water) of the source by other groups. For e.g., in the semi arid area of North-eastern Nigeria among other factors the ethnic antagonism among the main ethnic groups of Hausa and Fulani is an important factor governing water accessibility and use [28]. Control over the collection of domestic water from the source ensures that the water in the source is not depleted due to high water collection pressure especially in the water-stress periods. In case of communal sources, control of use is not possible except for preventing contamination. The water collection pressure on the source, therefore, is very high. This generally result in long queues for water collection when the sources (collection points) are few and rapid exhaustion of the water in the sources when water stress is high.

Table 7 The pattern of ownership of domestic sources among the high, medium and low SES households of the Sohra Syiemship in the lean and rainy season

SES Category	Ownership (% of households)	
	communal	private
Rainy season		
High	46.0%	54.0%
Medium	67.9%	32.1%
Low	91.4%	8.6%
Lean season		
High	49.2%	50.8%
Medium	72.0%	28.0%
Low	94.8%	5.2%

In the study area, three types of ownership status are observed: government (Public Health and Engineering Department - PHED) operated sources like the common standposts; community maintained sources like ponds, springs and private ponds, springs, etc., under private individual ownership. Private piped water connection is an interesting case, as it is provided and maintained by the PHED, but real ownership lies with the household who avail the facility. Domestic water in this case is available only to the individual household who may chose to share the water with other households who do not have this facility. Common standposts have no such restrictions and all can collect domestic water from them. So is the case with the community ponds, springs; but not from private springs, ponds and tube wells. Therefore, in terms of access two broad types of ownership status can be identified, viz., communal, where domestic water collection is unrestricted and private where domestic water collection from the sources is the prerogative of the owner, i.e., individual household.

Expectedly, low SES households mostly collect their domestic water from communal sources in the lean (94.8%) as well as the rainy season (91.4%). More than half of the high SES households, on the other hand, have private sources of domestic

water (especially, individual private connection). In case of the medium SES households, like the low SES households communal sources are the most important sources of domestic water with dependence increasing during the lean season (from 67.9% to 72% of the households). But a significant number of medium SES households also have their own private sources of domestic water which helps them in collecting the required amount of domestic water.

A few points emerge from this description. Firstly, a significant proportion of households belonging to the high SES and medium SES category have a private source of their own. Secondly, this is true in both the seasons, though the proportion of households in the monsoon season having a private source comes down a little from the lean season. Rainfall recharges the sources in the monsoon season enabling the communal sources to become more reliable enabling more households to collect domestic water from them. What these signify is that having a private source is very important in ensuring household water security through the collection of adequate amount of domestic water, especially in the water stress period, i.e., lean season. While in most of the households belonging to the high SES category, the private source is the private piped water connection, for the medium SES households it is the springs, ponds and tube wells. On the other hand, households belonging to the low SES households depend almost exclusively on communal sources that are not able to supply the required amount of domestic water due to high water collection pressure and exhaustion of the sources particularly in the lean season. Having a private source, thus, ensures collection of adequate quantity of domestic water in the monsoon as well as lean season.

Ownership status, especially, having a private source of domestic water, hence, plays a very important role in household domestic water collection. Having a private source facilitates the collection of adequate amount of domestic water in the monsoon as well as the lean season. Households collecting domestic water from communal sources, on the other hand, are in many cases not able to collect the adequate amount of domestic water, particularly when they need it the most, i.e., lean season.

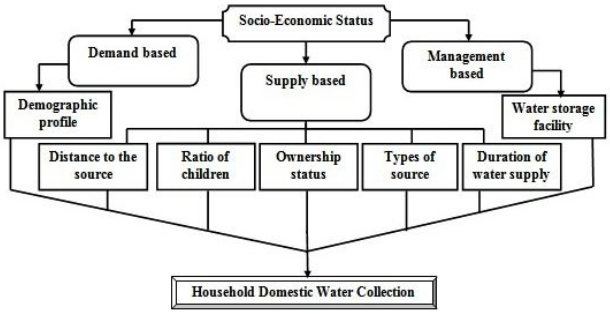

Figure 1 Framework of household domestic water collection in the Sohra Syiemship

3.2.7. Household domestic water storage facilities:

Domestic water collected needs to be stored at a proper place as all of it is not consumed or used for the household domestic activities immediately. The task of domestic water collection is normally undertaken either in the morning or in the evening. The domestic water collected, thus, has to last for the duration in between. The more storage facilities a household possess the more domestic water can be stored. This stored water can not only be used for carrying out the domestic activities on the day of collection itself, but if sufficient storage facilities are available for an extra few days as well. This is very important in the periods of water shortage periods, i.e., lean season, when water storage is an important coping strategy [for e.g., see 8, 11, 15, 28]. Also, lack of adequate storage facilities compels the households to collect only a small amount of domestic water at one point of time. Since water collection trips consume a lot of time, especially if the sources are far, undertaking another trip after consumption (used for the different domestic activities) is not always possible because the elder household members (main water carriers) have to go to work. This discourages further domestic water collection and reduces the amount of domestic water needed for the household domestic activities.

In the study area, households were found to collect domestic water from the different sources using varied utensils, the most common being the aluminium pot *khew* whose capacity ranges from 12 to 20 litres. This they carry it on their head or shoulder, around the hip or inside a conical shaped basket made of bamboo called *khoh*. Other water collection utensils are plastic buckets, oil tins, jerry cans and bottles. These are also the same articles in which domestic water collected is also stored. For storage, however, additional storage arrangements are also used. These are oil drums, sintex water tanks, concrete water tanks and conical baskets that are

bigger than the ones described above. Households having these water storage facilities are in a much better position regarding household water security compared to those who don't as domestic water can be stored for a longer time that can be used at a later date reducing the need for daily water collection trips. While more than 20% of the households (23.8%) high SES households have at least two major sources of water storage facilities apart from the common containers, majority of the medium SES households (59.2%) either have only one major domestic water storage facility in the form of 200 litres oil drum. Also more than 1/3rd of the households in this category have no major storage facility. However, the worst performers in this regard are the low SES households 67.2% of whom have no major storage facility and about 1/3rd of them having only one storage option. This lack of any major storage facility correlates highly with the low domestic water availability in the low SES households

Table 8 The pattern of availability of major storage options among the high, medium and low SES households of the Sohra Syiemship

SES Category	Number of storage options (% of households)			
	no major storage	one	three	two
High	4.8%	69.8%	1.6%	23.8%
Medium	67.2%	32.8%	.0%	.0%
Low	34.9%	59.2%	.5%	5.5%

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Table 9 The factors governing the collection and availability of domestic water in the households of the Sohra Syiemship

Factors	ANOVA[a]		Kruskal Wallis[a]		χ^2 [b]	
	F	Sig.*	Chi Square	Sig.*	value	Sig.*
household size[a]	9.520	.000	15.552	.000		
ratio of household members below 15 years of age/children[a]	6.224	.002	13.018	.001		
main source of domestic water[b]					52.984 (R) 42.306 (L)	.000 (R) .000 (L)
distance to the main source of domestic water[a]	7.191 (L) 13.943 (R)	.001 (L) .000 (R)	31.925 (L) 30.217 (R)	.000 (L) .000 (R)		
duration of piped water supply[b]					10.271 (R) 214.642 (L)	.036 (R) .000 (L)
ownership of the main source of domestic water[b]					28.467 (R) 30.997 (L)	.000 (R) .000 (L)
household domestic water storage facilities[a]	45.708	.000	73.392	.000		

N.B. * significant at .05; L = Lean season, R = Rainy/Monsoon season

The availability of domestic water storage facilities, hence, is a very important factor for determining domestic water collection. More storage facilities encourage higher domestic water collection that can be stored for longer periods, reducing the need for daily water collection. This proves particularly convenient when households have a private piped water connection or are using the common standpost as individual household water connection. The domestic water stored on a good day of water supply can then last for water stress periods in between (due to the domestic water supply being irregular in the lean season). Facilities for domestic water storage, thus, have a great influence on household domestic water collection.

3.3. Household domestic water collection framework:

All the micro factors discussed above can be classified into three specific categories, viz., demand based, supply based and management based factors. The demographic structure of the household generates the demand for domestic water: higher the household size higher the demand for domestic water and vice-versa. On the other hand, the number of water carriers, (by inversing the ratio of children below 15 years), the types of sources of domestic water, distance to the sources of domestic water, duration of public piped water supply and the ownership status of the sources of domestic water are all supply based factors. These are concerned with the mode and the characteristics of the domestic water supply that the households in the study area access. The last is the management based factor which is represented by water storage facility available in the households. Households, therefore, have to take into consideration the demand, supply and management factors while determining their household domestic water collection configuration (Figure 1).

However, the most important governing factor regarding domestic water collection is the socio-economic status (SES) of the households.

Households belonging to the stronger socio-economic background, i.e., high and medium SES categories are found to be in a comfortable position irrespective of their location (particular geomorphic zone or settlement type), climatic condition, or the institutional and infrastructural state of the water supply system. On the contrary households belonging to the weaker socio-economic background are in a highly disadvantageous position regarding household domestic water collection across all spatial and temporal scales. They suffer from infrastructure deficiency and institutional weakness that makes them highly vulnerable to water insecurity problems.

Household domestic water collection, thus, is not a product of only one set of factors but of multiple factors operating at multiple spatial scales (see figure 1). It is the interaction and interdependence of all these factors that determines household domestic water collection that in turn determines household water security.

4. Conclusion:

Household water collection deals with the collection of water from the different water sources by a household to accomplish the domestic activities. This mundane seeming activity however, is a product of the consideration of multiple factors. The discussion has revealed is that the issue of domestic water is a very comprehensive issue that has to be dealt with by working at different levels. It is not enough that infrastructure is constructed and institutional arrangement is established. It is also very important that the real access to adequate amount of domestic water is assured by understanding the ground reality and formulating appropriate interventions. Otherwise, access will be concentrated to a few pockets and large portion of the people will be segregated pushing them into water poverty as seen in the present study area. There is a need to bring about a system that would ensure accessibility of adequate amount of domestic water to all through the creation of favourable conditions for household domestic water collection. Unless this is done the paradoxical situation of *scarcity in plenty* will persist.

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