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WATERSHED-WISE ANALYSIS OF WATER DEMAND AND SHORTAGE

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INTRODUCTION

Water is essential for socio-economic development and maintaining healthy ecosystems. It is becoming more and more scarce and valuable resource as population and water consumption rise. Other side water resource management is poor. A properly managed water resource is critical due to its complex nature and its association with other natural element. Water resources management aims at optimizing the available natural water flows, including surface water and groundwater to satisfy these competing needs. Hence in this study, geographical analysis of water demand and shortage has been done to provide fundamental information for water resources management. Considering the ever-growing population and its requirement of water, the present pattern of water extraction is certainly unsustainable e.g. the rate of water pumping from aquifers is greater than its recharge. If same trend is continued then we have to face water shortage problem in coming decade. As we know fresh water supply sources are limited and its demand is constantly increasing therefore to avoid gap between demand and supply there is need to proper water resource analysis and management of this vital resource. Considering the ever-growing population and its requirement of water, the present pattern of water extraction is certainly unsustainable e.g. the rate of water pumping from aquifers is greater than its recharge. If same trend is continued then we have to face water shortage problem in coming decade. The water scientists and experts around the world are ringing the alarming bells for future water crisis. It is observed that till today various water related studies are conducted but, it has not got complete success as it was expected; rather the problem of water crises got only limited success. As we know fresh water supply sources are limited and its demand is constantly increasing therefore to avoid gap between demand and supply there is need to proper water resource analysis and management of this vital resource.

STUDY AREA

The present study Ahmadpur tahsil has been selected. Ahmadpur is one of the tahsils of Latur district in eastern Maharashtra. Its latitude and longitude extend is about 18° 32' 28" to 18° 50' 18" North latitude and 76° 43' 17" to 77° 05' 34" East longitude covering an area of 783.15 Sq. km It is situated on 402 to 622 meters above MSL.

OBJECTIVE

- To estimate water demand and water shortage.

MATERIAL AND METHODOLOGY

Present study, following data is used to perform study.

- Survey of India (SOI): (56: B/10, B/13, B/14 and 56: F/1, F/2) Topographic maps of 1:50000 scale.
- National Remote Sensing Centre (NRSC) / Indian Space Research Organisation (ISRO): thematic Services, Bhuvan's land use land cover map of 1:50000 scale.
- Shuttle Radar Topography Mission (SRTM) and Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER):

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- Ahmadpur tahsil has divided into sixteen watersheds for study convenience. Watershed delineation has done based on DEM and major stream using GIS software. In this study watershed name has given on stream or river name which is major in particular watershed; further each watershed code has given such as AH-1 to AH-16 to symbolize its name in map, table and description. Water demand of area has estimated from following formula. As per **Falkenmark** standard annually per person 1700 cubic meters water is required. In this study additional agriculture potential factor has considered for annual water demand calculation.

Water demand = Population **×** 1700 cubic meters **× K**
Where: K = Agriculture Potential Factor

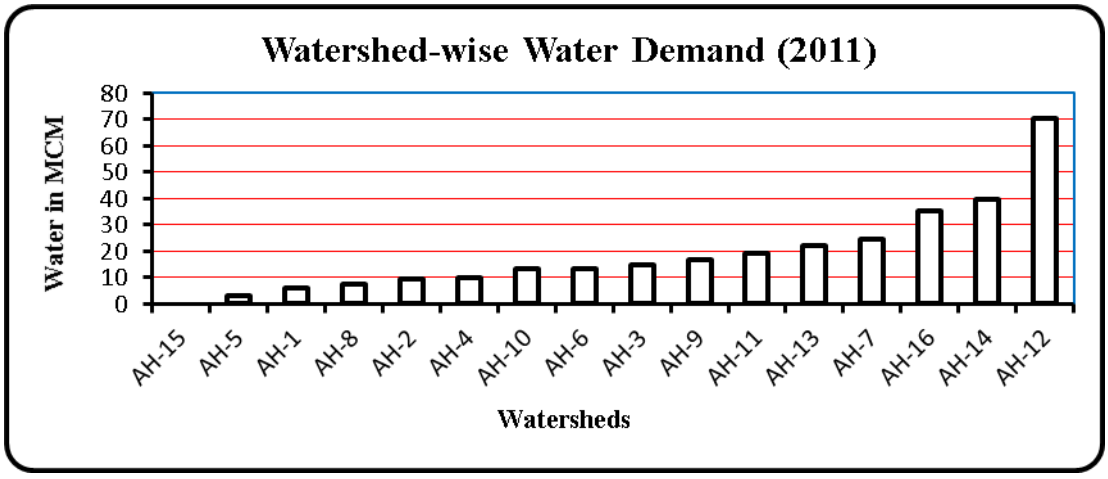
$$\textbf{Agriculture Potential Factor } (K) = \frac{\text{Total Area under Agriculture}}{\text{Total Geographical Area}}$$

Water shortage has calculated using following procedure.

Water Shortage = Water demand – (Absolute available water for use)

Results & Discussion:

A) Watershed-wise water demand: Water demand of Ahmadpur tahsil is about 306.2 MCM. Low water demand is observed in AH-15, AH-5, AH-1, AH-8, AH-2, AH-4, AH-10, AH-6, AH-3, AH-9 and AH-11 watersheds; it is below 20 MCM. Moderate water demand is observed in AH-13, AH-7, AH-16 and AH-14 watersheds; there annual water demand is between 20 to 40 MCM. High water demand is observed in AH-12 watershed; it is above 40 MCM due to high population density.



B) Watershed-wise water shortage: Ahmadpur tahsil water shortage is about 155.58 MCM. Low water shortage is observed in AH-6, AH-11, AH-15, AH-5, AH-10, AH-8, AH-3, AH-1, AH-13, AH-4 and AH-2 watersheds; there annual water shortage is below 10 MCM. Moderate water shortage is observed in AH-9, AH-16, AH-7 and AH-14 watersheds; there annual region water shortage is between 10 to 40 MCM. High r water shortage is observed in only in AH-12 watershed. There water shortage is above 40 MCM.

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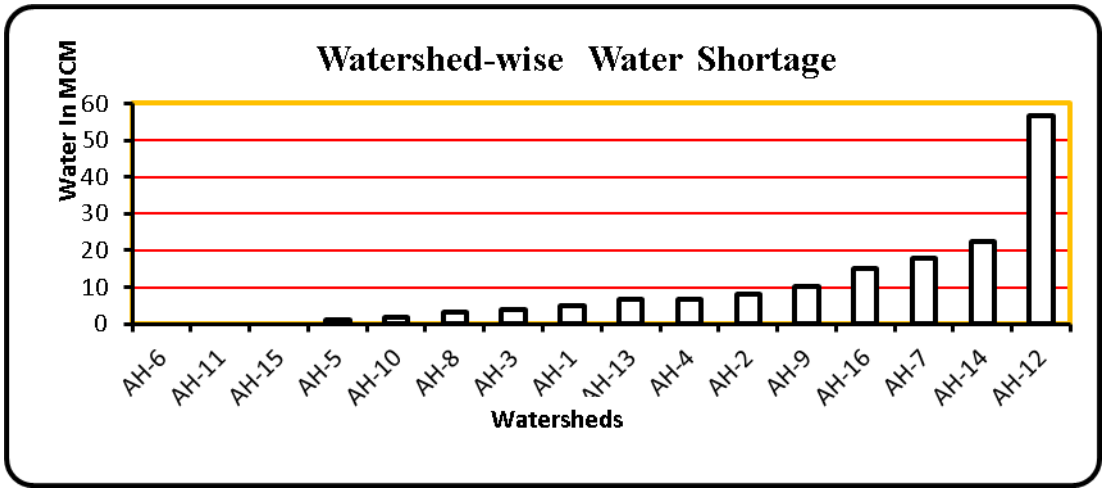

Annual low supply is found in AH-15, AH-2, AH-1, AH-5, AH-4 and AH-8 watersheds it is below 5 MCM. High water supply is found in AH-6, AH-13, AH-14, AH-16 and AH-11 watersheds; it is above 15 MCM. Annual low water shortage is found in AH-6, AH-11, AH-15, AH-5, AH-10, AH-8, AH-3 and AH-1 watersheds; it is below 5 MCM. High water shortage is found in AH-16, AH-7, AH-14 and AH-12 watersheds; it is above 10 MCM. As per water supply and water demand, low water shortage is found in AH-6, AH-11, AH-10, AH-15, AH-3, AH-13 and AH-5; it is below 40 percent. High intensity of water shortage is found in AH-9, AH-4, AH-7, AH-1 AH-12 and AH-2 watersheds; it is above 60 percent.

Table 1: Water Demand, Water Supply and Water Scarcity Overview of Ahmadpur Tahsil

Watersheds	Villages	Population 2011	Total Developed Water Resource in MCM	(A) Delivered or Absolute Available Water for Use in MCM	Agriculture Land Use K Factor	(B) Water Demand	Water Scarcity in MCM = (B-A)
AH-1	3	5705	5.38	1.331	0.64	6.25	4.919
AH-2	7	8695	8.46	1.097	0.63	9.33	8.233
AH-3	4	9815	15.4	11.226	0.9	15.08	3.854
AH-4	6	8483	11.27	3.255	0.69	9.98	6.725
AH-5	6	5966	109.1	1.944	0.29	2.92	0.976
AH-6	5	10134	16.36	15.355	0.78	13.44	-1.915
AH-7	4	16440	11.21	6.519	0.87	24.41	17.891
AH-8	3	4955	5.69	4.551	0.92	7.75	3.199
AH-9	15	13169	16.86	6.594	0.75	16.69	10.096
AH-10	6	8695	12.89	11.36	0.89	13.2	1.84
AH-11	11	14502	19.24	20.333	0.78	19.24	-1.093
AH-12	11	56616	30.17	14.102	0.73	70.7	56.598
AH-13	11	21126	26.54	15.693	0.62	22.29	6.597
AH-14	19	31371	27.73	17.268	0.75	39.8	22.532
AH-15	0	0	0.4	0.104	0.35	0	-0.104
AH-16	13	22958	28.84	20.088	0.9	35.12	15.032
Total	**124**	**238630**	**345.55**	**150.82**	**0.75**	**306.2**	**155.38**

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Table 2: Watershed-wise Land use and Water Shortage

Watersheds	Agriculture Fallow Area in ha	Barren Scrub Area in ha	Agriculture Area in ha	Deciduous Forest Area in ha	Water Body Area in ha	Barren Area in ha	Settlement Area in ha	River Area in ha	Total Area in ha	Villages	water body in %	Water shortage in %
AH-1(GV-96B)	207.13	48.69	1689.14	1.51	34.49	640.83	0.00		2621.78	3	1.32	78.7
AH-2 (GV-97B)	68.23	11.79	2845.09	2.07	42.53	1523.82	12.01	0.17	4505.71	7	0.94	88.24
AH-3 (MR-37)	96.53	2.47	4264.40	3.68	173.02	108.38	51.87	17.31	4717.66	4	3.67	25.55
AH-4 (MR-37)	557.95	5.67	3021.71	2.77	78.48	552.05	22.27	125.51	4366.41	6	1.80	67.38
AH-5 (MR-37)	1082.04	10.25	823.35	1.24	24.10	889.04	6.46	27.73	2864.19	6	0.84	33.42
AH-6 (MR-31A)	565.32	2.26	3214.37	3.65	164.05	84.22	37.13	47.74	4118.75	5	3.98	0
AH-7 (MR-31A)	216.99	0.40	2461.91	1.10	57.55	0.57	67.50	13.29	2819.30	4	2.04	73.29
AH-8 (MR-31A)	49.42	0.30	2111.03	1.77	88.83	0.00	9.92	34.47	2295.76	3	3.87	41.27
AH-9 (MR-37)	534.68	6.13	3837.93	4.56	58.50	517.73	34.26	153.99	5147.78	15	1.14	60.49
AH-10 (MR-31A)	156.63	0.58	3305.81	3.08	140.06	0.01	20.97	73.36	3700.49	6	3.78	13.93
AH-11 (MR-38B)	1065.59	3.61	5911.93	4.97	171.90	264.49	41.09	111.36	7574.94	11	2.27	0
AH-12 (MR-38B)	935.54	8.93	5945.38	5.66	264.53	534.69	297.09	102.01	8093.83	11	3.27	80.05
AH-13 (MR-38B)	1521.91	8.33	4240.04	4.00	134.74	711.58	94.16	115.41	6830.17	11	1.97	29.59
AH-14 (MR-38B)	1887.30	7.28	7661.64	3.40	282.63	342.84	82.34		10267.43	19	2.75	56.61
AH-15 (MR-38B)	116.82	12.25	108.05	9.76	4.91	54.67	0.00		306.46	0	1.60	0
AH-16 (MR-47 & 52)	339.93	1.22	7270.21	3.60	226.06	194.03	44.51		8079.55	13	2.80	42.8
Total	9402.00	130.15	58711.98	56.83	1946.38	6418.95	827.14	822.18	78315.61	124	2.49	50
%	12.01	0.17	74.97	0.07	2.49	8.20	1.06	1.05	100.00			

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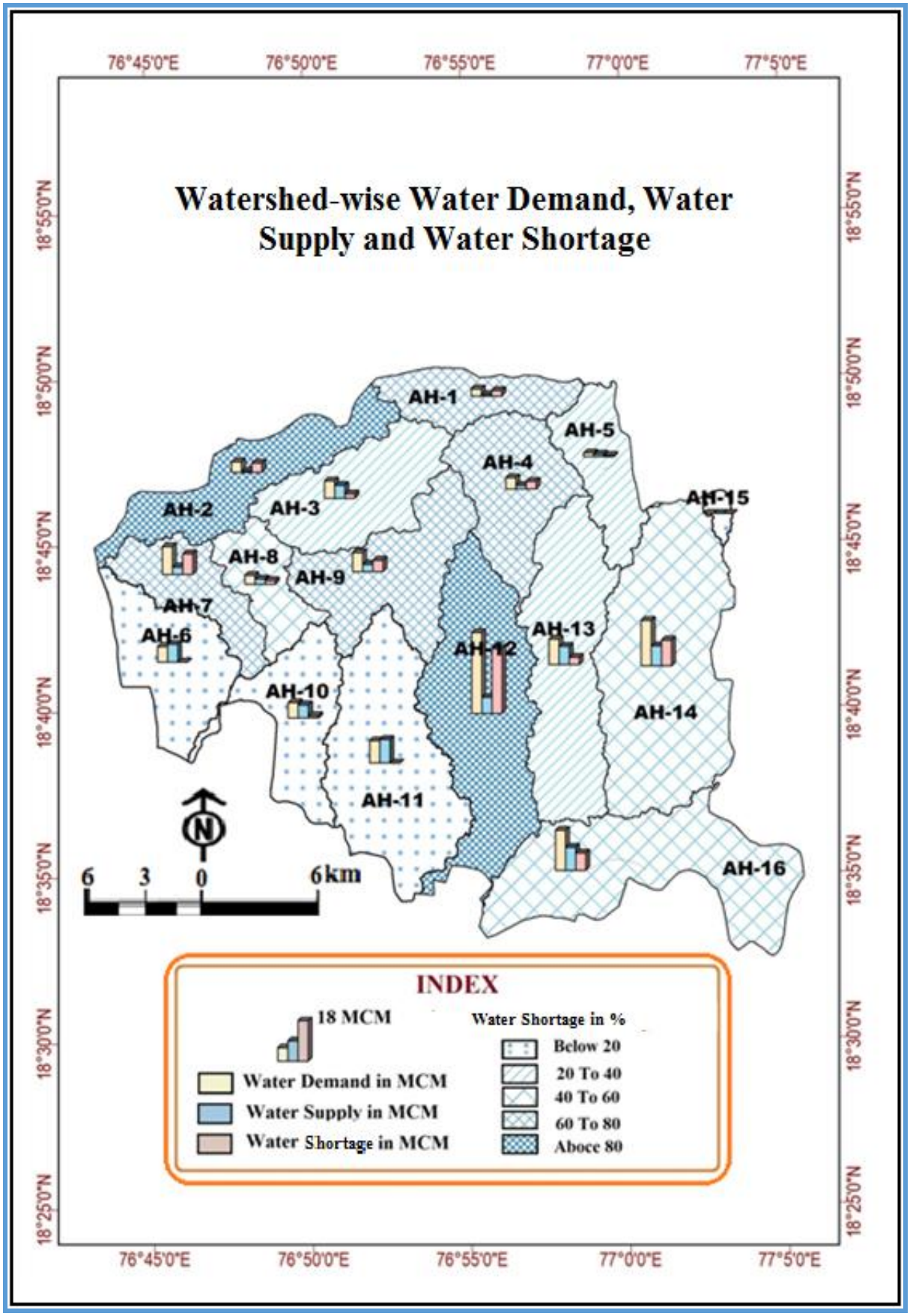

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This study focuses that as per water demand water resources, water supply system and water management techniques are not applied. Mismanagement of water is main cause of water shortage in Ahmadpur tahsil, because there potential of water is more than demand. It can be rectify through the proper water conservation and management techniques. In this region underground, small scale and base location water storage such as farm dam, artificial riverbed, dug-well etc. are more effective than large scale water storage. Underground, small scale and base location water storage projects water use efficiency is fine comparative to surface and large scale water storage project. This study would be helpful for researcher and decision maker in water resources development & management.

REFERENCES

1. Amber Brown (2011): "A Review of Water Scarcity Indices and Methodologies", the Sustainability Consortium, April 2011.
2. Brouwer, C, Hoevenaars, J. P. M. and Van Bosch, B. E. (1992): "Irrigation Water Management: Training Manual No. 6 – Scheme Irrigation Water Needs and Supply", FAO.
3. Falkenmark, M., Lundquist, J. and Widstrand, C. (1989): "Macro-Scale Water Scarcity Requires Micro-Scale Approaches: Aspects of Vulnerability in Semi-Arid Development", Nat. Resour. Forum 13, pp. 258–267.
4. FAO (1993): "The State of Food and Agriculture 1993", FAO Agriculture Series no. 26, Rome.
5. Murty, J. V. S. (1995): "Watershed Management in India", Wiley Eastern, Limited.
6. Poul, P. V. (2015): "Geographical Analysis Water Resources and Management in Ahmadpur Tahsil", unpublished thesis submitted to SRTMU Nanded.
7. USGA: "Domestic Water Use". Website: http://water.usgs.gov/edu /wudo.html"