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STUDY OF WATER BODIES-TANK'S, KUNTAS AND GROUNDWATER OF UNGUTURU MANDAL BY USING GIS

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Abstract: ***Surface water bodies are the major source for irrigation in India. Information on surface water bodies such as water spread area, volume of water stored in a water body is useful for understanding the availability of water resources for the crop season in a river basin / sub basin. The study extensively used satellite based techniques for the estimation of surface water spread at regional level and at temporal scale to facilitate mapping, monitoring visualization of the dynamics unlike conventional methods. The study considers only water bodies where water is stored for irrigation purpose such as tanks, kuntas, etc excluding rivers. Study is focused on use of GIS techniques with extensive use of Image processing and GIS software ARC Desktop GIS and analyses the spatio- temporal water body layers. Quantitative estimates on water bodies are worked for annual analysis. The present study has brought out geospatial database and provided scope for sub regional / regional analysis. Estimation of regional surface water storage is estimated with separate methodology for larger and smaller water bodies. Storage in larger water bodies is estimated by developing satellite based Area. Storage in smaller water bodies is estimated with the help of annual rainfall data.***

The study has brought out suitable spatio-temporal information of water bodies useful for analysing operational issues related to water resources availability. The information generated can be made use for web based regional analysis and for public domain with suitable visualization tools.

Keywords: Water Bodies, Tanks, Kuntas, Groundwater, Unguturu Mandal, GIS

1. INTRODUCTION

Water is one of the fundamental necessities for sustaining life on the earth for all living entities. Man needs water for many of his activities in day to day life. Initially Man used to live nearby water bodies such as rivers, lakes etc. This led to the development of water resource engineering, as a part of civil engineering, to develop a system for supplying water to various types of crops and eventually man started to make water storage bodies and also ground water for irrigation. Arc GIS can be used to find out the location and areas of existing water bodies. Now a days ground water is highly use for irrigation purpose there for there are still some areas doesn't use ground water due to greater depth of water table and in some cases salt water intrusion in ground water. The water resource system consists of several components such as storage, pumping, and distribution on land. By using ARC GIS we can find out the existing water bodies and use the data to develop the availability of water bodies for irrigation.

Objective of the Study

To have an assessment of Status and the dynamics of small water bodies-tanks, kunta's (common resource). An examination of the dynamics of tank irrigation, so as to understand why gravity flow irrigation from tanks declined in the first place. This would involve a detailed socioeconomic analysis of tank irrigation. An examination of the reason as to why traditional rehabilitation schemes have failed to work. To an examination of the existing governance system of water bodies. To look at new and innovative ways in which water bodies-tanks, pond can be revived. To get the status of existing ground water locations in the study area.

To get an data of overhead tanks in the area and to estimate water demand and number of fillings need to meet the demand.

2. STUDY AREA

The Unguturu mandal comes under Krishna district, Andhra Pradesh. The study area consist of 27 villages. The average rainfall of district is 950.66 mm. The study area of about 11493 ha, out of which the irrigated area is 11695 ha and un-irrigated area is 924 ha. The study area is comes under the Krishna river basin as major Non-perennial River of the district and with rocky terrains, and grazing lands. District has soil of sandy clay loamy soils type, and agriculture is suitable but faces water scarcity. Agriculture and allied activities are the major livelihoods of the people but due to the uneven rainfall, the people became victims of continues drought. Among the total households, 27.5% of people are comes under bellow poverty line. Migration to cities like Vijayawada, Eluru, Thirupathi and Hyderabad is common phenomena. Rainfall is major source of water for agriculture in the district, and for the past few centuries, a number of cascading tanks have centred to irrigation and water needs of livestock. These tanks have been constructed in the period of fore fathers in olden periods which shows the importance of water bodies.

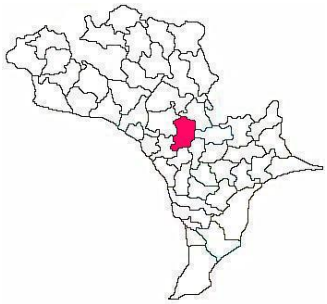

Figure 1 Ungуturu mandal, Krishna district

Ungуturu mandal is one of the 50 mandals in Krishna district of the Indian state of Andhra Pradesh. The headquarters are located at Ungуturu. The mandal is bounded by Agiripalle, Bapulapadu, Ganavaram, Vijayawada (rural) and Kankipadu mandals The mandalis also a part of the Andhra Pradesh Capital Region under the jurisdiction of APCRDA. Ungуturu Mandal of Krishna district has total population of 54,323 as per the Census 2011. Out of which 26,660 are males while 27,663 are females. In 2011 there were total 15,839 families residing in Ungуturu Mandal. As per Census 2011, all of the population of Ungуturu Mandal lives in urban areas. The average literacy rate in urban area is 72.4% The population of Children of age 0-6 years in Ungуturu Mandal is 5106 which is 9% of the total population. There are 2598 male children and 2508 female children between the age 0-6 years. Thus as per the Census 2011 the Child Sex Ratio of Ungуturu Mandal is 965 which is less than Average Sex Ratio (1,038) of Ungуturu Mandal. The total literacy rate of Ungуturu Mandal is 72.42%. The male literacy rate is 69.32% and the female literacy rate is 62.04% in Ungуturu Mandal.The heavy populated area is telaprolu which is 8984 and least populated area is Ondrampadu of the population of 189.

Data collection

Most of the data is collected manually by visiting each village by village in mandal and the data is also collected by Google earth pro images which is used for calculation of areas and finding out the co-ordinates of the location of water bodies and overhead tanks and as well as bore hole locations. Overhead tanks, water bodies, and bore holes. With co-ordinates at each location can help in mapping of locations in Arc GIS.

Collection of map

In data collection we have collected a Krishna district shape file which helps in Georeferencing with image of Krishna district to get the boundy area of study area.

Satellite Imagery

To carry out the present investigation the following satellite images were used. The hi-resolution, multispectral, multi temporal satellite imagery obtained from Landsat were procured from the United States Geological Survey's(USGS), data dissemination portal called "Earth explorer" (https:/ / earthexplorer .usgs. gov/). LISS3 images are obtained from BHUVAN website.

Collection of irrigation data

Table 1: Irrigation data of each village in study area

S.no	Name of village	Total area:-ha	Irrigated area:-ha	Un-Irrigated area:-ha
1.	Amudalapalle	352	287.35	3.23
2.	Atkuru	1489	880.59	256.29
3.	Bokinala	143	116.15	9.45
4.	Chagantipadu	325	284.08	10.94
5.	Chikinala	219	184.94	18.22
6.	Elukapadu	287	214.5	38.84
7.	Garapadu	335	294	1.02
8.	Indupalle	1097	938.06	74.88
9.	Koyyagurapadu	284	216.91	28.34
10.	Lankapalle Agraharam	216	188.59	2.02

Table 2: Average annual rainfall data of study area

S No	Month	Rainfall in (mm)
1	JAN	6.3
2	FEB	11.9
3	MAR	15.28
4	APR	15.27
5	MAY	50.37
6	JUNE	108.85
7	JULY	189.57
8	AUG	182.94
9	SEP	166.02
1	OCT	130.4
11	NOV	60.1
12	DEC	13.67
	TOTAL	950.66

3. METHODOLOGY

The following methodology was adopted in the present work.

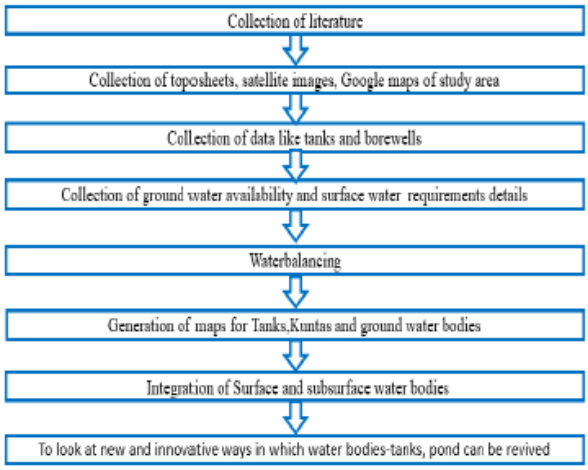

Figure 2: Flow chart showing the methodology

4. RESULTS & DISCUSSION

Results obtained in this work were presented here.

Clipped study area

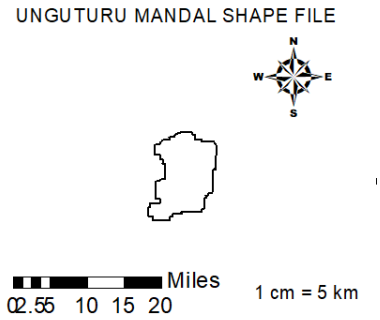

Figure 3: shape file of unguturu mandal

Figure 4.stacked image

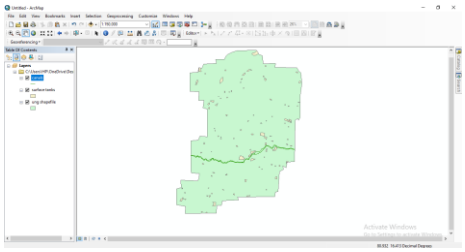

Figure 5: Mapping for surface water tanks

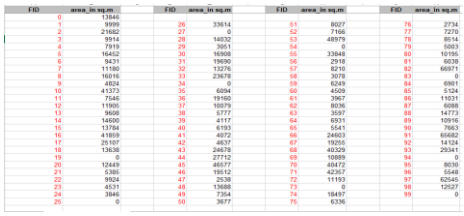

Figure 6: showing all attribute area surface tanks

The sum of all the tanks =1398937
Total area in hectares=1398937/1000 =1398.937 ha
Then the area of land available excluding the surface water tanks area is = total area of unguturu mandal – total area of surface tanks in ha
19620-1398.937=18221.063 ha

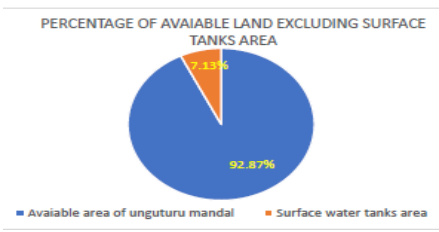

Figure 7: pie chart showing percentage of land available excluding the surface tanks area

Calculation for water balancing

Availability of water by rainfall data
Water balancing is to find out the availability of quantity of water and consumption for irrigation purpose
Finding out the availability of water has been a difficult task for surface water bodies through we thought to find out the water quantity by average annual rainfall data.
Availability of water = area of land in m2 * rainfall in mm * runoff factor
Area of land of water bodies = 1398937 m2
Annual rainfall = 1047.68 mm
Runoff factor is taken based on the land, taken as clay the runoff factor for 0.42-0.51
Adopt runoff coefficient as 0.47
Availability = 1398937 * 1047.68 * 0.47=688850008.5952 litres.
= 688850008.5952 /1000= 688850.008 cum
Water quantity thought the study area = 19620*1000=19620000m2
=19620000 * 1047.68 * 0.47 =9661076352 litres
= 9661076352/1000=9661076.352 cum
6.6.2 Water required for Consumption for crops
Duty of crop (D) =8.64*(B/delta)
The total irrigated area of unguturu mandal is = 11595.06 ha
Base period (B) =90 days
Delta =depth of water need for crop = 900mm=0.9m
Duty = 8.64*(90/0.9) =864 ha/cum
Quantity of water need for irrigation =11595.06*864 =10018131.84 cum

Water consumption for livestock:

Table 3 Livestock water required

Animal type	No. of animals	Demand per day	Total quantity No.of animals*lpcd
Cattle	77388	113	8744844
Buffalos	106349	113	12017437
Sheep	224757	10	2247570
Goat	73748	10	737480
Pigs	3360	6.8	22881.6

Total quantity of water for all animals =23747331 liters
=23747331/1000 =23747.331 * 365 =8667775.815 cum
Total availability =9,024,830 cum
Total consumption =18685907.65 cum
The consumption is greater than the availability of water, 48.2 % of drought water is found out.

Generation of borehole location maps

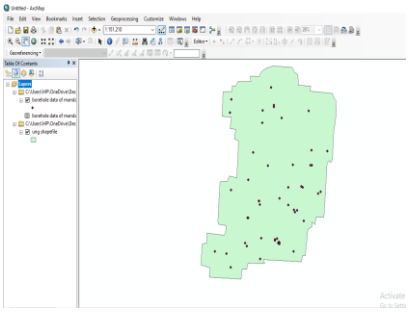

Figure 8 Generation of borehole locations by excel data sheet

Calculation of water quantity for population of study area
Total population=54323
Lpcd =135 litres
Total quantity =7333605*135 =7333605 liters
=7333605/1000 =7333.605 cu.m
Quantity of water that can be stored for one filling =1764.18 cu.m
No. of fillings required =7333.605/1764.18 =4.156 times

5. CONCLUSIONS

Geographic information system is one of the fastest growing technologies being applied in the field of water resources. With the use of Arc GIS and toposheets provided by survey of India, it is studied that there are about 99 surface tanks in unguturu mandal. The study has told that there is a need to revive water bodies and need for emerging new water bodies throught the area.

One of the more significant findings to emerge from this study is that traditional informal governance system such as village committees, Neerghanttis system are reducing day by day as tanks are not being used due to rainfall. It was also shown that government works or management is less as legally they have rights maintain.

This study has found that generally community dependence reducing and interest to protect and maintain decreased. The results of this study show that there is need to revive the water-bodies with community participation as early as possible.

This study has given way forward to many questions in need of further investigation. For instance, tanks detailed governance system, fishing rights auction methods.

Remote sensing and GPS with integration of GIS provides remarkable advantages for irrigated area mapping with enhanced dependable analysis at various temporal and spatial scales.

GIS with appropriate blending of remote sensing helps in equitable use of water resource.

Remote sensing and GIS integrated approach can be used for estimation of crop water requirement and irrigation water requirement. It also helps in getting maximum yields with optimum water use which ultimately causes more savings.

Integration of remote sensing data with ground data in GIS provide efficient estimation of major crops, area under each crop and variation in water demand of different crops in irrigation scheduling.

The study showed that there is about 48.2% drought where the availability of water is less than the consumption of water from surface water bodies.

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