

Quantitative Analysis of Minor Irrigation Projects using Geo-Spatial Techniques

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Abstract— Minor Irrigation sector plays a critical role in agricultural growth and increasing farmer's income. Government is spending a lot of money for minor irrigation projects for its revival and management. In order to meet the requirements of planning & policy formulation of this sector, a reliable Quantitative analysis of data is a prerequisite. The prime objective of this study is to provide a quantitative analysis of Minor Irrigation projects using Geospatial techniques. The data generated through Geospatial techniques would be more accurate data when compared with data collected through conventional methods. The Geo database of 1863 tanks in Nalgonda district would be generated from Cadastral data, Toposheet and satellite Imagery and compared with secondary data from line departments. The parameters such as status of tank, catchment area, capacity and bund length etc, would be assessed. The outcome of this project would be useful especially for the line departments such as irrigation, Agriculture, pisciculture, Finance and Planning etc.

Keywords: Minor Irrigation, Quantitative Analysis, Catchment Area, Command Area

I. INTRODUCTION

The Centrally Sponsored scheme - Rationalization of Minor Irrigation Statistics (RMIS) was launched in 1987-88 and is being implemented by Minor Irrigation (Stat.) Wing of the Ministry through State Governments. It is now renamed as "Irrigation Census" which is a Centrally Sponsored scheme with 100% central funding.

The objective of the scheme is to build a comprehensive and reliable database in the Minor Irrigation Sector for effective planning and policy making. Five Minor Irrigation Censuses with reference years 1986-87, 1993-94, 2000-01, 2006-07 and 2013-14 have been conducted so far.

The major activities under the scheme are (i) conduct of 6th Minor Irrigation Census with reference year 2017-18 and (ii) conduct of a Census of Water Bodies which is taken up for the first time.

For comprehensive improvement of water bodies, two schemes - Repair, Renovation and Restoration (RRR) of Water Bodies, one with external assistance and the other with domestic support for implementation during XI Plan Period was approved by the Government. The scheme of RRR of water bodies include the catchment area treatment, command area development, capacity building of stakeholders and increased availability of drinking water.

India is enriched with a rich and huge assorted variety of regular assets, water being one of them. Its turn of events and the board assume an essential job in farming creation. Coordinated water the executives are essential for neediness decrease, ecological food and practical monetary

turn of events. Public Water Strategy conceives that the water assets of the nation ought to be created and overseen in a coordinated way.

Water bodies are areas of water, salty and fresh, large and small, which are distinct from one another in various ways. The biggest water bodies are seas, while the littlest are streams or lakes. Smaller aggregations of water, for example, puddles or pools are not typically alluded to as water bodies in the geological sense.

II. OBJECTIVES

First is to build a comprehensive and reliable database in the Minor Irrigation Sector for effective planning and policy making.

Second, to Quantitative analysis of Minor Irrigation projects using Geospatial techniques.

Third, to this project would be useful especially for the line departments such as irrigation, Agriculture, pisciculture, Finance and Planning etc.

III. STUDY AREA

Miryalaguda is located at a distance of 42 Km from Nalgonda, the district headquarters. It is located at the intersection of 16.8667°N latitude and 79.5833°E longitude and spreads over 21 sq km. It acts as the administrative headquarters of Miryalagudamandal. It is administered by Miryalaguda Municipality. Miryalaguda town is well connected by road. It is connected to National Highway 9 at Nakrekal, 41 Km away. It is connected by Broad gauge line from Bibinagar to Nadikudi. The town is connected by road to Kakinada, Badrachalam, Sreesailam and Tirupathi etc. The nearest city with more than 5 lakh population is Hyderabad which is at 143

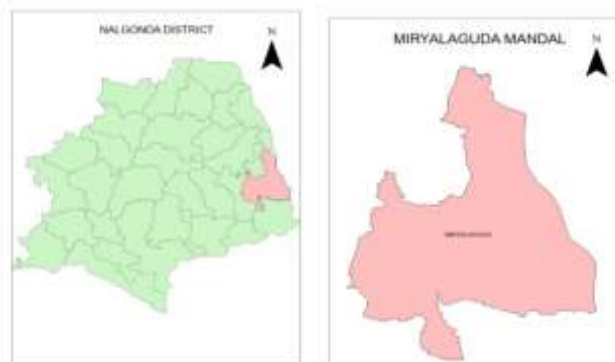


Fig. 1: Location map of study area

IV. METHODOLOGY

Sources: Toposheets (1:25000), Landsat-8, Sentinel-2 from USGS, Contour map (10m Interval) and cadastral data.

Geo-rectifying the toposheet to sentinel-2 projections and digitizing the tanks on toposheet. Georeferencing the toposheets that cover study area with sentinel-2 imagery.

Comparing the tanks on toposheet with multi-temporal sentinel-2 data. Overlayed the digitized tank on sentinel-2 data and checked whether the bund of each individual tank is matching with satellite imagery and its existence in multi-temporal imagery.

Bunds of digitized tanks which are not matched with bunds of respective tanks in satellite imagery, those were identified and corrected. Most Minor irrigation structures in India are, owned by individual farmers or group of farmers and hence it has maximum outreach for irrigation purposes. Within this, small and marginal farmers (having less than 2 ha of land) still own a major share of minor irrigation schemes. This emphasizes the need for strengthening the network of MI structures for irrigation purposes in the country which, in turn, will play a crucial role in improving the livelihood of these farmers. Generally minor irrigation census was done by manually. By the application of geospatial techniques we can also find out the some parameters which are most important for the analysis of minor irrigation census. I have choose some parameters.

The parameters are as follows

- 1) Current status of the tank
- 2) Culturable command area
- 3) Water spread area of tanks
- 4) Number of villages covered under scheme. etc

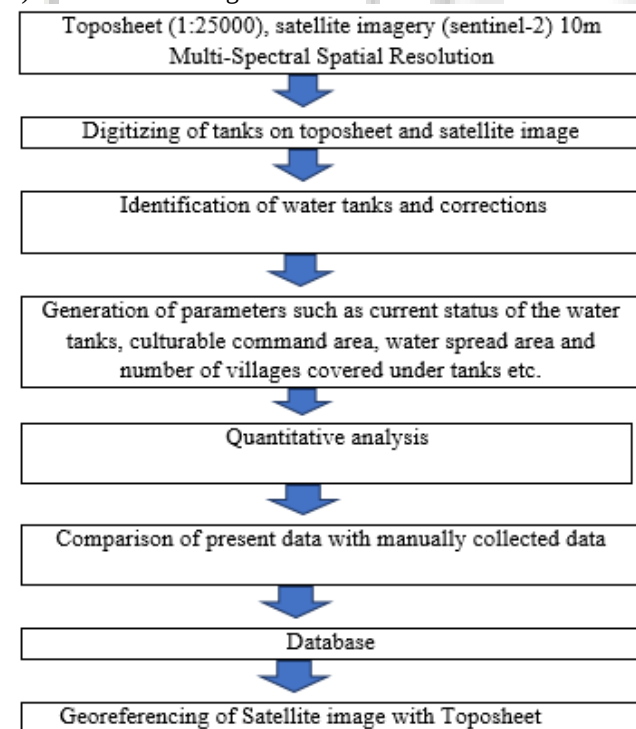


Fig. 2: Methodology (Flow chart)

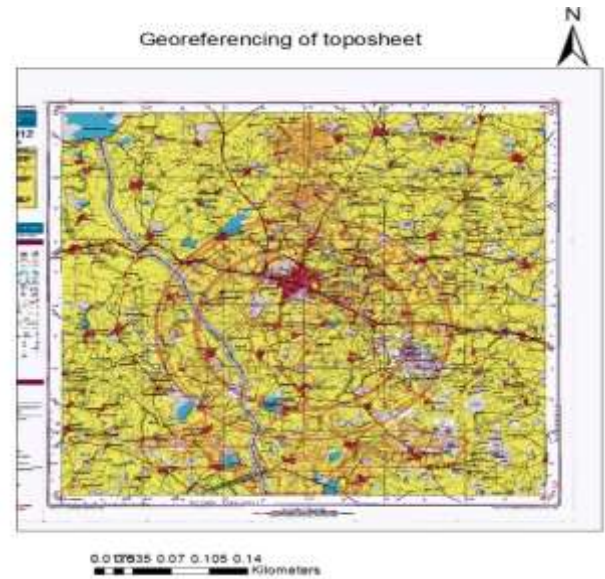


Fig. 3: Georeferencing of toposheets Image

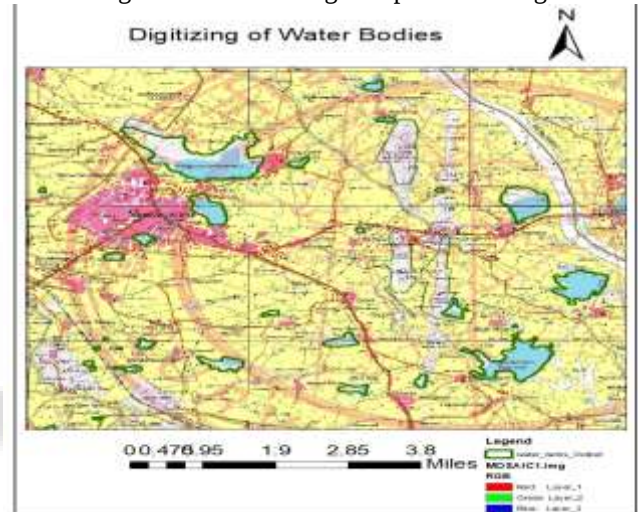


Fig. 4: digitizing of water bodies

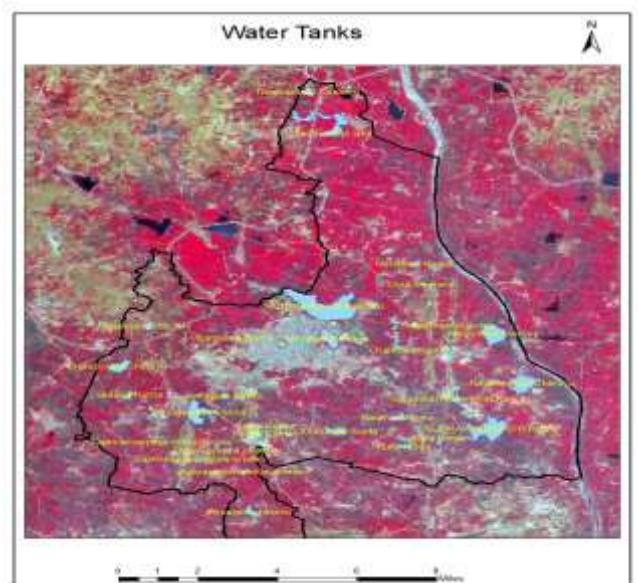


Fig. 5: Map of water Bodies and satellite

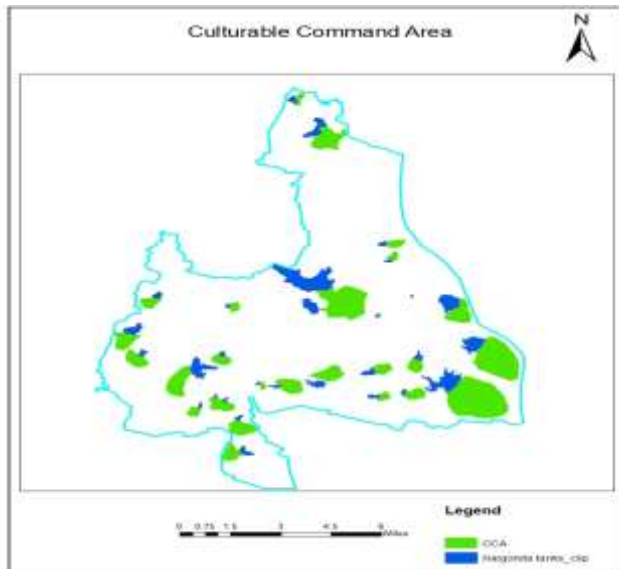


Fig. 6: Culturable command area

V. RESULTS

For the first time, a dedicated Irrigation (MI) Census has been developed which facilitated online data entry, updation, validation and tabulation. Due to the fact that data can be accessed by both Central level and State level users in real time, the bottlenecks in data entry and validation were removed instantaneously which resulted in quick processing /verification of data and finalization of results. The Ministry of Water Resources, River Development and Ganga Rejuvenation monitored the progress of implementation of fifth MI Census rigorously through periodic video conferences with all stakeholders, regular communication through DO letters, email etc and field visits to the States by senior Officers of the Ministry which were lagging behind in the Census work at any stage. Ground water schemes are increasing but Surface water schemes are declining.

By Observations some water bodies were encroachment due to several development activities and other

water bodies are dried due to lack of rainfall. Share of surface water schemes has slightly reduced and Surface flow schemes contribute significantly to minor irrigation in the hilly terrain of the district.

Overlay the satellite imagery, contour map, stream network and digitized water bodies in Arc GIS software and Analysis was done, database of each water bodies were prepared.

Minor Irrigation sector plays a critical role in agricultural growth and increasing farmer's income. Government is spending a lot of money for minor irrigation projects for its revival and management. In order to meet the requirements of planning & policy formulation of this sector, a reliable Quantitative analysis of data is a prerequisite. The prime objective of this study is to provide a quantitative analysis of Minor Irrigation projects using Geospatial techniques. The data generated through Geospatial techniques would be more accurate data when compared with data collected through conventional methods.

Sl. No.	TANK NAME	DIST.	TAQ.	LOC.	T. TYPE	T. AREA	T. PERCENT	T. STATUS	T. YEAR	T. STATUS
1	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes
2	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes
3	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes
4	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes
5	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes
6	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes
7	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes
8	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes
9	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes
10	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes
11	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes
12	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes
13	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes
14	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes
15	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes
16	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes
17	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes
18	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes
19	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes
20	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes
21	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes
22	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes
23	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes
24	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes
25	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes
26	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes
27	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes
28	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes

Table 1: Details of the Water Bodies

Quantitative Analysis of Minor Tanks and its Parameters														
Sl. No.	TANK NAME	DIST.	TAQ.	LOC.	T. TYPE	T. AREA	T. PERCENT	T. STATUS	T. YEAR	T. STATUS	CCA Area	CCA PERCENT	CCA STATUS	CCA YEAR
1	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
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5	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
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12	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
13	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
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16	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
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18	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
19	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
20	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
21	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
22	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
23	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
24	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
25	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
26	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
27	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
28	Thakurpatti	16-51-34	16-51-34	16-51-34	To Be Classified Tanks	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Fig. 7: Quantitative analysis of tanks and its parameters

VI. CONCLUSION

Distribution pattern was identified from the map developed using Arc GIS 10.6 software. The average tank density of Nalgonda district was one tank per 2.68 km². Documentation and mapping would be helpful for planning to provide effective and efficient management. Further, this study initiated the maintenance of a database for the irrigation tanks in Nalgonda district. This methodology could be expanded for the data base management of irrigation tanks in other districts of this country.

The remote sensing and GIS application tools are very useful for the extraction of surface water body's information and analysis. Water spread area is analysed in Oct, 2017, Feb, 2018 and May, 2019 satellite derived total WBA, number of water bodies categorised by size as observed from satellite data. The water spread area is higher in February, 2018 because the amount of rainfall received in the month of October and November, 2017 is more.

In Miryalaguda mandal of nalgonda district total number of water bodies were digitized on the toposheets are 62 out of which 28 water bodies are in use, Remaining water Bodies are occupied for development activities and cities development purpose. The outcome of this project would be useful especially for the line departments such as irrigation, Agriculture, pisciculture, Finance and Planning etc.

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