



GEOSPATIAL TECHNOLOGIES FOR IMPACT ASSESSMENT OF DAMS

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ABSTRACT

Dams are constructed to impound water for many purposes. The construction of dam poses many environmental impacts such as inundation of its upstream areas. Due to this, the ecological balance of the location may get affected. Rehabilitation of people living in that area is also an issue. The flora and fauna that will be destroyed due to water impoundment needs to be addressed. All such investigations are labour oriented and time consuming along with the monetary aspects. Here we can rely on geospatial technologies for easy, effective and efficient investigation on probable inundation due to construction of a dam.

The digital elevation model, the earth observation data from satellites, the land use land cover map prepared from the satellite imageries serves as an effective tools for estimating the probable inundation due to dam construction. Open source software such as ILWIS (Integrated Land and Water Information System) is used to process the elevation model and to get the inundation for different elevations of water level in the reservoir. The flora and fauna that will be destroyed due to the dam can be estimated using the land use land cover maps.

Keywords : dam, digital elevation model, inundation, impact assessment, land use land cover.

1. INTRODUCTION

Dams are the major structures constructed across river for multiple purposes such as storage, irrigation, power, recreation and others. The construction of dam also creates environmental impacts which are irreversible such as loss of homes, farmlands, agricultural fields, flora and fauna. Hence before envisaging major projects it is always necessary to have the inventory of all these data that can be obtained from field survey which is both time consuming and labor intensive. Geospatial technologies are very helpful in assessing these impacts easily and efficiently. ILWIS (Integrated Land and Water Information System) is open source software which is very helpful in assessing the inundation caused due to construction of dam and its impact on environment.

2. DATA AND SOFTWARE USED

- Shuttle Radar Topographic Mission (SRTM) digital elevation model of 30 m posting
- ETM image of 30 m resolution
- Land use land cover map
- ILWIS software

3. OBJECTIVES

- Assessment of inundation upstream of dam for various water levels in the reservoir.
- Assessment of elevation capacity table
- Impact assessment due to inundation

4. METHODOLOGY

A probable dam site was selected and the inundation upstream of the dam was assessed using ILWIS software.

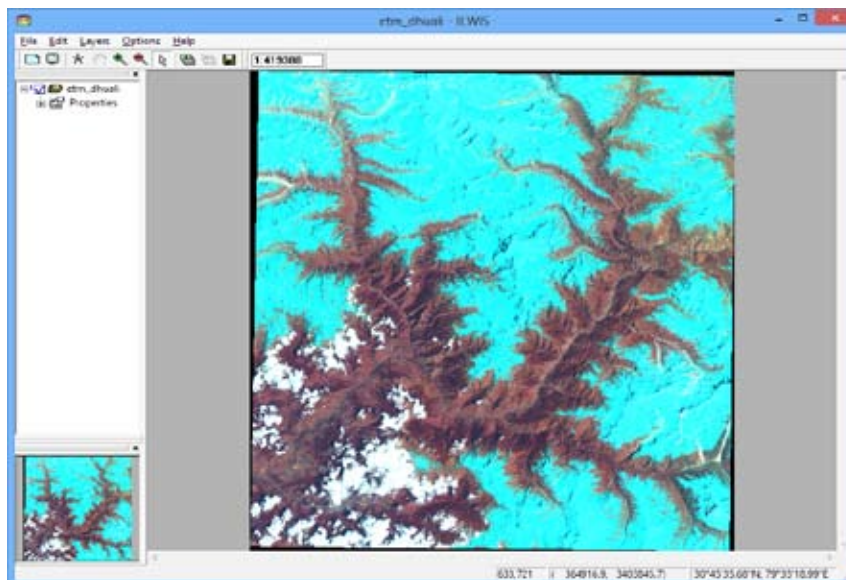


Fig. 1 : ETM imagery of the study area

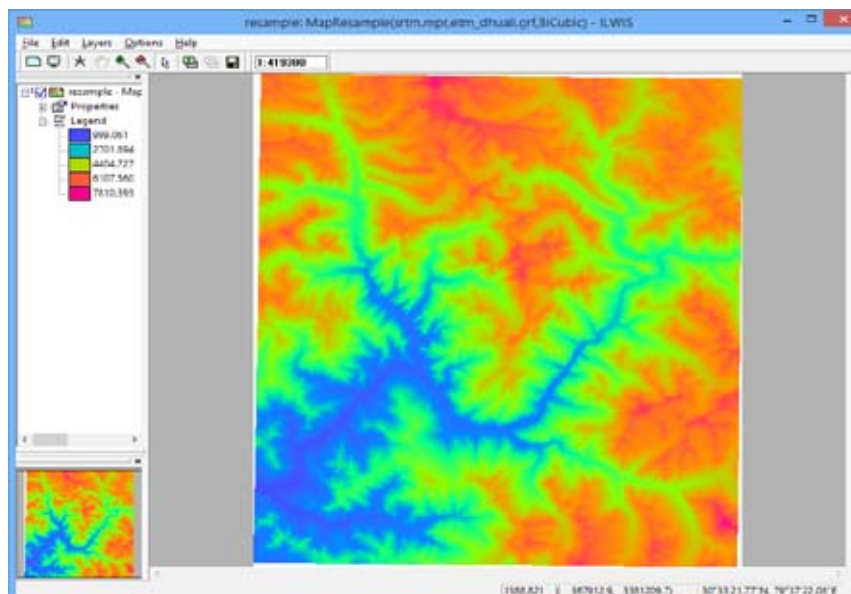


Fig. 2 : SRTM DEM of the study area

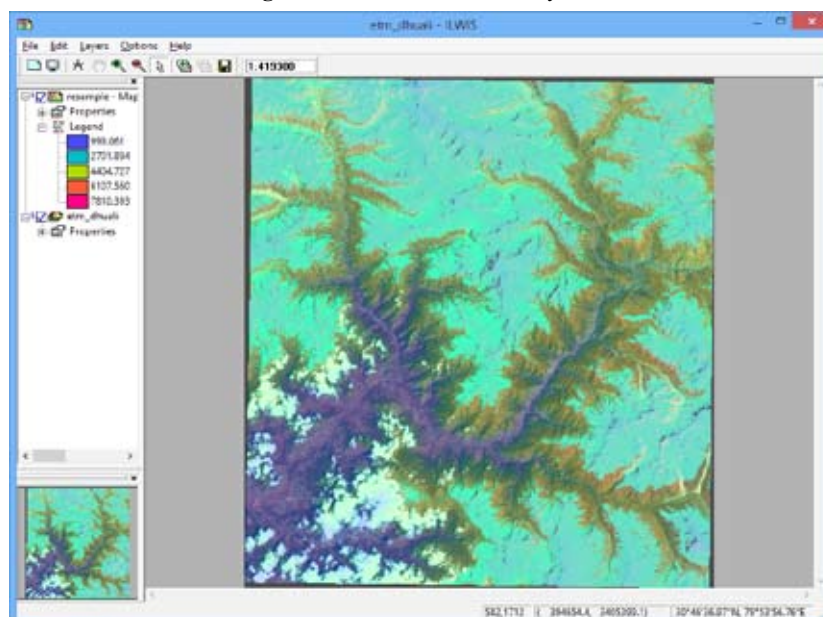


Fig 3 : SRTM layer added over ETM image and new raster image for dam site

The elevation of the dam site was ascertained from the SRTM DEM and it was 2938m. The Dam height was designed as 27 m. Hence new elevation value to the Dam site assigned was $2938+27=2965$ m.



Fig 4 : Location of dam site on the imagery

From the raster map for the Dam site, area inundation map were generated for different elevations i.e., 2960 m, 2955 m, 2950 m, 2945 m, 2940 m, 2920 m and 2900m.

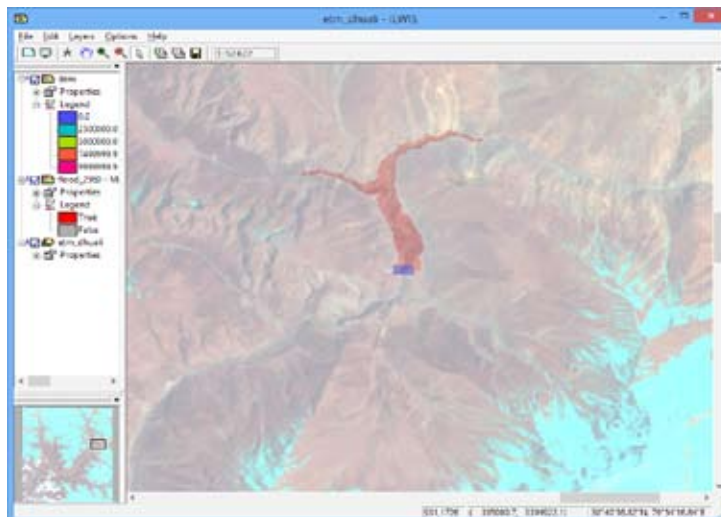


Fig. 5 : Inundation map at 2960 m elevation:

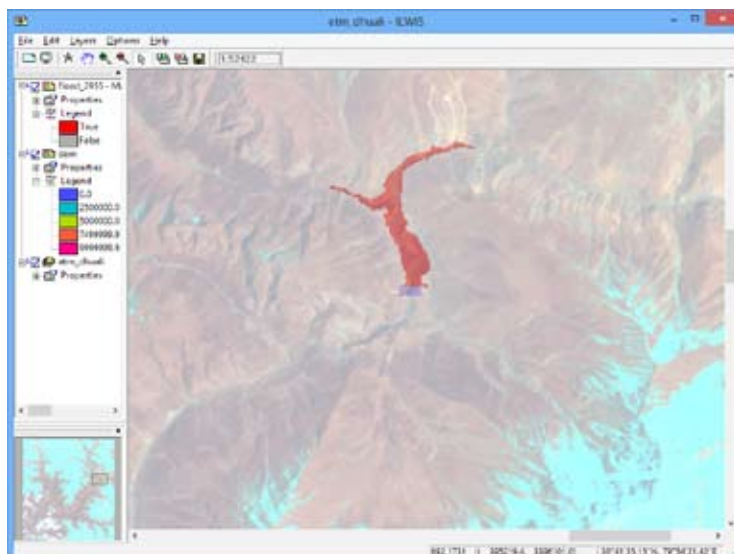


Fig. 6 :Inundation map at 2955 m elevation:

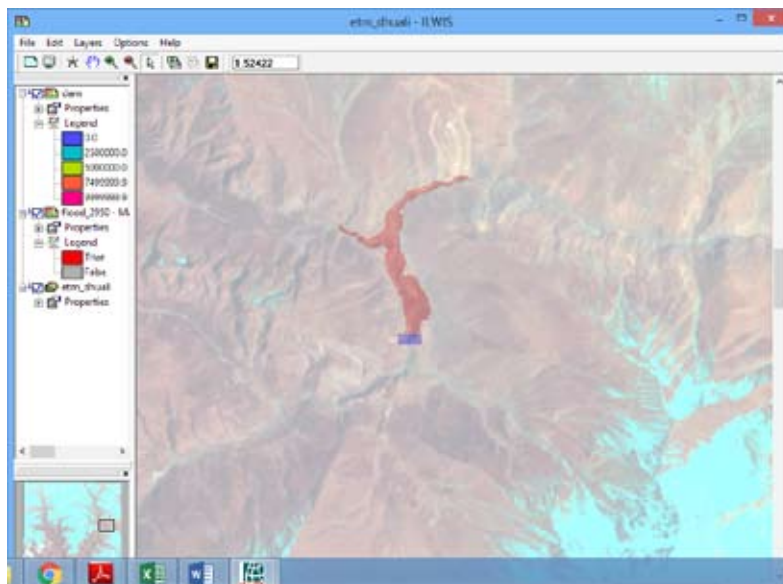


Fig. 7 : Inundation map at 2950 m elevation:

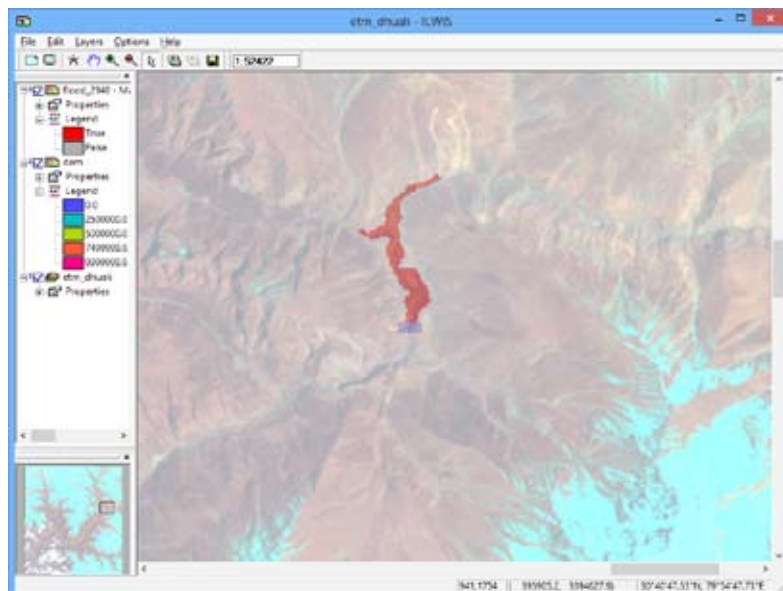


Fig. 8 : Inundation map at 2940 m elevation:

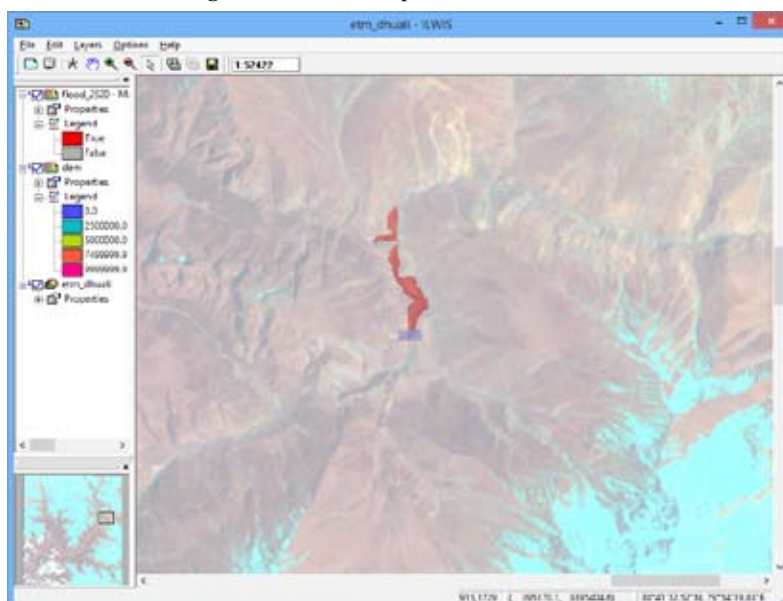


Fig 9: Inundation map at 2920 m elevation:

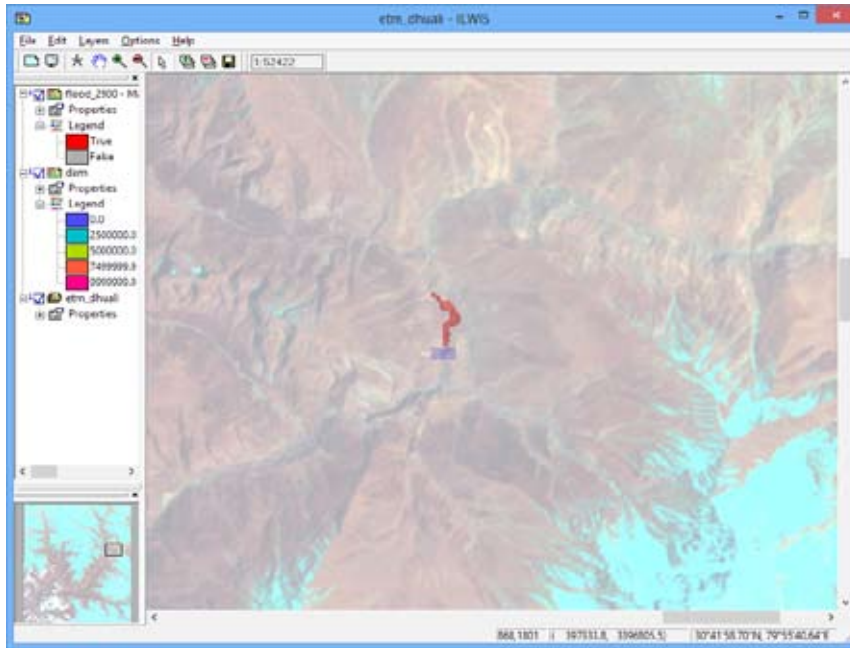


Fig 10 : Inundation map at 2900 m elevation:

5. RESULTS AND DISCUSSIONS:

From the maps, area under inundation was found for each of the elevations. Prismoidal formula was used to estimate the capacity of the reservoir. Area- elevation and capacity-elevation curves are plotted below;

Table 1 : Area elevation capacity table

Area in Sq.km	Area in Sq.m	Elevation in m	Depth in m	Volume in Mm ³	Gross Capacity in Mm ³
0.1197	119700	2900	0		
0.4149	414900	2920	20	5.05	5.05
0.7344	734400	2940	40	22.68	27.73
0.8415	841500	2945	45	35.43	63.16
0.937	937000	2950	50	44.44	107.6
1.0656	1065600	2955	55	55.03	162.63
1.215	1215000	2960	60	68.37	231

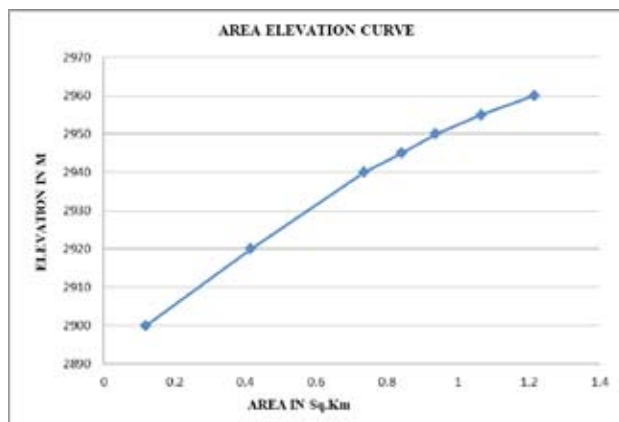


Fig. 11 : Area elevation curve

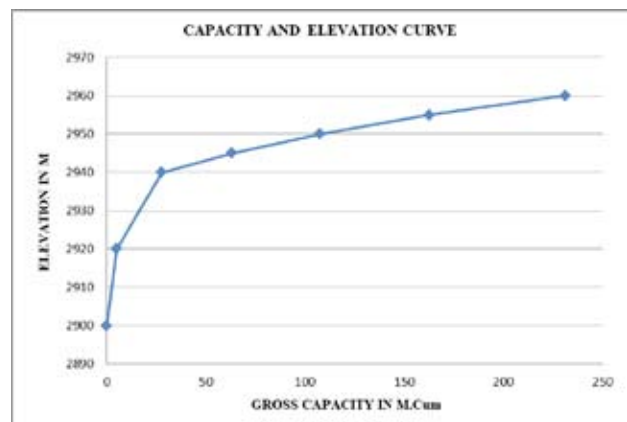


Fig. 12 : Capacity Elevation Curve

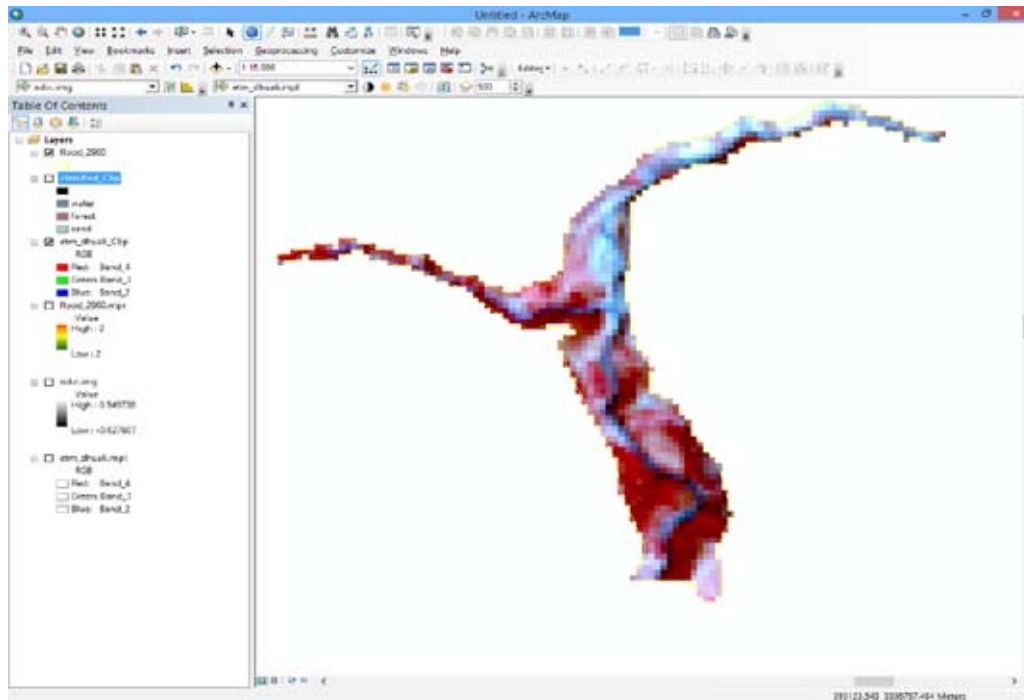


Fig 13 : Land use land cover map of the inundated area

The inundated area has forest cover, river and river sand as seen from the FCC image. Supervised classification was carried out on the image The inundated forest area was estimated to be 0.537 Sq.Km.

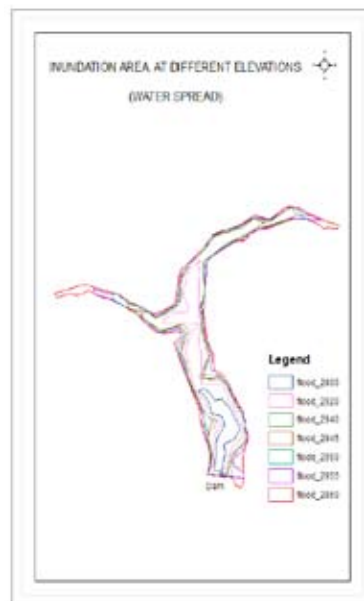


Fig 14 : Water spread area contours showing inundation at various elevations

6. CONCLUSIONS

The geospatial technologies provide an efficient way to assess the impact of a dam construction on the environment. The population that will be affected due the inundation on the upstream of the dam can also be assessed.

REFERENCES

ILWIS user guide and manual