APPLICATION OF REMOTE SENSING AND GIS TECHNOLOGY TO ESTABLISH MAPS FOR RESPONDING TO GLOBAL CLIMATE CHANGE IN MEKONG DELTA RIVER

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ABSTRACT

With more than 3000 km coastal line, Vietnam is one of eleven countries which seriously affected of global climate change. The rise of sea level will influence to the life of people living in the coastal area. Using the responding maps to global climate change is required for the sustainable development of Mekong delta. With the remote sensing data as Quick bird and various topographical maps combined with GIS, this paper shows the way to establish database using for modeling sea level rising in Duyen Hai District, Mekong Delta River.

1.   INTRODUCTION

In 50 years (1958-2007), annual average temperature in Vietnam has increased from 0.5 to 0.7 degrees, annual rainfall decreased by about 2%, and sea level rise rate in Vietnam is about 3mm/year. 12.2% of land where is home to 23% of the population could be lost if temperatures rise 2 degrees and sea level rise by 1m [1]. About 45% of land areas of the Mekong River Delta are at risk of extreme salinity and cause serious crop damage by floods and water logging (assets estimated at $ 17 billion) if the sea rises as predicted in 2030.
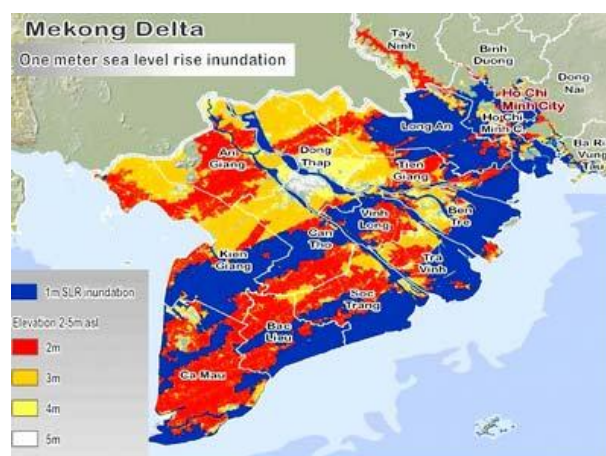

Figure 1: Map of flooding in the Mekong Delta with the sea-level rise
(Source: Carew-Reid, 2007 on http://www.icem.com.au)

2.   STUDY AREA AND DATA USED

2.1   Study area

Study area is Duyen Hai District of Tra Vinh province, Vietnam. Duyen Hai's total land area is 38,405 ha in nature. Of which 25 495 ha agricultural land, land for perennial crops 3952 ha, 1206 ha of land for special use. Also the district also has 55 km of coastline and 12 km of the estuary, 2640 ha river and canal, and over 100 ha of coastal land.
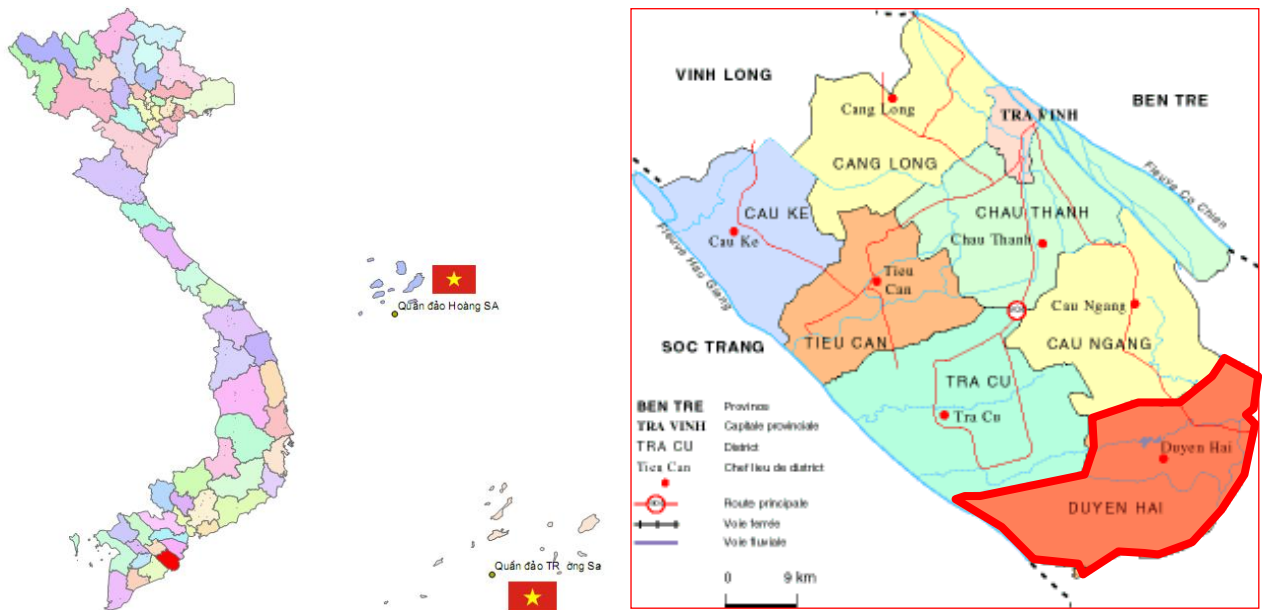

Figure 2: Study area

2.2   Data used

2.2.1 Satellite image data

Quick bird image was acquired from the end of 2006 to 2008 used for establishing 1: 5000 topography maps in Mekong Delta river areas where aerial photographs was not available.

DEM of Duyen Hai District was received from two methods: GPS surveying for the coastal area and aerial photogrammetry for the inland area with the accuracy is 0.4m in VN2000 datum.

2.2.2 Map data

Forty eight topography maps are at 1: 5000 scale in *.dgn format.
Land use land cover map 2005 was standardized by National Remote Sensing Center in 2006.

3. METHODOLOGY

From the topography data and image data, readjusting map is carried out to build geodatabase of Duyen Hai District. This progress is based on the "Regulation of establishing 1: 5000 database" of the Department of Surveying and Mapping in Vietnam.

The DEM data has built digital elevation model of the experimental area, select the appropriate flood levels to find the inundated floodplain for each.

The created geodatabase is used for Information Extraction progress on finding submerged objects for defined purposes.

Rising level selection: September 9th, 2009 in Hanoi Ministry of Natural Resources and Environment, has officially declared the scenarios of climate change and sea level rise in Vietnam. Accordingly, in the middle of the 21st century, sea levels could raise further turn is 28 - 30 - 33 cm and the end of the 21st century, sea levels more than 65 -75 - 100 cm compared with the period 1980 – 1999.

This research will be selected as the flooding in low-emissions scenario and high emissions for the last time 21st century. I.e., sea level could rise 65 cm or 100 cm more. The choice of this level to predict the highest and lowest possibilities which flood potential damage at the end of the 21st century.

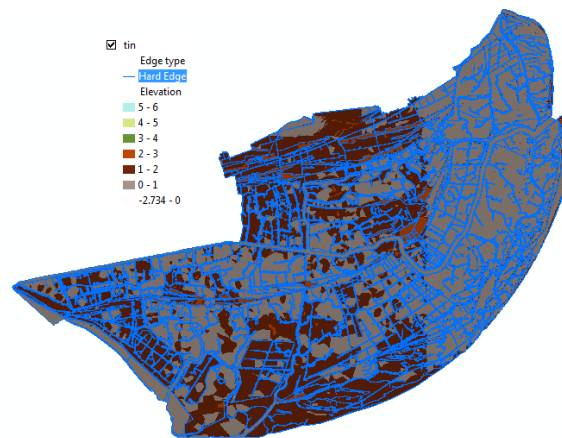Overlaying inundated floodplains to the information in database to find out objects in the

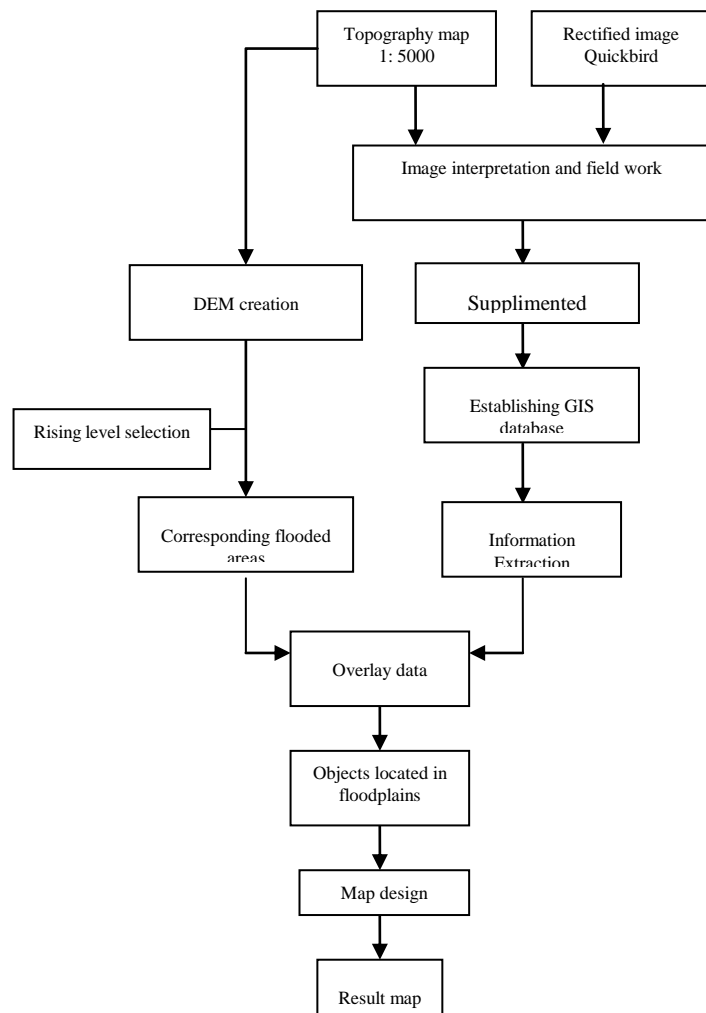**Figure 3: DEM of Duyen Hai district**

Figure 4: Methodology flowchart

floodplain.

Finding floodplain corresponding to rising levels: based on the selected rising levels reclassification is conducted. 3 markers for range are 0.65 - 1 - 6 m equal to 1-2-3 after reclassification.
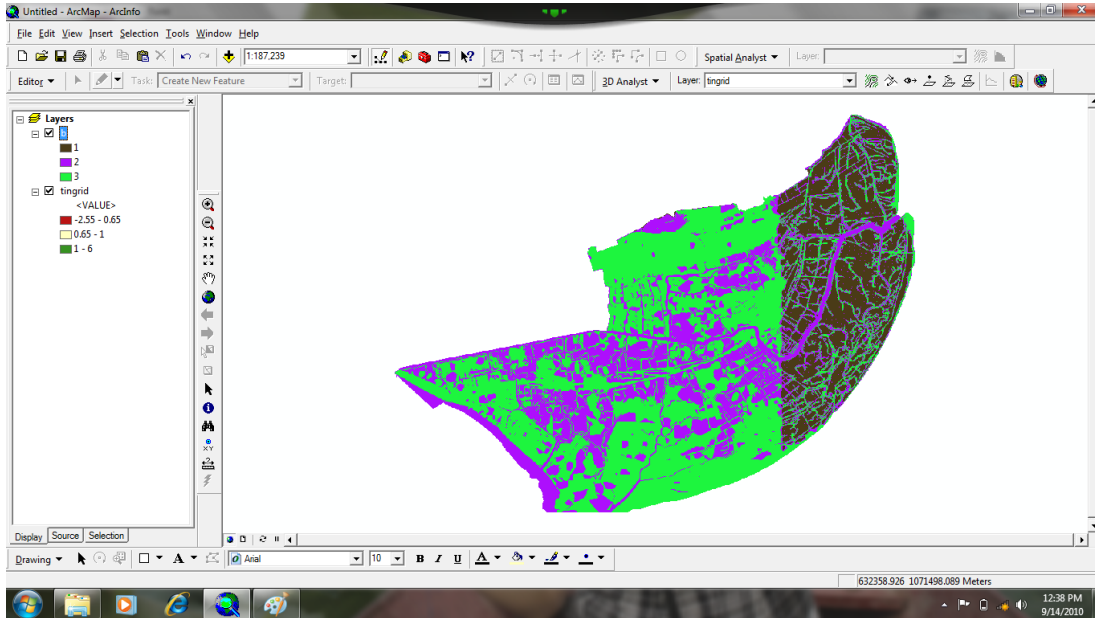

Figure 5: DEM reclassification

After reclassification, Raster image is converted into regional feature and assigned the value 1, 2 and 3 corresponding with smaller than 0.65m, from 0.65 to 1m, and more than 1m respectively.
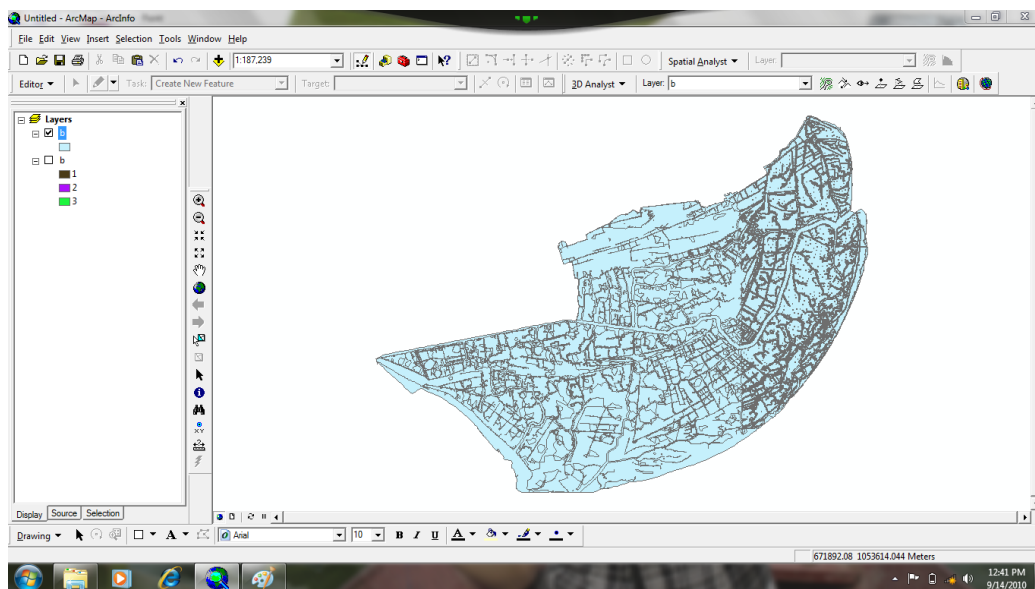

Figure 6: Floodplains file after conversing data

Floodplains with 0.65m sea level rise file will be exported to vungngap065.shp and vungngap1.shp with 1m sea level rise.

4.   RESULT

Using calculation tool in ArcGIS, the floodplain area are calculated with the relative result:

Table 1: Floodplain areas correspond to sea level rises

Sea level rises (m)	Floodplains (ha)	Flooded rate (%)
0,65	11680	30
1	23397	60

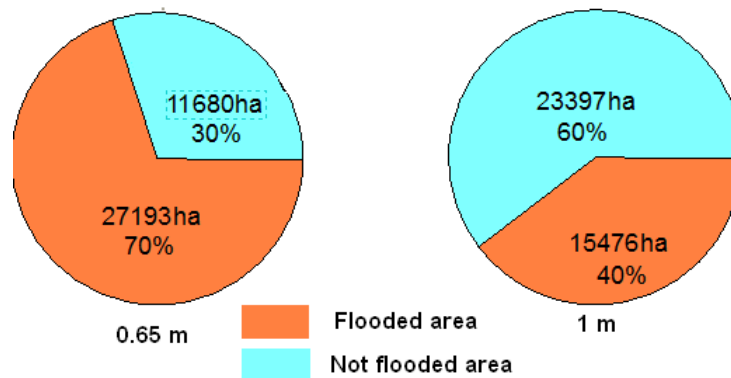Two pie charts are created respective to the table 1:

Figure 7: Sea raises levels pie charts

Residential areas were flooded with the respective sea level rise by using intersection tool for resident level with two sea level rise files (figure 8).

To find the inundated area is located in the corresponding sea level rises, use the Select By Location Selection module. The houses are flooded respectively to the sea level rises.

Table 2: Flooded houses correspond to sea level rises

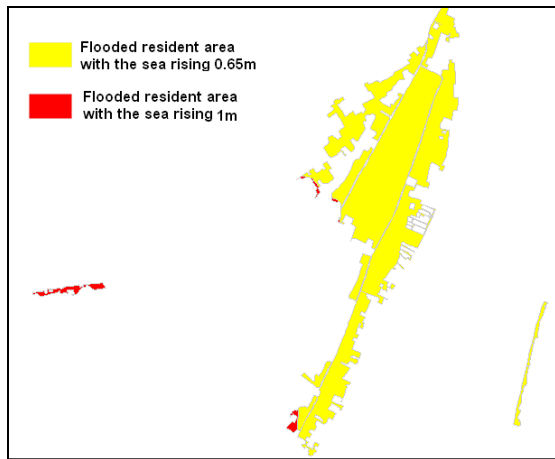| Sea level rises (m)	Flooded houses (house)	Flooded rate (%)
0,65	4212	23
1	6131	35

Figure 8: Residential areas were flooded with the respective sea level rises
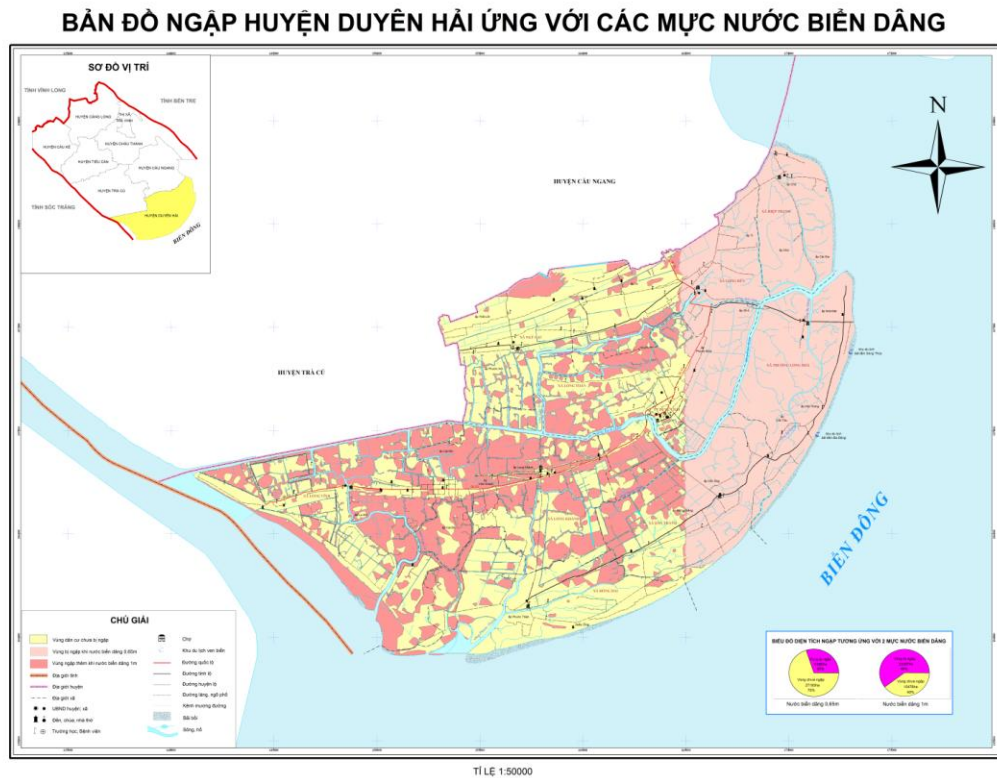

Figure 9: Flooded Map of Duyen Hai District with the sea level rises
Conclusion

DEM is an important data in finding floodplains under selected scenarios. With a digital elevation model in the database, the perfective sea level rise scenarios have been selected to find out the respective floodplains.

Analysis results in information system can be exported to tables or report format for statistical purposes, assessing the risk of damage of sea levels were timely. From the obtained results can fully edit the map easily.

The result of combining the capabilities of remote sensing and GIS to build the database for responding to climate change are: data for each sea level rise for Duyen Hai districts - Tra Vinh province is not only determined the correct area to be inundated (inundated maps showing Duyen Hai districts with the rising sea levels) but also identified an area of residential areas and houses were flooded (shown on map the risk of damage Duyen Hai district inhabitants as sea levels) and other objects located in the floodplain (i.e. functional areas, special buildings, residential sites, power stations, base stations, ...)

5. ACKNOWLEDGEMENT

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