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GIS BASED VULNERABILITY RISK ASSESSMENT OF RASAPETTAI COASTAL VILLAGE PANCHAYAT, CUDDALORE DISTRICT, TAMIL NADU, INDIA

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ABSTRACT

Raasapettai is a tiny, elegant coastal hamlet in Cuddalore district situated in between the Buckingham Channel and Bay of Bengal. The Sothikuppam village is seen at the north end of the village and wasteland is seen in the southern side. Both Raasapettai and Sothikuppam are connected with nearby villages Kudikadu, Pachchyankuppam through a narrow bridge on Uppanaru River. It has been chosen as the study area as it is one of the most vulnerable coastal village in Tamil Nadu, since it has been experiencing many natural hazards resulting in significant loss of life and property. This study focuses on creation of Geo database of the village and analyzes the land patterns with ref to disasters, socio-economic status and suggestion for making the community as the resilient community. The project area is Raasapettai coastal village in Kudikkadu Village Panchayat in Cuddalore Block of Cuddalore District in Tamil Nadu. The village has 432 households. The study area Raasapettai is situated at latitude of 11°44'55.83'' N and longitude of 79°46'17.54'' E. It is located 10 m above from Mean Sea Level (MSL) with a total number of 432 households.

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INTRODUCTION

Objectives of the Action Research Project

- To map all thematic information of the study area by interpreting satellite imageries and also from Cadastral sheets. The thematic layers include Base Map, land use / land cover, drainage network, water bodies (river, ponds, Lake and open wells, channels, bar mouth), Locations of cyclone shelter, soil, land capability, road network, escape routes etc.,
- To analyze the physical distance with graduation between sea/river and the habitation using GIS.
- To identify vulnerability of the coastal village and safer places, escape routes to safer places and shelters, by using local wisdom and GIS

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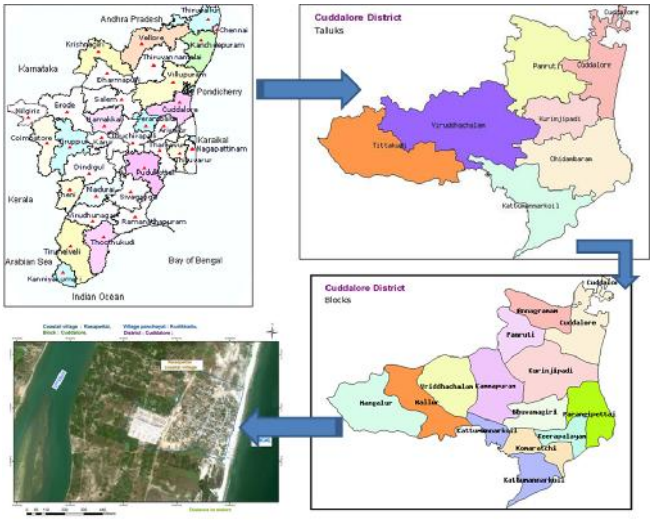
METHODOLOGY

For conducting socio economic resilience study, vast amount of data about the individual households, specific groups and community as a whole is required. Primary data has been collected for vulnerable habitations form field survey through observations, structured recording of responses of important individuals and groups through PRA tools, interaction with important stakeholders, case studies to analyses important events and a detailed questionnaire based survey of the households in the study area. Secondary data such as average annual precipitation, availability of disaster management plans, zoning, vulnerability assessment, evacuation and mitigation plans, road infrastructure and public transport, rainfall, borehole data etc., has been collected.

Coastal Vulnerability Index Assessment: Establishing and understanding of vulnerability in the coastal zone from coastal processes and the associated hazards are important. The vulnerability of coastal assets is a function of three overlapping elements exposure, sensitivity (to potential impacts) and adaptive capacity of a system.



Understanding of the elements functions is a basis for helping to describe how the different elements of vulnerability are related to each other. It also assists with identifying threats, opportunities and potential management and adaptation measure arising from climate change and provides important context and data sources for the coastal hazard risk management and adaptation planning process.

The mapping of coastal vulnerability zones (CVZ) includes, the preparation of various thematic and derivative maps from 4 different data sources, such as of Topographic sheets, Satellite data, Field survey data and PRA Tools calculation and assigning of weightages based on the coastal vulnerability zones suitable remedial measures have been suggested.

- Conducting socio economic resilience study, vast amount of data about the individual households, specific groups and community as a whole is needed.
- Primary data has been collected for vulnerable habitations from field survey through observations.
- Structured recording of responses of important individuals and groups through PRA tools, interviews with important stakeholders, case studies to analyses important events and a detailed questionnaire-based survey has been conducted in each households in the study area.

The qualitative as well as quantitative information has been collected to capture the values of variables identified to assess vulnerability such as community's sensitivity and ability to face hazards, availability of traditional skills to predict and effectively respond to hazards, early warning system, social cohesion, team spirit and administrative preparedness and response mechanism for evacuation, rescue and relief etc. Secondary data such as average annual precipitation, availability of disaster management plans, zoning, vulnerability assessment, evacuation and mitigation plans, road infrastructure and public transport, rainfall, borehole data etc were collected from various administrative and community organizations.
Based on collected data using different tools and techniques of GIS various layers of the village like Distance map, Elevation map, Drainage map etc., and features includes Hospitals, Infrastructure, Hazards, Population, Government Buildings, Transportation, Utilities etc., for Mitigation, Preparedness, Response, Rescue and Recovery management during disasters. With the help of Visual Basic, the collected household data are compiled with the Base map to create Village GIS.

Application of PRA Tools: The following tools of PRA were employed to elicit data from the community.

- Transect Walks
- Social Mapping
- Census diagram
- Venn Diagram

It is now clear to you that people's participation in the development process is both an essential input in development as well as a means of empowering the people. This PRA Tools deals with the various participatory methods and their application in the development process. There are various participatory methods, which have been used over the last few decades. Some of these are: The Beneficiary Assessment Method (BA), SARAR and Participatory Rural Appraisal (PRA). BA is a systematic investigation of the perceptions of the beneficiaries and other stakeholders. SARAR stands for five attributes, namely – self-esteem, associative strength, resourcefulness, action planning and responsibility for follow through, which are considered to be critically important for achieving full and committed participation in development programmes. PRA has been evolved from Rapid Rural Appraisal (RRA), which is a process of appraisal, analysis and action by local people themselves. To emphasize on the learning part sometimes the anagram PLA, which means Participative Learning and Action, is used. However, PRA is the most commonly used word. It is also the method, which is mostly used to encourage and ensure people's participation. Here this method has been explained in adequate detail so that it can be used in practice.

Geo database creation using Decision Support System: The main aim of this study is to construct inclusive village level information system applying visual basic.

The specific objectives are,

- To prepare different display forms using VB programs and connect it to database.
- Assemble different forms and prepare comprehensive system for use.
- To create user friendly interface using Unicode for Web GIS

Study out come

Water Quality

- Ground water is very good but during the rainy season the intrusion of sea water the ground water turns yellow and salty causes various diseases like Diayeria.
- During summer season ground water became normal and suitable for drinking Purpose

Soil Quality: According to the sand testing this area is not good for Paddy Cultivation but here they are cultivating "**Vettiver"** Plants in Rasapettai Village.

Intrusion of Sea Water: The quantity of beach sand characteristic and intrusion of sea water during this years, 2003,2006, 2011 and 2015 noted that, erosion was prominent. It has reduced to 10 km² before 35 years to 2016.

Escape Routes: To reach the evacuation/escape route distance is 3km from the shoreline. Round type shelter is available in village panchayat.

Artificial Bio -Shield

- Erosion and buildup land are noted. No places for tree plantation because intrusion of sea water due to this area not suitable for Bio Shield Cultivation.
- There is also a disturbance in construction of bio shields due to the ships which had been placed in the sea shoreline for fishing.

Trents of Shore line changes

- On the 1973 the shoreline is measured distance is 1.5km (SOI). In 2016 investigated by the community and verified by Google Earth image analysed in distance 0.85 km (45%) from the shoreline.

- Forecasting for the next 50 years coastal Erosion Expected 60% from the current stage (85m), remaining towards landward area is 425m.

Web GIS

Web GIS is a type of distributed information system, comprising at least a server and a client, where the server is a GIS server, and the client is a web browser, desktop application, or mobile application. In its simplest form, web GIS can be defined as any GIS that uses web technology to communicate between a server and a client. Here are a few key elements essential to web GIS:

- The server has a URL so that clients can find it on the web.
- The client relies on HTTP specifications to send requests to the server.
- The server performs the requested GIS operations and sends responses to the client via HTTP.
- The format of the response sent to the client can be in many formats, such as HTML, binary image, XML (Extensible Markup Language), or JSON (JavaScript Object Notation).

Elements of a web GIS application

There are five essential elements in every web GIS application:

- A web application
- Digital base maps
- Operational layers
- Tasks and tools in the web GIS application

A Web Application

The web application provides the software interface to the client, and its corresponding tools are used to visualize, interact with, and work with geographic information. It may be an application that runs in a web browser, or it could be a mobile application that works on a GPS-enabled field device or a smartphone, such as an iPhone. Often, the right choice depends on the set of functions, tools, and map displays required by the users' workflows. Just as often, the choice of application will depend on the end user and his or her experience using computers and the setting in which the work is done.

Digital Base maps: In web GIS applications, the base map provides the geographic context for each application. The type of application (for example, hydrology, parcels, electrical utilities, and conservation) often defines the type of base map that you'll need to use. For example, in a web GIS application aimed at water flow conservation, high-resolution ortho imagery would be an appropriate base map for digitizing wetlands.

The following Base Maps are integrated in the Web frame Works:

Transportation Base maps often contain roads, street names, points of interest, generalized land use, water bodies, and placenames.

Topographic Base maps often contain administrative boundaries, water features, physiographic features, parks, landmarks, transportation, and buildings.

Terrain base maps often contain shaded relief imagery, bathymetry, and coastal water features designed to provide a neutral background for other data layers.

Cadastral Imagery base maps often contain low-resolution satellite imagery for the world and high-resolution satellite imagery for select geographies around the world.

Hybrid base maps often contain optional layers that you can toggle on and off as map overlays—for example, map layers such as transportation, topography, terrain, and imagery are often included as optional base map overlays that can be turned on or off for different viewing purposes. Because high-quality base maps can require a lot of time and skill to produce, Series of base maps that you can utilize in your web GIS applications. However, if you prefer to build your own base map, ArcGIS Desktop provides all of the tools necessary for you to efficiently assemble, author, and cache highly attractive base maps. It is important to remember that base maps tend to be relatively static. In a typical setting, base maps are updated on an infrequent basis. For example, a transportation network may be scheduled to be updated on an annual basis to account for street network changes in a large metropolitan city. Conversely, a topographic base map may only be updated on a decennial basis, due to its dependency on a national census or surveying effort.

Operational layers

Operational layers are the small set of layers that you work with directly or derive as the result of an operation (such as a query) in a web GIS application. These layers are often tailored to a particular group of users by a GIS professional. For example, an urban planner uses a Windows smart phone running a GIS application to update the location of manhole covers in a sanitary sewer/storm water system layer. GIS datasets must be compiled in unison, harmonized, and integrated to fit together in a geographic framework.

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