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Mapping and Analysis of Wasteland in Machilipatnam Mandal, Krishna District, Andhra Pradesh, India by using Geographical Information System

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Abstract The report of this project is mapping and analysis of wastelands in Machilipatnam Mandal, Krishna district, Andhra Pradesh by using Geographical Information System. The wastelands of the Machilipatnam has identified and categorized through the satellite images, SOI Toposheets, field checking and Final interpretation. Results have been summarized according to wasteland type as per Survey of India (SOI) code. The study has shown that 5 different categories of wastelands are investigated and those total coverage area having 184.774 Km^2. Apart from the above mentioned wastelands, we have identified different categories areas like., Salty affected land, and Coastal and Waterlogged/Marshy land are most dominated type, land with/without scrub and sand Riverine moderate and less dominated is barren land. This type of research in Mandal level is very useful for Ground water development, subsequent use of cultivation, forestry development, determination of degrading wasteland and various reclamation measures.
Keywords *GIS; Land Affected by Salinity/Alkalinity; Coastal/Inland; Satellite Data and Visual Inter Pretation*

1. Introduction

India is the second largest population country in the world. The present population is 1.252 billion. The population was increasing day by day and which will makes a pressure on food processing land, fuel & fiber. India having good land resources, i.e., forests, Agricultural land, tanks and mining area etc., On the other hand the land degradation problems facing due to desertification, soil salinity, water logging, floods/droughts, soil erosion due to deforestation etc., has resulted in the creation of vast stretches of waste lands and decreases per capital cultivable land besides ecological in balance.

The calculated of waste lands are a diplomatic issue about there is no particular boundary, structure and constitutes of waste land. So the estimated waste lands depending on the no use of land and unutilized by human being. The word of waste is interpreted for waste lands offer it is reclaimed and soon. (Farmer, 1974; Chadha, 1982; Farmer, 1974; Govt. of India, 1993, 1995; IFPRI, 1995;

Pushpavathi, K.N. and Basavarajappa, H.T., 2009; Sahina Khatun and Gopal Chandra Debnath, 2014).

Wastelands have been considered as one of the natural resource and Degradation of wastelands have been phase more problems such as Change of Climate regulations, spreading toxics absorption fall out, stabilization of biosphere processes, decreasing of water storage capacity, loss of Flood control, health benefits, erosion control etc. Wetlands are also considered has a wasteland in terms of swamp or wasteland are frequently used – belying a common failure to understand value of wetland environments and wetlands are among the richest of environments, often providing a wide range of benefits to the society. Simply put, an environment without wetlands is incomplete process and may be unable to support the functions which depend for livelihood; lifestyle and life support (David Brackett, 1999).

The Spatial information on wastelands in the village level can be utilized for various reclamation measures and subsequent uses under social forestry, agro forestry, fuel and fodder form forestry and afforestation programme (Rao, Gautam and Baldev Sahai, 1991). Remote Sensing and GIS is an advanced technology for determination of surface change on earth and with the help of this technology we can found easy and free to capture from the satellite images of over object (Rajiv Chopra, Litoria, R.K., Thomas A. and Sharma P.K., 1994, Padmini Pani and Mohapatra, 2001). The main aim of this project is to determination of wastelands in Machilipatnam Mandal, Krishna district, Andhra Pradesh by using Elshayal Smart GIS.

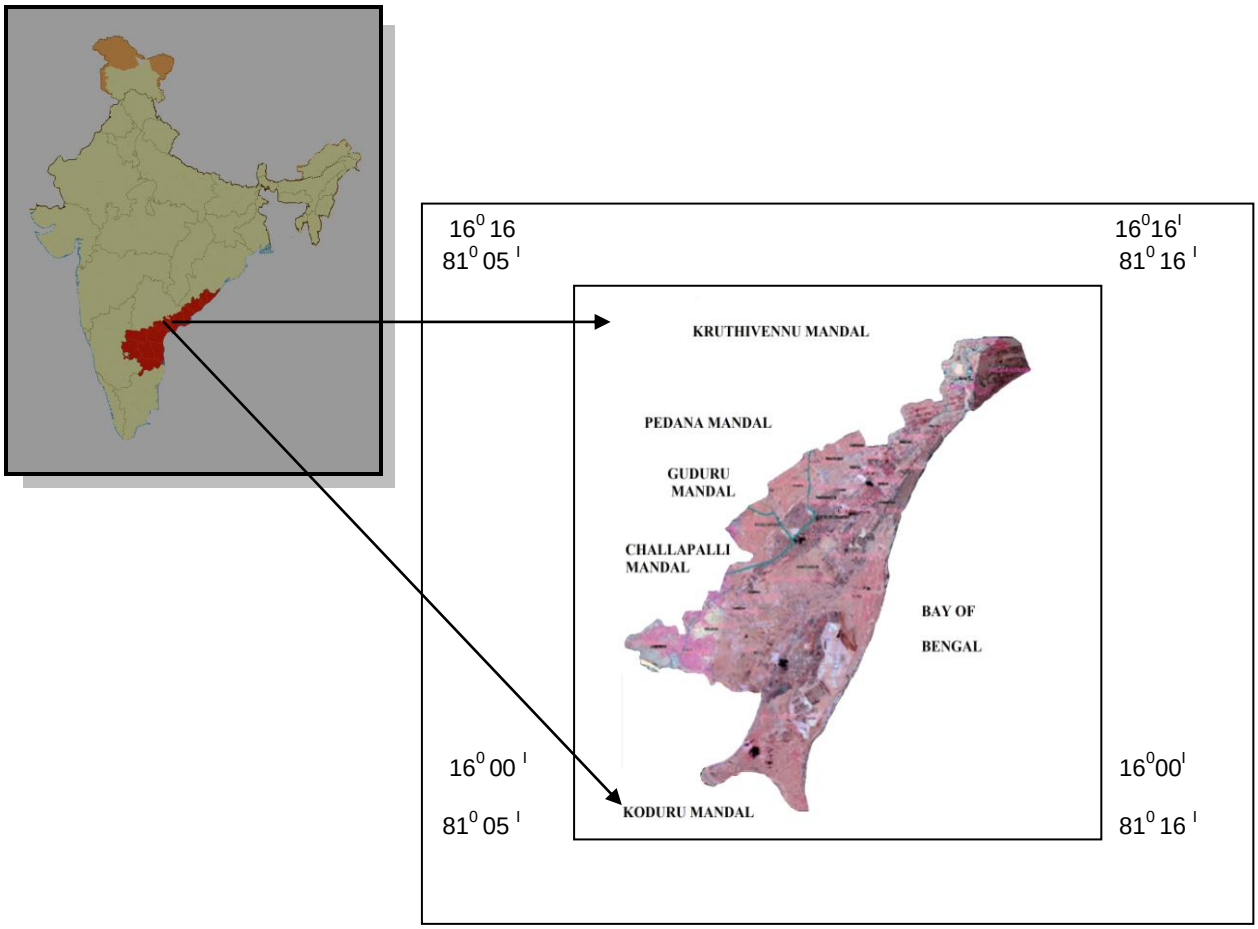

Figure 1: *Map of the Study Area*

2. Study Area

Machilipatnam area having along 74 km length of coastal line. It has located between 16°00'N to 16.16°N latitudes and 81°05'E to 81.16°E longitudes on the south-east coast of India and in the east corner of Andhra Pradesh (Figure 1). Crescentic shape of Machilipatnam Mandal has 29 villages (Figure.10) and the coastline covers 8 villages (Sinnappah Arasaratnam and Aniruddha Ray, 1994). Under Machilipatnam northern side Kruthivennu Mandal and south side having Krishna River and Koduru Mandal, western side 4 villages occupies such as Bantumilli, Pedana Mandal, Guduru Mandal and Challapalli Mandal, Eastern covered by the Bay Bengal (Figure 2). Krishna River enters into a sea at Hamsaladeevi. Pallethummalapalem region is highly matured in the mangrove community (Nabi and Brahmaji Rao, 2012). This Mandal mostly affected on natural disasters like cyclone in 1977 to 2014 and tsunami 2004. The average rain fall of this Mandal is 110cm due to southwest monsoon and the mean precipitation was 1250mm, it has Humid climatic conditions, highest temperature is 23^0C to 33^0C in April, May and June moths, Coldest temperature is 19^0C to 22^0C in December and January months.

2.1. Geology of the Study Area

The Machilipatnam area is covered by lower delta of the Krishna River. Most of the region is overlain by river alluvium soil such as clay, sand, shells and gravels. The age of the lithological formation is Archean to recent alluvium the Archean group of rocks includes Kondalite, Peninsular gneiss, Charnockite, Dharwar and Dolerite dyke, which were found in the extreme north and north-western part of the delta area. The Machilipatnam soils are very deep, moderately drained and very dark greyish brown in colour. The soil of the coastal tract is occasionally saline and deep, coarse textured with sandy sub-soils. The delta comprises sediments of both fluvial and marine origin (Bhishm Kumar, 2011).

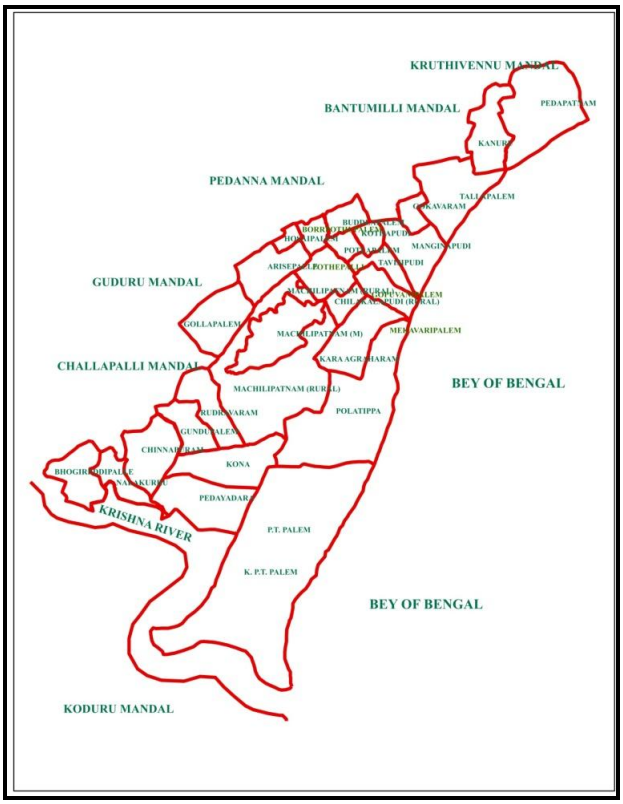

Figure 2: *Machilipatnam Mandal Village Map*

3. Methodology

➢ Satellite DATA

High resolution of Google earth images are download form Elshayal Smart GIS software, the scale of the images 1:12,000 (15/4/2014).

➢ Elshayal Smart GIS

Remote sensing and GIS software's are very advanced spatial technology to analyse surface features of the Earth. In this regards Elshayal smart GIS is the one of the First Arabian free software to help free download Google earth satellite images. Authors have to installed Google Earth 4.3 Version and Elshayal Smart GIS. After that click on Inside the Google Earth open tool menu turns off terrain. Display of Google Earth image have to be very flat for that purpose double click on the North arrow and pressing the Keyboard shift and up arrow, again press the keyboard buttons of Ctrl and keyboard down arrow after that close Google Earth. Open the Elshayal Smart GIS (Mohmed Elsayed Elshayal et al., 2012) click on the Google Earth Icon, login Google Earth and press refresh cords button in software to get Google Earth position. Enter Lon and Lot cords and Scale zoom, and press Import Rectified Image button to get B&W satellite image (Figure 3) and save the image. Minimize the software. Open Google earth and save the color image at same name of the B&W image. In Elshayal Smart GIS Reload Layer from Layers Menu to get colored rectified Image (Figure 4). Use Up, Down, Right, Left Buttons to navigate and found images of object area image. Save image is late step of the download of image, click on the save image setup, select the paper size and press ok button and select the type of the image format like JPEG, BIT and BMP etc.,

➢ Ground Data

After the preliminary interpretation of the satellite data ground verification of the drought full areas so / for /as extent as well as classification system concerned. They were carried out during field traverses the terrain classification conditions needs very accuracy requirements and updating of images interpretation key were also looked into detail ground data collection and which is helped in final interpretation of the imageries.

4. Work Flow

1) Preliminary quality check and necessary corrections are carried out for preparation of all the maps

2) Field visits are carried out to check the delineated units of the maps prepared by visual interpretation of satellite imageries. Photographs are related to the study areas were, primary data of land use, soil, well inventory and secondary data related to irrigation, agriculture, land use and ground water were collected (Basavarajappa, H.T. and Manjunatha, M.C., 2014).

3) Field observations were incorporated with related to thematic layers and Well status map is prepared by plotting the well inventory data on the village maps (Figure 5).

4) Final to check the quality and necessary corrections are carried out for all the maps prepared.

5) All maps are prepared and converted into soft copy by digitization in that process editing, labelling, mosaicing, quality checking, data integration etc., are carried out.

6) Land use/land cover map, drainage map, ground water prospects map well status map, slope map and command area map are integrated with village map and to get analyzed village-wise statistical findings.

7) Villages are categorized by irrigation utilization, natural resources utilization based on the village-wise statistical findings.

8) Ranking criteria is prepared for prioritization of villages for the developmental activities based on the available natural resources and accordingly villages are ranked and categorized.

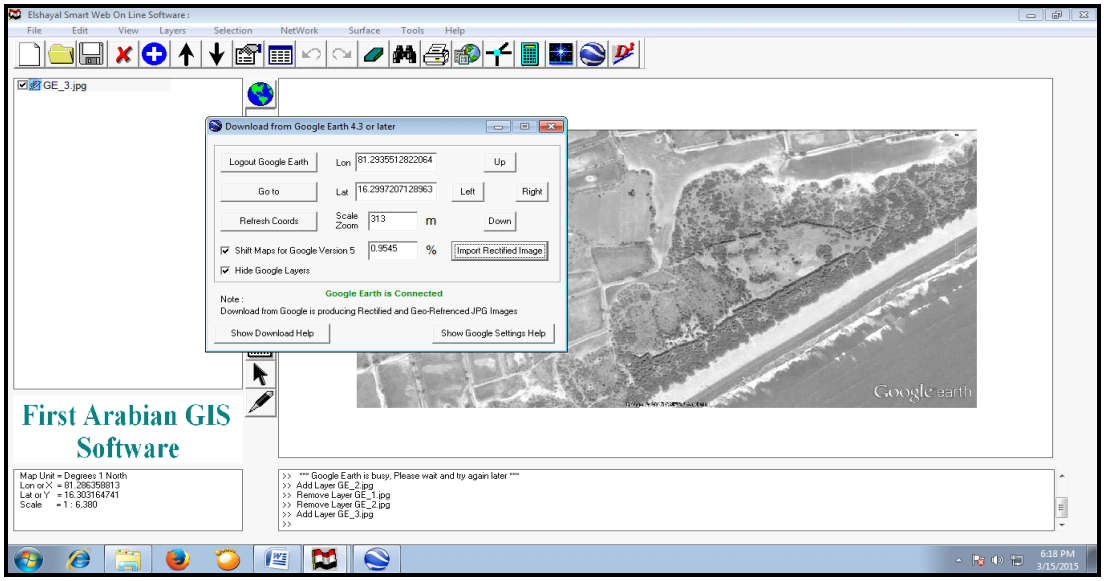

Figure 3: *Download the Google Earth Image from Elshayal Smart GIS*

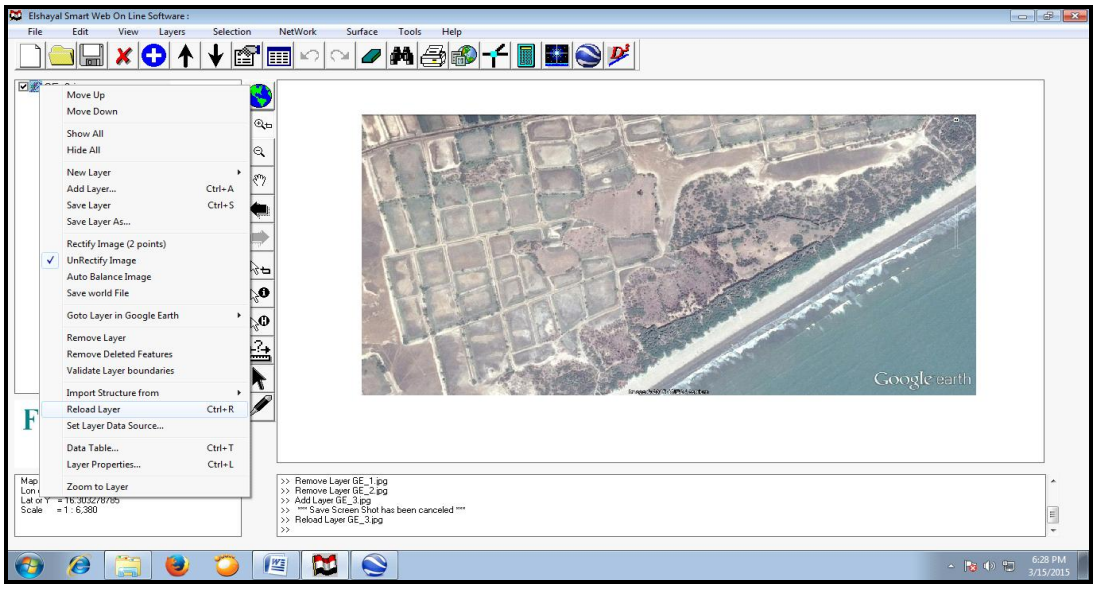

Figure 4: *Elshayal Smart GIS Reload Layer from Layers Menu to get Colored Rectified Image*

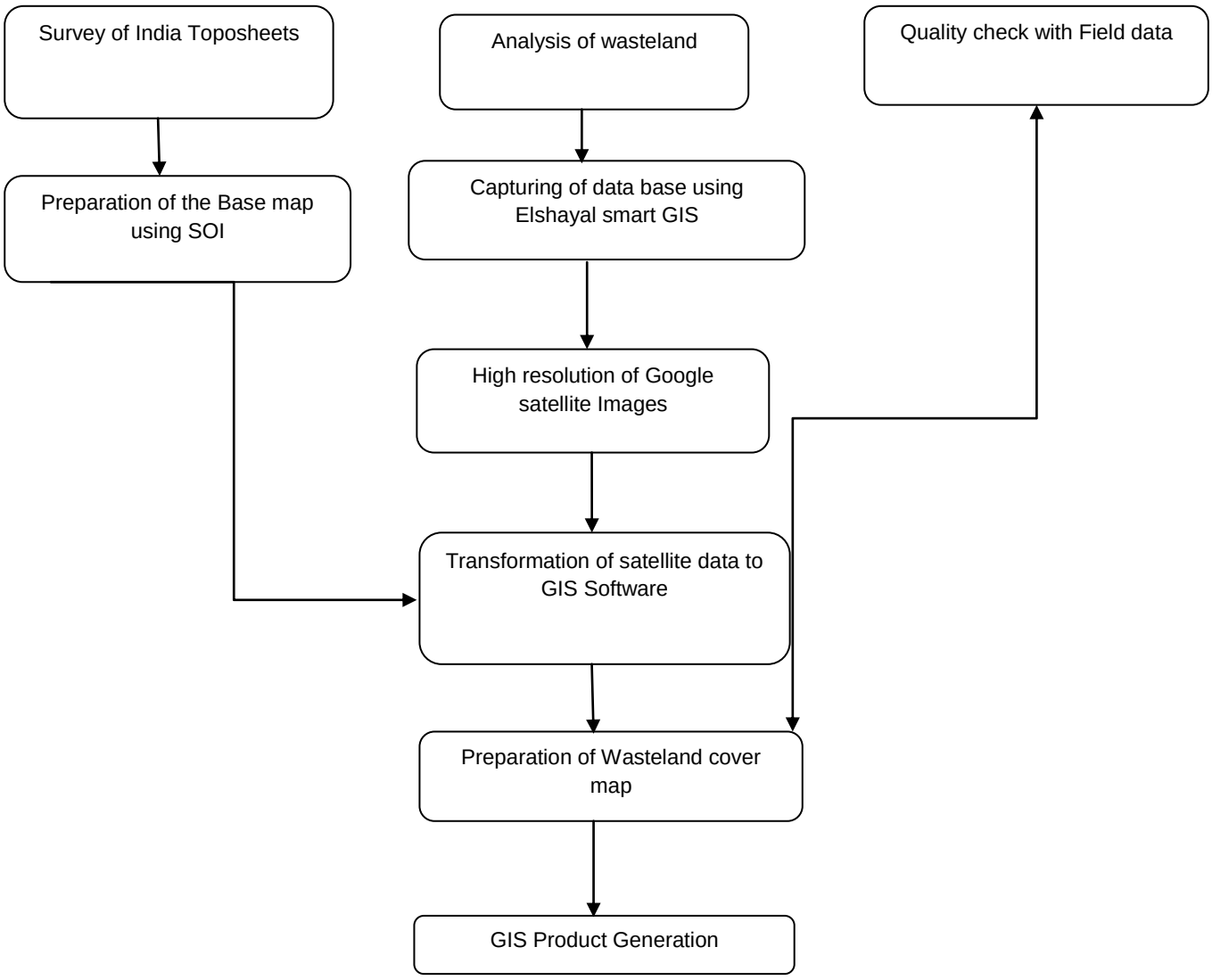

Figure 5: *Flow Chart Represent the Methodology of Wasteland Mapping*

5. Results and Discussion

5.1. Categories of Wastelands

In study area of wastelands are imposed several factors mainly natural causes and some percentage of miss use of land resources. V.C. Jha defined that the Wasteland is not suitable for either cultivation or any other beneficial use under the existing conditions of land management. Out of thirteen different types of wastelands, only 5 types of waste lands are presence in Machilipatnam (Figure 6). These are Water logged/Marshy land, Land affected by salinity/coastal, Land with/without scrub, Barren land and Riverine. The category wise wastelands area and percentage given in below (Table 2).

Table 2: *Category wise Waste land in Machilipatnam Mandal*

Wasteland Category	Wasteland Area (Km^2)	% to Total Wastelands
Waterlogged/Marshy land	60.3	33%
Land affected by salinity / coastal/	57.734	31%
Land with / without scrub	41.19	22%
Sand Riverine	24.17	13%
Barren land	1.38	1%
Total	184.774	100%

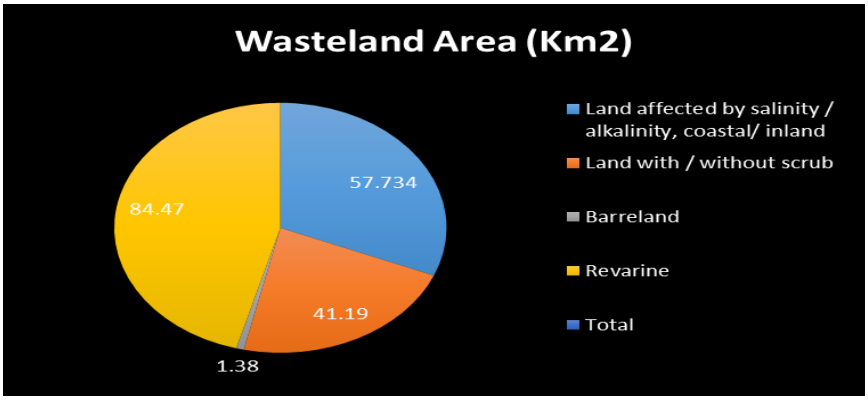

Figure 6: *Graphical Represent of the Wasteland Areas in Machilipatnam Mandal*

5.2. Village Wise Distribution of Wasteland in Machilipatnam Mandal

Machilipatnam Mandal area having 74 km of coastal line. Sea level fluctuation and cyclone effects are most common problems in this Mandal. Most of the Mandal having high Wasteland -formation due to coastal and alluvium environments problems. The Wasteland distribution from Northeast to Southwest (Table 3). Pedapatnam villages are northern upper most part having area of 33.217 km^2. These Mandal wastelands are Riverine 1.29 km^2, coastal land 10.12 km^2. Kanuru village having 11.197 km^2 of area. One of the tributary of Krishna River flows through in this village and meets in Bay of Bengal. Wastelands are Riverine 3.2 km^2, coastal land, 2.1 km^2 respectively. Manginapudi, Tavisipudi, Gopuvanipalem, Mekavaripalem and Karagraharam villages of the total waste lands areas are listed below, i.e., 7.76 km^2, 0.64 km^2, 2.425 km^2, 0.76 km^2 and 6.64 km^2. Polatitippa village have 2.267 km^2 areas and it has barren land, marshy land and costal effected land. The occupied waste land is 2.24 km^2. P.T. Palem (Pallethummala palem) having two types of wastelands most dominantly such as marshy land and sand Riverine because in this village the Krishna river meet at Bay of Bengal and this village most effected to floods. The thematic map of the Marshy land shows in Figure 9 and total wasteland is 74.46 km^2. Bhogireddipalli village of 9.15 km^2 land area. The wastelands are sand Riverine and land with scrub. Total wasteland of Bhogireddipalli is 3.74 km^2. Pedayadara village have sand Riverine wasteland because Krishna River flows through in this village, meandering, river action and floods most affected in this village, total wasteland of this village is 0.72 km^2. Less domination of wasteland villages are Arisepalli, Pothepalli, Kona, Potlapalem, Gundupalem, Rudravaram, Machilipatnam (M), Buddala palem, Kothapudi, Hussainpalem and Borrapothu palem. Land with/without scrub has the villages are Machilipatnam (R), S.N Gollaplaem and Chinnapuram villages (Table 3).

5.3. Waterlogged/ Marshy Land

The Machilipatnam Mandal has 60.3sq.km of waterlogged and marshy land. River water, coastal water contact with land that area has more wet and it's covered by the vegetation which grows grass and reeds and Water remains stagnant for practically whole of the year. The Wasteland distribution of this Mandal as Polatitippa village (26.3 Km^2) and P.T. Palem village (30.3 Km^2) largely covered by the marshy land and less percentage of this wasteland are Tallapalem, Kanuru and Pedapatnam (Figure 15).

5.4. Lands Affected by Salinity/Alkalinity – Coastal/Inland

These lands having the layer or encrustation of different salts, the depth of layer may vary with the quantity of the salts which have deposited over a period. These salts may be soluble or exchangeable. Soils are usually fine textured, light with good porous space but low water holding capacity. Due to

deposition of salts on the upper crust, their colour varies which may be from white to grayish white (Bhattacharyya, S. and Mukherji, K., 1999). These factors are contributing to the development of these soils are generally arid and semi-arid climate. Sea level fluctuation, Coastal Wave action and Salinity affected villages are form Pedapatnam to P.T. Palem villages along the coastal area of the Machilipatnam Mandal. Thematic map of the sand Riverine represent in Figure 7.

5.5. Land With/Without Scrub

This is one of the most dominated wasteland the percentage is 22% in this Mandal. The villages are Bhogireddipalli and Chinnapuram and Machilipatnam (R), Nelakurru, Chilakalapudi, Kona, Karagraham and Pothepalli occupies this type wastelands. Land with/without scrubs wasteland form due the undulation of topography, and remains of cultivated land. Figure 8 shows good example of land with/ without scrub.

5.6. Sand Riverine

Krishna River and its tributaries are flows and enter into the Bay of Bengal at various places such as P.T. Palem (Hamsala Devi), Kanuru, Polatipala palem villages. Shifting of river and meandering of the river area form of the sand bodies are accumulated and stabilized in Riverine of inland areas. This is one of the most distributed wasteland in this Mandal. The percentage of wasteland is 13%.

5.7. Barren Land

These areas appear in light grey to black one texture due to elevated land one side one light brown on the other side due to vegetation and tonal variation is subject to degree of soil erosion. This type of wasteland category is noticed in Gopavanipalem and Pothepalli villages.

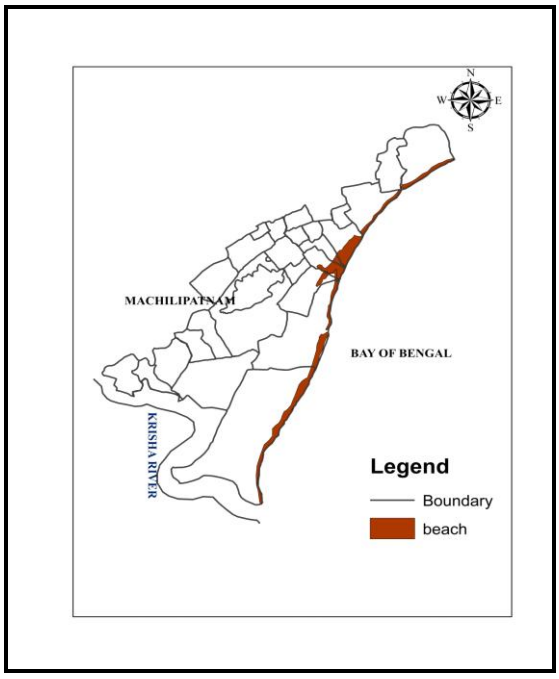

Figure 7: *Land affected by Salinity/ Coastal*

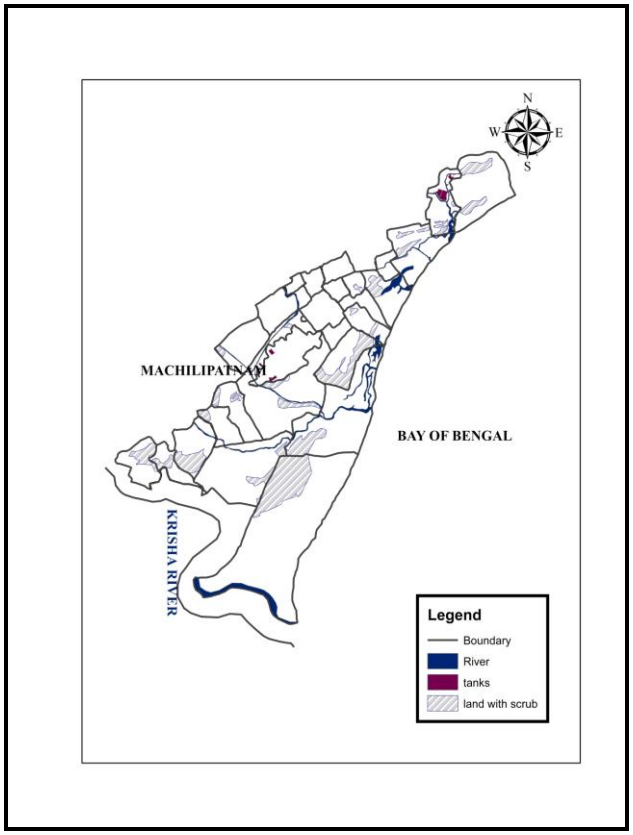

Figure 8: *A Land with/without Scrub Map*

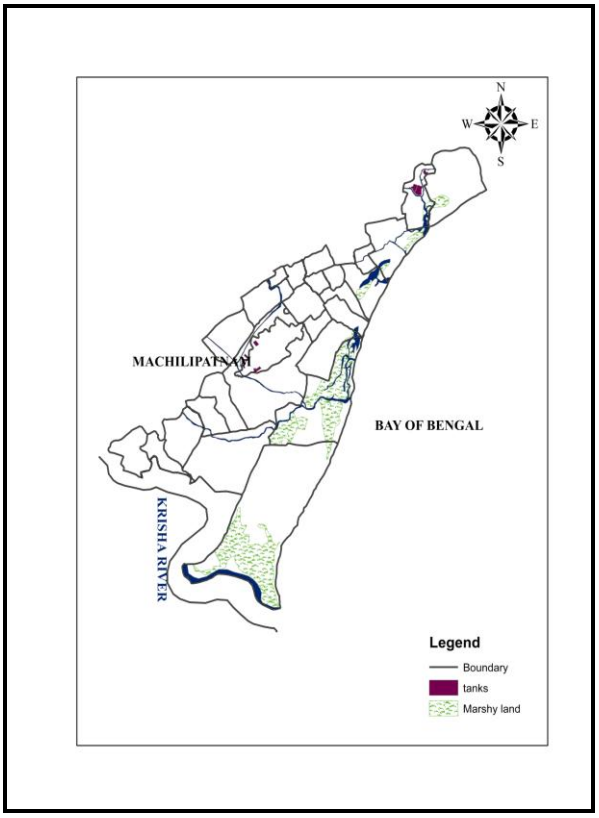

Figure 9: *Marshy land Map of Area under Machilipatnam Mandal*

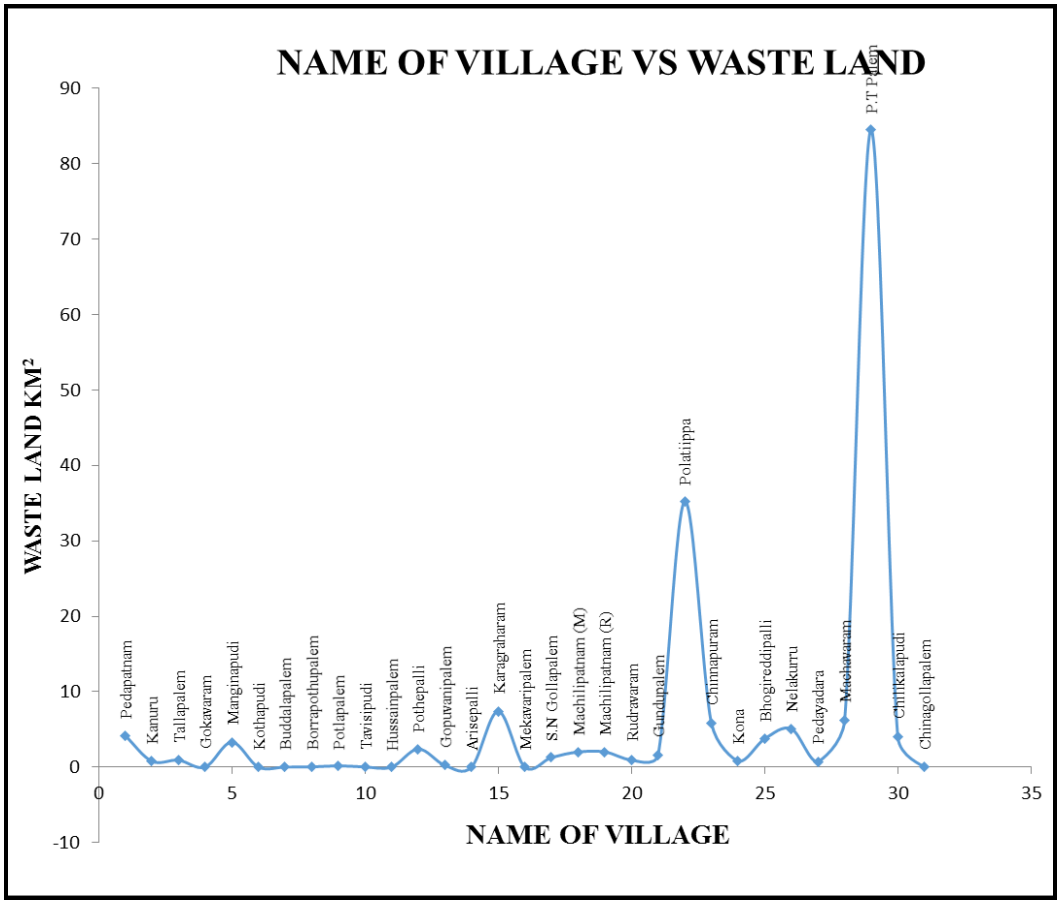

Figure 10: *Difference between the Village of Machilipatnam Mandal and Wasteland Area in Graphical Represent*

Figure 11: *Land without scrub at Manginapudi Village in Machilipatnam.*

Figure 12: *Salty Mud Flats Covered by Thick Vegetation in Gokavaram Village*

Figure 13: *Coastal Sand Dunes in Tavisipudi village*

Figure 14: *Presence of Marshy Land Covered by Thick Green Plants in Kanuru Village*

Figure 15: *A Pure Patch of dense Mangrove Plants nearby Tallapalem Village*

6. Wasteland Reclamation Must Consider the Two Following Categories (Sharma, 1997)

(i) Identification of nature, extent and location of wastelands and their availability for agricultural uses and

(ii) Identification of technology and management practices suitable for specific type of wasteland, taking into account the availability of resources for their care after planting or introduction, and unless these objectives are clearly defined and understood, money and energy spent on the development of wastelands will go waste.

7. Recommendation for Reclamation of Wasteland

1) The Physiographical most of the land covered by coastal and alluvium land forms.
2) Environmental wasteland point of view it's not easy to guideline about reclamation of wastelands in Machilipatnam Mandal.
3) Survey of wasteland to prepare the base map through Elshayal smart GIS with 1:12000 scale to determine specific waste land every micro level should be considered.
4) During field survey the village boundary route map also considered.
5) Such development plan for specific wasteland may be prepared in a participatory mode of involvement for village people.
6) Such type of wastelands can be utilized for forest mangroves coastal lands to the development of in this Mandal to prevent cyclone affect.
7) In case of land with scrub and without scrubs the coverage is only 24% of the total Mandal (Figure.9). The land with scrub most probably found in flood plains of Krishna river sand dunes this area limited basis only for agricultural use
8) Wastelands of sand Riverine are the abandoned channels of the shifting rivers these are the areas for ground water recharging percentage of river wasteland is 13 % in the Mandal.
9) Most of the water logged wastelands are natural depressions rather than formed due to any anthropogenic intervention. These depressions are surface water bodies catering to the need of surface water irrigation and also the vital source for ground water recharge in this Mandal - man-made water logged also occurring Chilakalapudi, Tavisipudi, Gokavaram (Figure. 12). Local people for their domestic and agricultural purpose they were using water logged area in this Mandal people get more benefits (Figure. 13).

8. Conclusion

GIS analysis provides accurate information of mapping, identification and validation of wasteland. The study carried out 1:12000 scale and determination of wasteland in village level can be utilized for various Reclamation measure ineffective manners. However with detail ground truth survey together with input from SOI toposheet and Elshayal Smart GIS high resolution images are helped to identify the wastelands properly. The total wasteland in this Mandal is 184.774 sqkm. Out of these wastelands Coastal land 57.74 Km^2 and Water logged/ Marshy land 60.3 Km^2 most dominated type in this Mandal, Land with/ without scrub 41.19 Km^2 and Sand Riverine 24.17 Km^2 moderate and less dominated is barren land 1.38 Km^2. The study also reveals that very small quantity of land area can be marked as wasteland compared with actual geographical area of the Machilipatnam Mandal. We concluded that this type of study in village level utilized for improvement of watershed, improvement of cultivation, Construction of manmade water logged area and forest development. Government and Private sector combined to construct the water recharge areas along the Tavisipudi, Manginipudi, Gopavani Palem, Kanuru and Pedapatnam villages (Figure. 14). For increase Ground water level Cultivate Salty trees like *Aegiceras corniculatum, Bruguiera gymnorrihiza* and develop the forest land along the coastal villages to prevent the cyclone affected these villages.

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