*LU/LC Development in Semi-arid Tropics*

# Large-Scale Wasteland Mapping for Sustainable Development

## A Case study of Achampet Mandal, Mahaboobnagar Dist, AP, India

By

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## Abstract

*The semi-arid tropics include parts of 48 countries in the developing world: most of India, locations in south east Asia, a swathe across sub-Saharan Africa, much of southern and eastern Africa, and a few locations in Latin America, which are characterized by unpredictable weather, long dry seasons, inconsistent rainfall, and soils that are poor in nutrients. This part of the world is quite sensitive to land degradation and increase in coverage of wastelands. Land resources are also found to be under stress due to pressure of population. Hence for optimum use of land resources, wastelands need to be mapped to be brought under productive use.*

*For effective developmental planning for wastelands, correct assessment is needed, which is being taken up by various Land use development boards and organizations across the globe using remote sensing techniques. Even if some countries have taken up wasteland mapping assignments, required detailed information at village level is still at large. It is being strongly felt that wastelands need to be mapped at sufficiently large-scale (i.e. 1; 12,500 or 1:10,000 scale) and maps need to be generated on a cadastral base. Further to mapping, a detailed action plan can be generated for reclamation of wastelands with due regard to other resource information.*

*Since no such study has been taken up by any department except a few discussions and proposals, Speck Systems Ltd., Hyderabad took up a study in this direction to map wastelands at a larger scale with due reference to available cadastral maps, land-use, soil type, groundwater prospects etc., and develop a comprehensive action plan for development/reclamation. Achampet mandal of Mahaboob Nagar District, AP was selected as the study area for the purpose. Advanced tools in Remote Sensing & GIS were used for the purpose.*

*The paper presents the scope, methodology and outcomes of this pilot scale project on large-scale wasteland mapping. A comparison was also carried out with regard to wasteland mapping undertaken at smaller scales. The advantages of large-scale mapping have been established and results have been presented in graphical form. The paper can be of use for decision makers/mapping scientists who are dealing with Land Resources and related developmental planning.*

## 1. Introduction

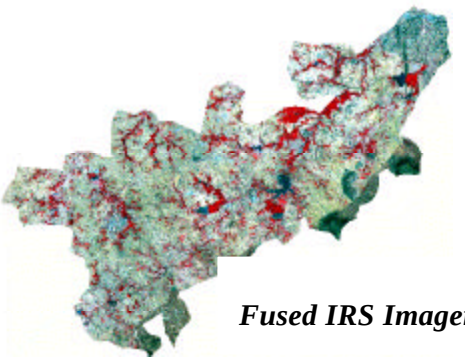
The semi-arid tropics include parts of 48 countries in the developing world: most of India, locations in South East Asia, a swathe across sub-Saharan Africa, much of southern and eastern Africa, and a few locations in Latin America. This zone is characterized by unpredictable weather, long dry seasons, and inconsistent rainfall; hence prone to land degradation. Land that used to support people since time immemorial turns into barren wasteland / degraded land mainly because of four factors e.g. climate, soil, topography and human factors. The first three being natural in origin are reasonably stable, whereas the fourth one, the human factor is variable in space and time. Efforts are on to develop land-use systems in semi arid tropics and meet the demands of food supply for increasing population. The main objective is to bring all the wastelands under productive use through afforestation, plantations, agro-forestry, horticulture and other productive use. This calls for the development of appropriate technology for wasteland development and management. Such types of developmental planning need very accurate and reliable database on the type, extent and ownership of wastelands. The need for an accurate and detailed database on wastelands calls for a large-scale mapping, so that the same can be integrated with cadastral maps on an LIS base. Even though 1:50,000 scale wasteland mapping has been completed for India, the same is not found suitable for implementation of wasteland development program at village level.

Hence Speck Systems Limited took up a study in this direction to map wastelands at a larger scale (1; 12,500 scale) using satellite remote sensing technique to establish the advantages over existing small scale maps in terms of available details, accuracy and capability to be integrated at cadastral level. Its applicability and usability for integrated wasteland development was also taken into due consideration.

# 2. Pilot Project

## 2.1 Study Area; Achampet mandal, Mahaboobnagar District, AP

Achampet Mandal lies in Mahaboobnagar district of Andhra Pradesh State. It covers 22 villages, out of which a cluster of 18 villages with an area of 22471.8 hectares have been taken as the study area. The area is covered in Survey of India toposheet (1:50,000) No.56L10, 56L11, 56L14, 56L15**.** The climate is tropical and temperature ranges from 40$^{o}$C – 18$^{o}$C with 1100 mm rainfall distributed over the entire Mandal.



***Fused IRS Imagery of Achampet mandal***

## 2.2 Data Requirements:

The project required a host of data from various sources to be incorporated into the system. As the data sets used were from various sources, adequate attention was paid for data standardization. Sufficient attention has been paid for data format, scale of maps, data quality, authenticity etc., at the time of procurement as well as throughout the execution phase. In this study, three types of data have been used e.g.

- ?? Satellite Data
- ?? Secondary Data
- ?? Ground Data

### 2.2.1 Satellite Data

Satellite data was procured from National Remote Sensing Agency (NRSA), in digital format. The study area is covered in one full LISS scene, one full PAN scene and three PAN sub-scenes. All these imageries were procured in standard BSQ format for the purpose of digital image processing. The mapping job being carried out at large-scale (1:12,500), LISS & PAN images were procured to generate fused imagery, which can

integrate the spectral resolution and spatial resolution available with LISS & PAN images respectively. Proper enhancement and filtering techniques were also applied to the fused imagery to derive maximum possible details during visual interpretation and mapping. Satellite image mosaic was prepared for Achampet mandal to have a synoptic view of all the villages in the mandal.

Hard copy maps were generated out of this fused digital data at 1:12,500 scale (6 plots) for visual interpretation and mapping. The fused images at 5.8-m spatial resolution supported hard copy generation at this scale at 50 microns plotting using ***fotorite machines***(Designed & developed by SSL).

### 2.2.2 Secondary Data

Secondary data used for the purpose include:

- Survey of India Toposheets for the study area at 1:2,50,000, 1:50,000 & 1:25,000 scale.
- Wasteland maps at 1:50,000 scale.

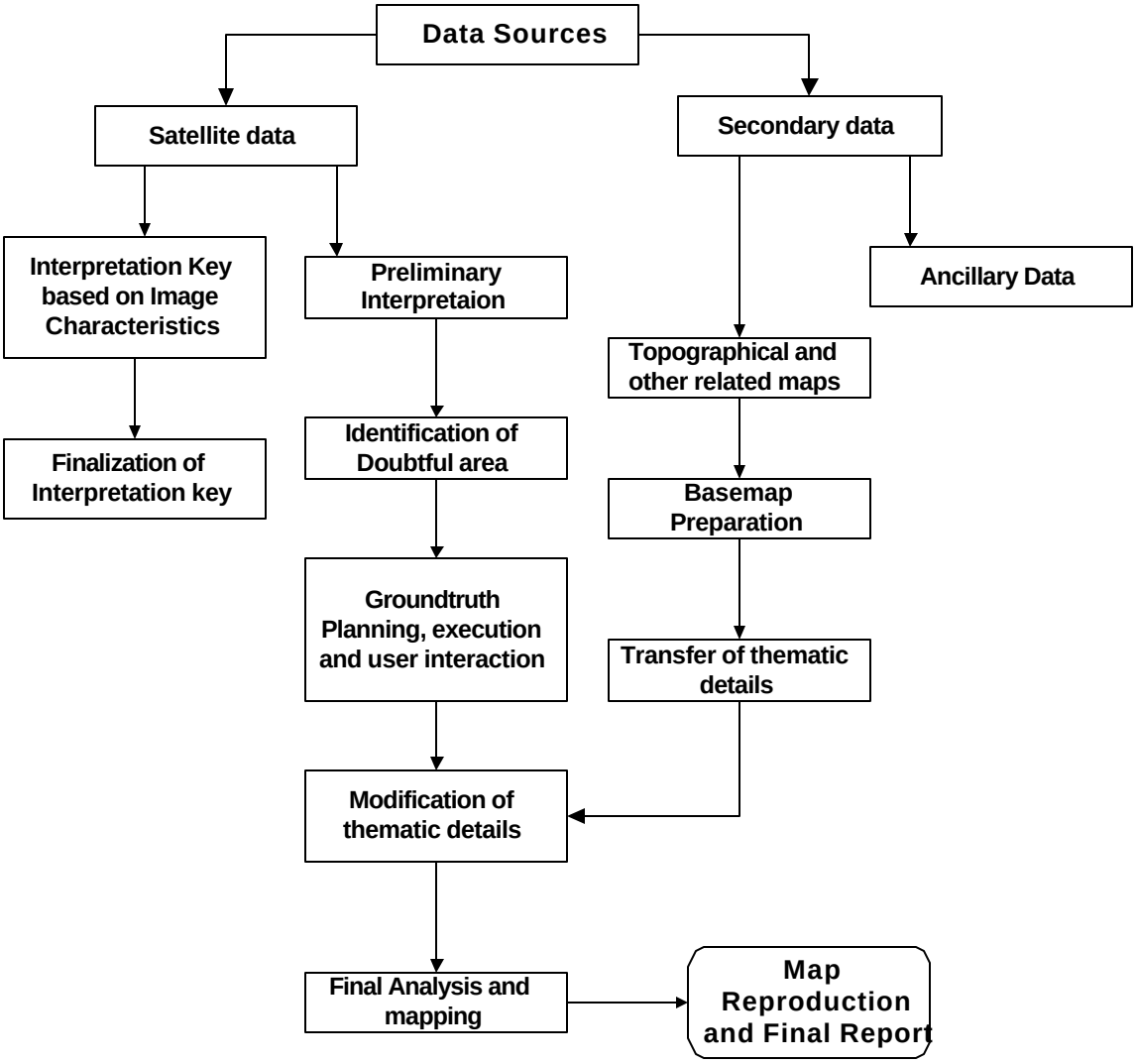
### 2.2.3 Ground Data

Ground verification forms an important and integral part of visual interpretation process of remotely sensed data. Ground data is attributed to collection / verification and measurement of information about different surface features, which are responsible for reflectance behavior patterns. It becomes necessary to use ground data in association with remotely sensed data to establish the mapped details with authenticity as well. Ground truth collection is dependent upon the extent of doubtful areas, the sampling procedure adopted during field traverse, terrain conditions, classification accuracy, requirement etc.

### 2.3 Wasteland Mapping:

The methodology essentially involves visual interpretation of IRS ID fused FCC (LISS & PAN) on hard copy for identification of different categories of wasteland using standard image interpretation techniques, based on tone, color, texture, pattern etc., in addition to field based knowledge of the interpreter. Other ancillary data e.g. topographical maps were also used for reference purpose in mapping of wastelands. The interpreted maps were checked on the ground in order to verify the doubtful areas and based on ground verification, the wasteland boundaries are finalized.

# METHODOLOGY

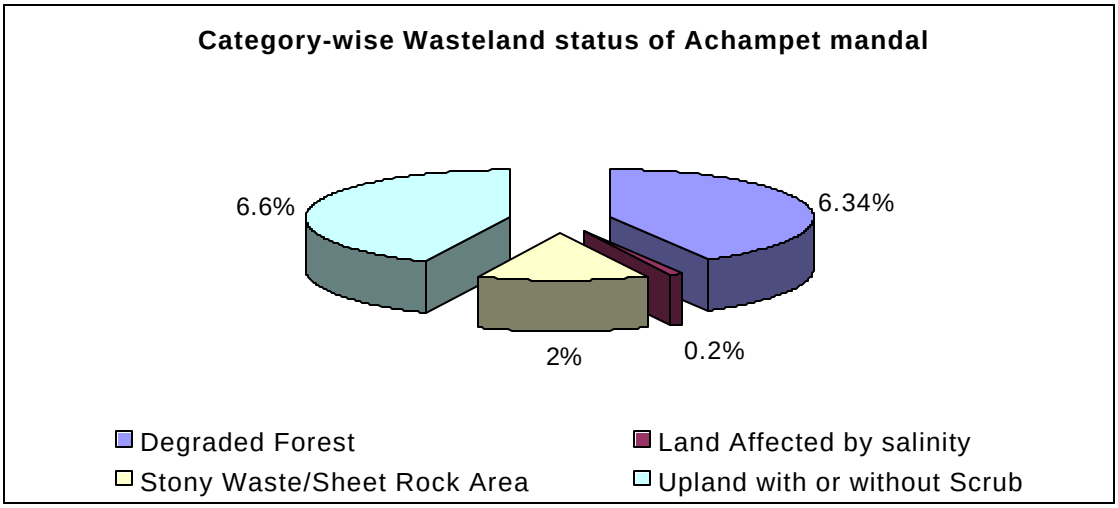


## 2.4 Wasteland Database Generated:

### 2.4.1 Category-wise Wasteland status of Achampet mandal

All in Hectares

| Sr. No. | Wasteland Category | Area | % to total Geographical area |
|---|---|---|---|
| 1 | Degraded Forest | 1423 | 6.34 |
| 2 | Land Affected by salinity | 43.7 | 0.2 |
| 3 | Stony Waste/Sheet Rock Area | 458.7 | 2 |
| 4 | Upland with or without Scrub | 1473.5 | 6.6 |




**Total Wasteland in the mandal: 3398.9 hectares (15.13% of total geographical area)**

The study area has four categories of wastelands e.g. degraded forest, land affected by salinity, stony waste/sheet rock area and upland with or without scrub. In total 15.13% of the total geographical area of the mandal, is covered with wastelands. “Degraded Forest” and “land with or without scrub” cover 6.34% and 6.6% of the total geographical area respectively and together contribute 85.22% of the total wastelands in the mandal. It is for the first time that “land affected by salinity” has been spotted in the area under study. It is seen in a spatial domain that wastelands are mostly concentrated towards north-eastern, central and western parts of the study area. But in all instances it is observed that wastelands are present far from settlements except few patches of “Upland with or without scrub”. A large patch of degraded forest is observed in northeastern part of the study area, which has good surface water potential. It can be an ideal case to take up reclamation activities.

### 2.4.2 Village-wise Wasteland Status of Achampet Mandal.

All in Hectares

| S. No. | Village name | Total Area | Wasteland | % to total Geographical Area |
|---|---|---|---|---|
| 1 | Siddapur | 3279 | 1230.5 | 37.8 |
| 2 | Singaram | 912.3 | 139.9 | 15.3 |
| 3 | Chennaram(Sabak) | 345.8 | 17.5 | 5 |
| 4 | Chandapur | 1047.2 | 133.4 | 12.7 |
| 5 | Hajipur | 880 | 214.2 | 24.3 |
| 6 | Puljal | 1678.2 | 151.3 | 9 |
| 7 | Ainol | 3139.2 | 519 | 16.5 |
| 8 | Nadimpalle | 1859.5 | 230.0 | 12.8 |
| 9 | Lingotam | 866 | 56.3 | 6.8 |
| 10 | Bramhanpalli | 724.3 | 56.2 | 8.29 |
| 11 | Palkapalli | 1051.2 | 103.9 | 9.9 |
| 12 | Achampet | 1189.5 | 87.2 | 7.3 |
| 13 | Rangapur | 1393.9 | 187.9 | 13.5 |
| 14 | Bolghatpalle | 687.5 | 86.5 | 12.6 |
| 15 | Tangapur | 417 | 34 | 8.2 |
| 16 | Lakshmapur | 987.8 | 85.9 | 8.7 |
| 17 | Gumpanapalla | 940 | 29.3 | 3.1 |
| 18 | Chautapalle | 1020 | 35.5 | 3.5 |

Data on wasteland status has been generated for all the 18 villages lying in the study area. The extent of different wastelands in each village limit have been identified, mapped and calculated. The generated statistics shows that village Siddapur has maximum wasteland under its limits i.e. 1230.5 hectares which forms 37.8% of its total geographical area. Similarly village Chennaram possesses 17.5 hectares of wasteland forming 5% of its total geographical area. Large portions of Siddapur, Hajipur, Nadimpalle and Ainol lie under wastelands. Siddapur possesses a large patch of degraded forest, where as other three villages have large sections of “Upland with or without scrub”.

The study also includes mapping at sub-watershed level as well as micro-watershed level. The mapped details, being available at sufficiently large-scale were plotted on a cadastral base. The integrated map showed wasteland patches on a back-drop of individual land parcels.

## 3. Conclusion

It is common knowledge that, without accurate information about the land and water, without an up-to-date inventory of the country's natural resources the government and the people of a nation are handicapped in controlling their own destiny. It is impossible, even to the best of governments, to make excellent use of the land and its natural wealth or to prevent its misuse, without good, factual knowledge of the country and its features.

Wastelands being an important aspect in land-use planning & development, needs to be put on a LIS base so that all the available details of parcels and land can be incorporated in the developmental planning of wastelands. Action plans can be generated mandal wise or village wise, giving sufficient scope to village groups or co-operative societies to initiate steps for reclamation. Availability of such micro-level details of wasteland can also help in preparation of micro level developmental plans for land and other allied resources.

As semi-arid tropics cover most of the under-developed and developing countries of world and as people of this region are mostly dependent on agriculture and allied activities, sufficient effort need to be put for land-resources of the region. Availability of such detailed information on cadastral base can accelerate land-resource development/reclamation activities.

## 3. Acknowledgement

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