TM/Landsat-5 and Sar Image Digital Processing Applied to Identify Salt Affected Soils Zones in the Baixada de Sousa, State of the Paraíba, Brazil

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Abstract: This paper describes the use of TM/Landsat-5 and Radarsat digital image processing to study salt affected soils zones in arid and semi-arid regions, Baixada de Sousa, in the State of the Paraíba, Brazil has been selected as a test area.

Keywords: remote sensing, salt soils, GIS.

1 - Introduction

One of the principal land degradation processes, resulting from the desertification, relates to the salinization of agricultural lands. The conventional methods used to study this problem are very expensive. Thus we propose to use a combination and integration of Earth Observations data within the structure of a GIS to study salt affected soils zones in the semi-arid of the Paraíba

2 - Innovation

This study represents the first opportunity to assess the use of RadarSAT in the semi-arid regions of the State of the Paraíba. The recurring nature of this drought phenomenon requires a space-based approach to assessment and information generation. RadarSAT offers significant potential in this regard since the region (although arid) has a ubiquitous cloud cover.

3 - Methods

The methodological approach is based on the use of two remote sensing packages; PCI and SPRING. The field data has been collected to supported the digital analysis. During the fieldwork a visual reconnaissance of the study area was conducted, that included the description of the natural elements and the description of the socio-economic aspects. Validation of TM and RadarSAT data is being conducted at detailed sampling sites within the study area. Sampling is being supported by a GPS system of the UFPB. The geophysical, socio-economic, and spatial variables collected during fieldwork is being integrated into a single GIS database of the study area. This framework will become the focus for an assessment of the integration of RadarSAT data into the drought assessment objectives of this research project.

4 – Results

4.1 – TM/Landsat-5 digital analysis

The digital analysis of the TM/Landsat-5 images was processed directly in the SPRING. The band-by-band visual analysis allowed to evaluate and to select the best bands that characterize the study area. After the selection of the more representatives TM/bands, the colour image was classified using the Maximum Likelihood Classifier (**Figure 1a**). The classified image was converted into vector image in the SPRING (**Figure 1b**). The **Figure 3** shows the final map resulted form the integration of the TM digital analysis and field work data. Comparing the **Figures 3 & 4** it is easy to see that the results of this work enriched the knowledge about the distribution of the salt affected soils zones in the study area.
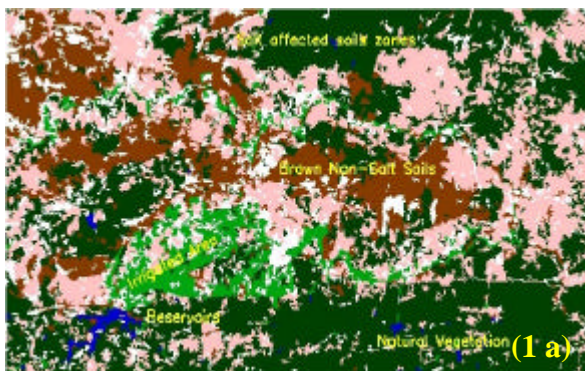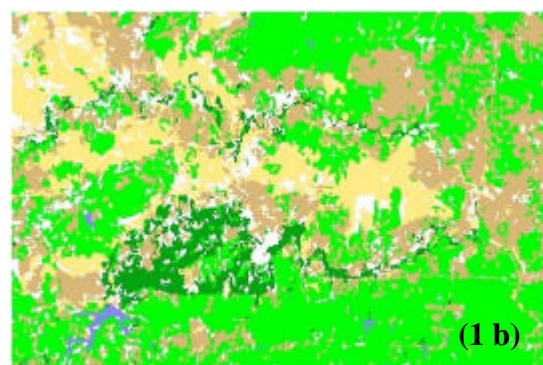

(1 a)

(1 b)

Figure 1 – a) Classified TM image   **b) – Vector image**

Salt Soils Zones	Brown Soils	Salt Soils Zones	Brown Soils
Natural Vegetation	Irrigated Area	Natural Vegetation	Irrigated Area
Reservoirs		Reservoirs	

Figure 2 – Map of the Salt Affected Soils Zones   **Figure 3** – Pre-existent Soil Map

Salt Soils Zones   Non-Salt Soils Zones   Salt Soils Zones

4.2 – Preliminary results of the SAR digital analysis

The SAR image was analyzed in PCI and in SPRING. In SPRING the SAR image was registered on the TM/Landsat-5 image. 28 control points had been used. The result was very satisfactory, although the acquisition process of these 2 images is very different. After the registration the SAR image was classified. The **figure 4a** shows the comparative analysis between the classified Sar image and the areas of salt soils occurrence. SAR image together with TM/bands 3 and 5 was treated by the Principal Components (**Figure 4b**). The **Figure 4c** shows the comparative analysis between the classified principal component image and the areas of salt soils occurrence (**Figure 2**).
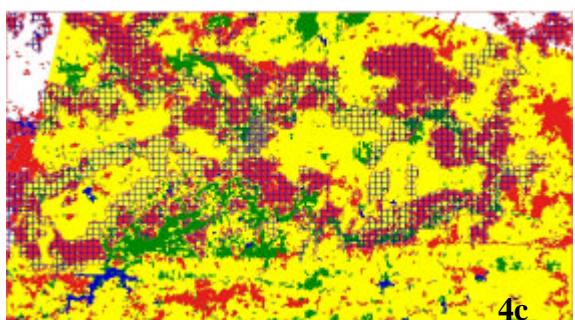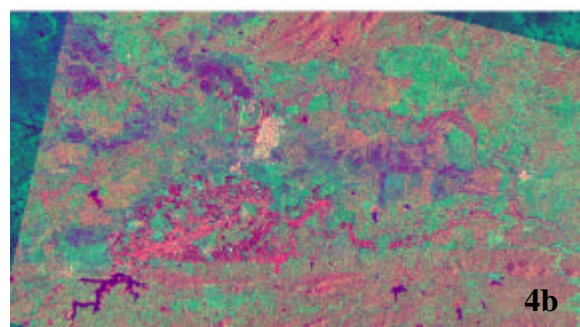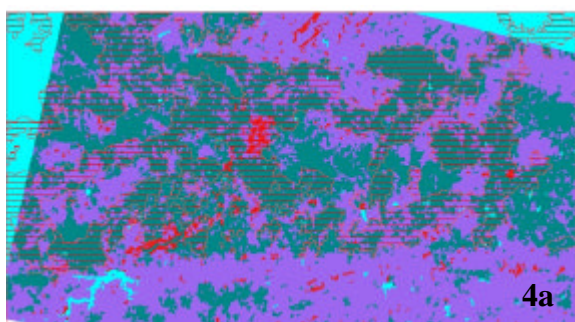
Figure 4a – Comparative analysis between Classified Sar Image and the areas of salt soils occurence;

Figure 4b – Sar/Tm Principal Components RGB image (PC1+PC2+PC1)

Figure 4c – Comparative analysis between Classified PC Image and the areas of salt soils occurence;

The comparative analysis between our data and the pre-existent data points to a rising of the salinization process in the region of the Baixada de Sousa. During the field work we observed that the environmental degradation was also followed by the social degradation. Economic deterioration was very high and the rural families have great difficulties to remain themselves in day-by-day. Technical deterioration was also very high, and shows the degree of abandonment of the rural man by the authorities. Today, many of the small farmers families already do not work in the agricultural business, due to degradation of their lands. Instead they work in the extraction and exploration of carnauba in artisan and home production of the carnauba wax[1]. Our suggestion to recuperate the degraded areas by salinization is to reforest them with carnauba and to develop its sustainable extraction, by the small farmers. Parallel, the governments need to open an agricultural credit facility, with low interests, to foment the small familiars' industries and cooperatives, to improve the productivity and quality of the extracted product from carnauba. Also, the development of polices of commercialization of the products becomes necessary, to finish with the presence of the profiteers, who today buy the products manufactured by these families for a very low price and sell for the industry to a price many times upper, having in the end of transaction a good profit, without having produced nothing.

5 – Acknowledgements

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[1] The carnauba well grouth in the salt soils but its exploration by the rural population, without planning, places in risk all the ecosystem of the region