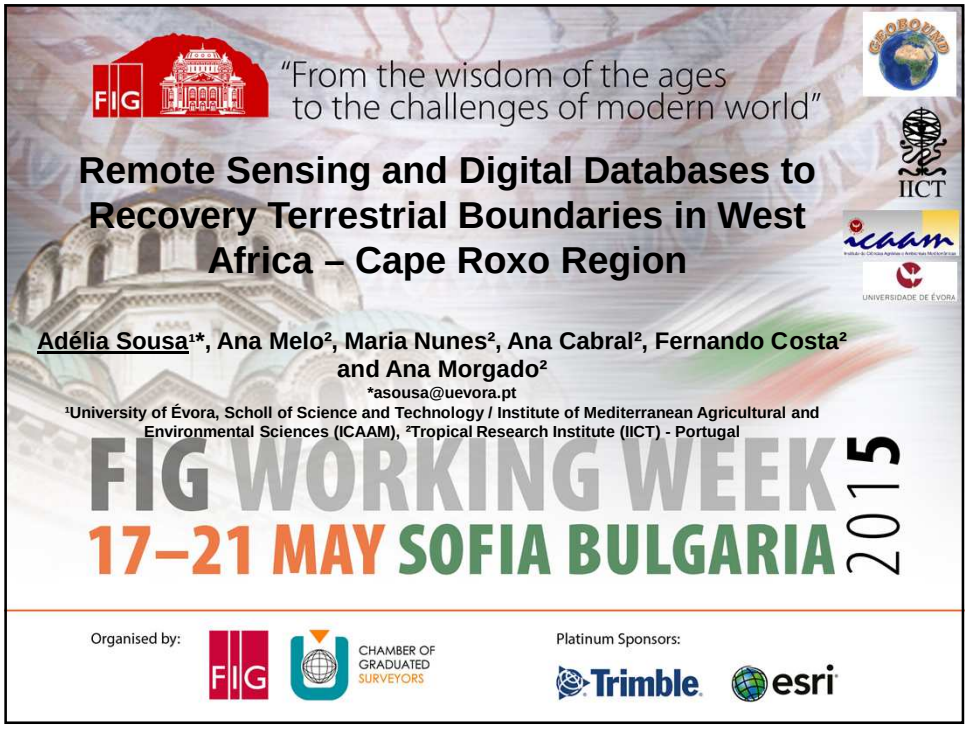

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Introduction / Objectives

- **This case study focuses on borderlands located in Guiné-Bissau, more specifically on the borderland of Cape Roxo region, with a controversial geographic location which have been raising great interest and several disputes, mainly due to the lack of geographical information.**
- **This study intends to contribute to clarify the problem combining geographical information and multitemporal analysis to define the exact position of some frontier beacons.**

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Study area

- **The study area is located in the more occidental sector of northern frontier of Guiné-Bissau – Cape Roxo region, was delimited by the middle distance of the Casamance and Cacheu rivers.**
- **The northern boundary of Guiné-Bissau with Senegal, consists of straight-line segments defined by beacons.**

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Study area

Cape Roxo beacon (nº.184), near the lighthouse

JMGIU/IICT, 1955

2009 http://autocaravanaspt.blogspot.pt/2009/03/dia-32-26.HTML

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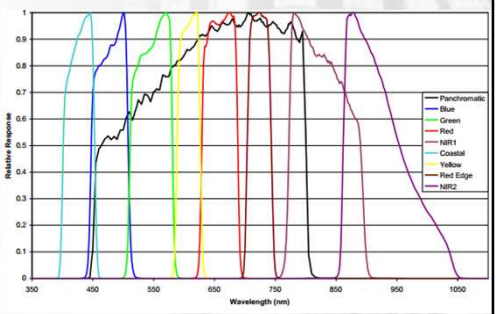
Data

- Varela map at a scale of 1:50 000 (1954);
- Two aerial photographs at a scale of 1:30 000, taken in 1953;
- Two satellite images from the WorldView-II sensor collected in 2013.

The WorldView-II images, have a panchromatic (PAN) band and eight multispectral (MS) bands with a spatial resolution of 0.50 m and 2.0 m, respectively.
b1 - Coastal
b2 - Blue
b3 - Green
b4 - Yellow
b5 - Red
b6 - Red Edge
b7 - NIR1
b8 - NIR2



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Methodology

- To perform the multitemporal study, the different remote sensing data and map were processed and compared using a Geographic Information System (SIG).

1. To improve the spatial resolution of the WorldView II images, several fusion algorithms merging PAN with the MS bands were applied.
   The Pan-sharpening methods used were Gram-Schmidt (GS), Principal Component (PC), Intensity-Hue-Saturation (IHS) and Colour Normalized (Brovey);

   The result was a Pan-sharpened Image (multispectral bands with a spatial resolution of 0.50 m);

   Pan-sharpened images were georeferenced and mosaicked;

2. Aerial Photographs and Analogic Map were converted to the digital format, georeferenced and mosaicked;

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Results - Fusion methods

- **Brovey method present the best result. The correlation coefficient was computed between the original MS bands and the equivalent fused bands, with a mean correlation of 0.9648.**

.


IHS


PC


GS


Brovey

	Band 1	Band 2	Band 3	Band 4	Band 5	Band 6	Band 7	Band 8
IHS	–	0.6760	0.7486	–	0.8941	–	–	–
Brovey	–	0.9652	0.9836	–	0.9456	–	–	–
PC	0.9360	0.4332	0.5583	0.5097	0.3304	0.1475	0.9391	0.9799
GS	0.6786	0.7238	0.8064	0.9195	0.9454	0.8018	0.6221	0.6165

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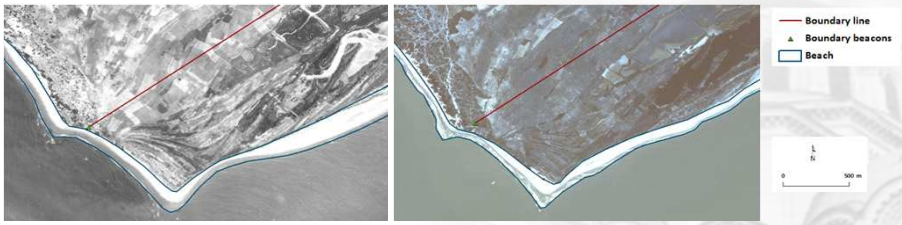
Results – Multitemporal study

Aerial photography (1953)

Satellite image WorldView II - RGB-5/3/2 (2013)



Comparing these two datasets, we concluded that between 1953 and 2013, at the southwest coast, the width of the beach was maintained with very small variations.

At the southeast coast, in south sector the beach area increased due to sedimentation in shoreline and in north sector of this coast the beach area was reduced.

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Conclusions / Final Considerations

- **The fusion technique that showed better results was obtained with the Brovey method.**

  Analysing the pan-sharpened image, we found some difficulties to identify the precise location of Cape Roxo beacon.

  Therefore, we concluded that concerning the boundary study, the spatial resolution of PAN and MS images must be higher to obtain a greater contrast and better sharpness, in order to improve the interpretation of the pan-sharpened image.

- **Multitemporal analysis showed relative stability of the inshore dune, where the beacon nº184 is located. The fieldwork done during the last month, allowed to validate this result.**

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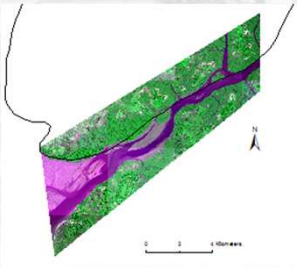
Future considerations

- **The results will be validated through fieldwork by collecting ground control points, over boundary beacons, using the Global Navigation Satellite System (GNSS) technology.**

- **To improve the analysis and the definition of the frontier, a WorldView-III satellite image, with higher spatial resolution (0.30 m), has now been acquired in order to study the Ponta Cajete region, located in southern Guiné-Bissau sector.**

  Cape Roxo and Ponta Cajete, should be studied to analyse the evolution of the border line and the boundary beacons to precisely locate the terrestrial frontier.



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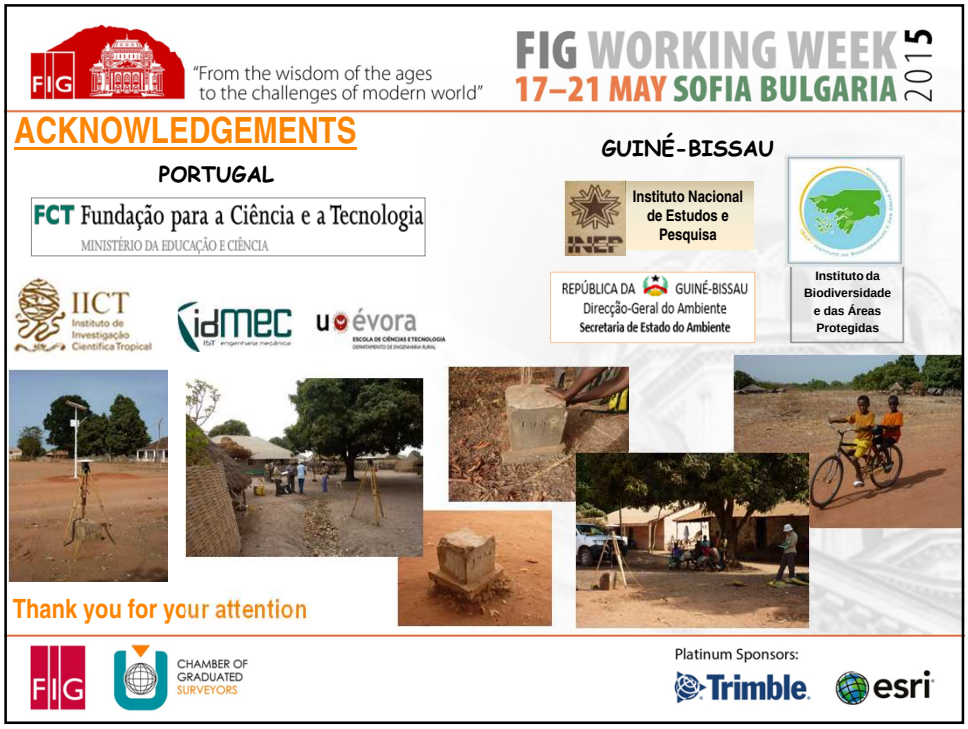
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ACKNOWLEDGEMENTS
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IICT Instituto de Investigação Científica Tropical
idmec IST engenharia mecânica
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