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Synergistic use of Hyperspectral and LiDAR data for coastal sand dune vegetation mapping in Portugal

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Introduction

- Recent advancements in geospatial technologies are benefitting different research areas.
- The increasing spatial resolution, spectral resolution and height information derived from hyperspectral imagery and LiDAR datasets has motivated research such as mapping of reeds, coastal mapping etc.
- The use of individual data is not preferred nowadays for more accurate and precise mapping due to spectral mixing or due to underlying features. Data integration or data fusion enhance mapping or removing certain amount of spectral mixing with hyperspectral imageries and covering 3D structure from LiDAR datasets.
- Different people have worked on the data integration or fusion of either multispectral imageries with LiDAR data or hyperspectral imageries with LiDAR data for forest estimation.

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Questions

- What textural characteristics are helpful in identifying *Acacia* species in sand dune vegetation?
- Does *Acacia* have certain intensity values, which can be identified by LiDAR?
- How can we identify *Acacias* species in the dune vegetation - by spectra, texture or intensity?

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Research statement

- Why shall we integrate the Hyperspectral and LiDAR data?

1. To map the species accurately using spectral profiles and intensity of LiDAR
2. To test an object-oriented image classification with and without LiDAR
3. To examine whether first and last return LiDAR data are helpful in identification of species
4. To quantify the difference that using the first and last return will provide for mapping *Acacia* species
5. To determine which factors lead to invasive growth of *Acacia* species on the slopes of sand dunes.

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Aims and objectives

- Textural characterisation of sand dune vegetation classification using integrated hyperspectral and LiDAR data.
- Analysis of spatial distribution of *Acacia longifolia* in sand dune habitat with its 3D structure.

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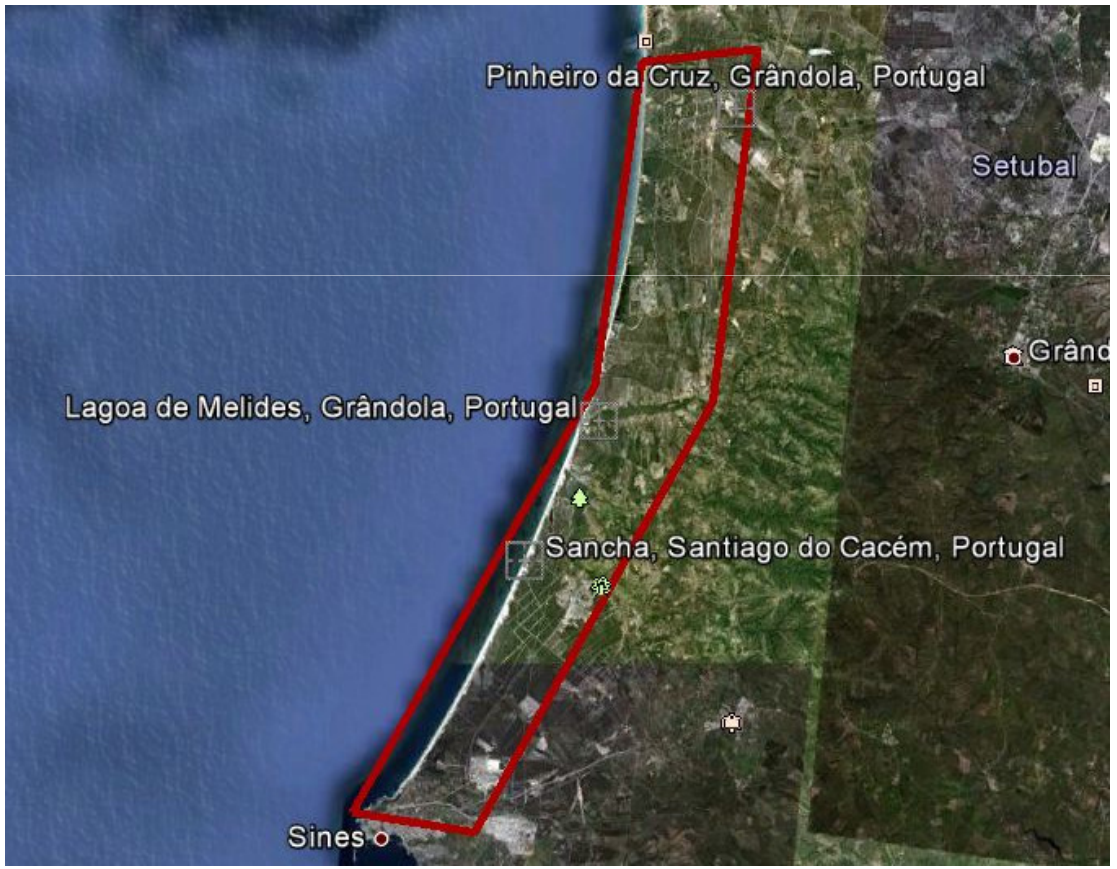
Location of Study area

- Portugal is the western most country in continental Europe.
- Study site is located (5 x 35 km) at coastal strip in South West of Portugal.



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Background of study & Data to be used

- **Habitat types**: Open dunes and dune forests
- **Flight campaign details**:
  - Date of Flight: 08 April 2011
  - Operator: Natural Environmental Research Council (NERC)
  - Leica RCD 105 Digital Photogrammetric Camera
  - **Hyperspectral AISA Eagle/Hawk sensor**
    - Spectral resolution 350nm -2400nm, 2.9 /8 nm
    - Spatial resolution: 0.75 m to 1.7 m
  - **LiDAR Leica Geosystems ALS50-II**
    - Average point density 4.5 points/m^2; Average Point spacing 0.64m
    - Multiple Pulse in Air (MPiA), up to 4 returns

***Data Source- EUFAR (European Facility for Airborne Research)**

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Expected outcomes

1. Method for data fusion of hyperspectral and LiDAR data.
2. Map of the spatial distribution of *Acacia* in a Portuguese sand dune environment.
3. 3D structure of *Acacia* spread in the sand dune with its total contribution to the region.
4. Last but not least, accuracy achieved in mapping the sand dune *Acacia* species.

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Timeline of the project

Sl		Year-1				Year-2				Year -3			
		Oct	Dec	Feb	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Sep
1	Pilot study				APG								
2	Review of Literature												
3	Data analysis												
4	External training												
5	Data collection phase												
6	Fused data work												
7	Model testing for *Acacia location & spatial* distribution												
8	Model evaluation												
9	Final write-up												
10	Thesis submission												

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- Any suggestions are welcome….