Hyperspectral remote sensing and analysis of intertidal zones: A contribution to monitor coastal biodiversity

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Overview:
Hyperspectral remote sensing and analysis of intertidal zones

1. Introduction:
   Research goals and study area

2. Data and analysis approach

3. Results:
   Biotope classification and data accuracy

4. Perspectives of GIS-RS-based environmental monitoring
Study area
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Biotopes in the study area

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2. Data analysis
3. Results
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- Red algae area (Mastocarpus)
- Abrasion platform of the northern intertidal
- Musselbed with brown algae (Mytilus and Fucus)
- Green algae zone (Enteromorpha)
Working scheme

Data Collection
- Hyperspectral Aircraft Survey with ROSIS
- GPS-supported Groundtruthing

Pre-Processing
- Radiometric and Geometric Correction

Hyperspectral Image Analysis
- Spatial Data Reduction: Minimum Noise Fraction-Transformation
- Spectral Data Reduction: Pixel Purity Index
- Endmember Selection: n-Dimensional Visualizer
  Compilation of a Spectral Library
- Final Classification: Spectral Angle Mapper

Monitoring
- Integration of Remote Sensing Data in Geographical Information Systems
- Establishment of a standardised long-term observation system
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Biotope classification


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Biotope classification

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### Thematic accuracy

<table>
<thead>
<tr>
<th>Classified Data</th>
<th>Reference Data</th>
<th>Total</th>
<th>User’s Accuracy %</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Veget.</td>
<td>9</td>
<td>15</td>
<td>60</td>
</tr>
<tr>
<td>Brown Algae</td>
<td>19</td>
<td>32</td>
<td>59,4</td>
</tr>
<tr>
<td>Dense Brown Algae</td>
<td>38</td>
<td>42</td>
<td>90,5</td>
</tr>
<tr>
<td>Red Algae</td>
<td>24</td>
<td>26</td>
<td>92,3</td>
</tr>
<tr>
<td>Green Algae</td>
<td>18</td>
<td>18</td>
<td>100</td>
</tr>
<tr>
<td>Kelp</td>
<td>3</td>
<td>28</td>
<td>60,7</td>
</tr>
<tr>
<td>Vegetated Channels</td>
<td>17</td>
<td>24</td>
<td>83,3</td>
</tr>
<tr>
<td>Mussel bed</td>
<td>12</td>
<td>36</td>
<td>75</td>
</tr>
<tr>
<td>Barnacles</td>
<td>3</td>
<td>45</td>
<td>66,7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>12</strong></td>
<td><strong>266</strong></td>
<td><strong>76,4</strong></td>
</tr>
</tbody>
</table>

### Producer's accuracy %

- No Veget.: 75%
- Brown Algae: 100%
- Dense Brown Algae: 100%
- Red Algae: 64,9%
- Green Algae: 81,8%
- Kelp: 85%
- Vegetated Channels: 50%
- Mussel bed: 69,2%
- Barnacles: 76,9%

**Overall Producer's accuracy %:** 75,9%
Location accuracy

Red Feature Line of Mole Parts in 1-03 Displayed on Image 2-03

Offset: 18 m between the two images (not showing the Offset from the "real world" position)

Offset: 12-14 m

Offset: 17-18 m Varying within the image
Field work

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Integrated GIS-RS-analysis approaches


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The presented study has been performed at the Alfred-Wegener-Institute for Polar and Marine Research (AWI Bremerhaven) for a Diploma Thesis at the University of Cologne, Department of Geography.

Field work has been conducted with the support of the Biologische Anstalt Helgoland (BAH) and the Wadden Sea Station Sylt (List).

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Thanks for your attention!