HeathReCover - Remote sensing support to assist ecological restoration management after heathland fires

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http://heathrecover.vgt.vito.be
HeathReCover – Administrative details

» Project Period: Feb 2012 – Dec 2013

» Belspo co-funding project

» Partners:
HeathReCover – Project background

» Heathlands and peat bogs ecosystems
  » Highly valued landscapes of common European heritage
  » Large investment of effort and resources to conserve and manage them
  » Yet ... under threat:
    » Anthropogenic activities
  » But also: (natural) phenomenon of uncontrolled fire

» RS has been shown to be useful to study fire – ecosystem interaction, but..
  » Mainly forest ecosystems
  » Limited research with hyperspectral and/or very high spatial data
  » Limited research on long-term analysis
HeathReCover – Recent fire events in Belgium

→ Maybe a tragedy, but definitely an opportunity..

» The *Kalmthoutse Heide*
  » May 25-26, 2011: +/- 450 ha of heathland (i.e. half of the core area)
  » 21 April 1996: +/- 330 ha of heathland and forest

» The *Kalmthoutse Heide*
  » Study area for RS projects over the past years
  » Short-term and long-term possibilities
  » Large amount of data (field and image)

→ Ideal Study Site

» The *Hautes Fagnes*
  » April 25, 2011
  » > 1300 ha (i.e. biggest fire ever in HF)

» The *Hautes Fagnes*
  » Less abundant data

→ Suitable Test Site
HeathReCover – Project objectives

“...to use RS as a tool to spatially and temporally investigate the complex interactions between fires and heathland and peat bog ecosystems”

More Specific:

- Delineate the burn scars in detail using VHSR airborne digital VNIR UltraCam data
- Develop new methods to assess heathland and peat bog fire severity using hyperspectral data
- Map the abiotic conditions (e.g. soil typology and hydrology) just after a fire to enable the investigation of their relationship to fire and vegetation re-growth patterns
- Spatially explicit assess (ecological loss in and restoration of) heathland and peat bog vegetation and habitats in the short-term, using hyperspectral data
- Investigate the potential of time-series analysis of historical Landsat datasets to characterize long-term post-fire heathland vegetation re-growth patterns
HeathReCover – Project approach – Study areas

» The *Kalmthoutse Heide*

**Before...**
During...
HeathReCover – Project approach – WP breakdown

<table>
<thead>
<tr>
<th>WP 1: Project management and Dissemination</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data</strong></td>
</tr>
<tr>
<td>WP 3.1: Burn Scar Delineation</td>
</tr>
</tbody>
</table>

**Data**

Short-Term Analysis

Long-Term Analysis

- WP 2: Data collection and pre-processing
- WP 3: Burn and Fire severity assessment of heathland fires
- WP 4: Analysis of vegetation re-growth patterns
- WP 5: Short-term assessment of ecological loss
- WP 6: Long-term assessment using historical time-series

**Logos**

[Logos]
HeathReCover – Current activities, first results

- Burn scar delineation - new method based on RGBNir VHSR digital camera images
HeathReCover – Current activities, first results

» Fire/Burn severity analysis

» Modification and insights of GeoCBI usability in heathland ecosystems

» Correlation of GeoCBI to several spectral indices is strongly dependent of vegetation type..
HeathReCover – Current activities, first results

» Fire/Burn severity analysis

<table>
<thead>
<tr>
<th>Index</th>
<th>Acroniem</th>
<th>Formule</th>
<th>Referentie</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normalized Difference Vegetation Index</td>
<td>NDVI</td>
<td>$NDVI = \frac{NIR-R}{NIR+R}$</td>
<td>Tucker (1979)</td>
</tr>
<tr>
<td>Global Environmental Monitoring Index</td>
<td>GEMI</td>
<td>$GEMI = \gamma(1 - 0,25 \gamma) - \frac{R-0,125}{1-R}$ met $\gamma = \frac{2(NIR^2 - R^2) + 1,5 NIR + 0,5 R}{NIR + R + 0,5}$</td>
<td>Pereira (1999)</td>
</tr>
<tr>
<td>Enhanced Vegetation Index</td>
<td>EVI</td>
<td>$EVI = 2,5 \frac{NIR-R}{NIR-6R-7,5B+1}$</td>
<td>Huete et al. (2002)</td>
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<td>Soil Adjusted Vegetation Index</td>
<td>SAVI</td>
<td>$SAVI = (1 + L) \frac{NIR-R}{NIR+R+L}$ met $L = 0,5$</td>
<td>Huete (1988)</td>
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<tr>
<td>Modified Soil Adjusted Vegetation Index</td>
<td>MSAVI</td>
<td>$MSAVI = \frac{2NIR+1 - \sqrt{(2NIR+1)^2 - 8(NIR-R)}}{2}$</td>
<td>Qi et al. (1994)</td>
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<tr>
<td>Burned Area Index</td>
<td>BAI</td>
<td>$BAI = \frac{1}{(0,1+R)^2 + (0,06+NIR)^2}$</td>
<td>Chuvieco et al. (2002)</td>
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<tr>
<td>Normalized Burn Ratio</td>
<td>NBR</td>
<td>$NBR = \frac{NIR-LSWIR}{NIR+LSWIR}$</td>
<td>Key en Benson (2005)</td>
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<td>Char Soil Index</td>
<td>CSI</td>
<td>$CSI = \frac{NIR}{LSWIR}$</td>
<td>Smith et al. (2007)</td>
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<tr>
<td>Mid-Infrared Burn Index</td>
<td>MIRBI</td>
<td>$MIRBI = 10 LSWIR - 9,8 SSWIR + 2$</td>
<td>Trigg en Flasse (2001)</td>
</tr>
</tbody>
</table>
HeathReCover – Current activities, first results

» Fire/Burn severity analysis

<table>
<thead>
<tr>
<th>Vegetatiotype</th>
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<th>a</th>
<th>b</th>
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<tbody>
<tr>
<td>Struikhei</td>
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<td>andere klassen</td>
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Time for Questions..

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