EARTH CASE STUDY

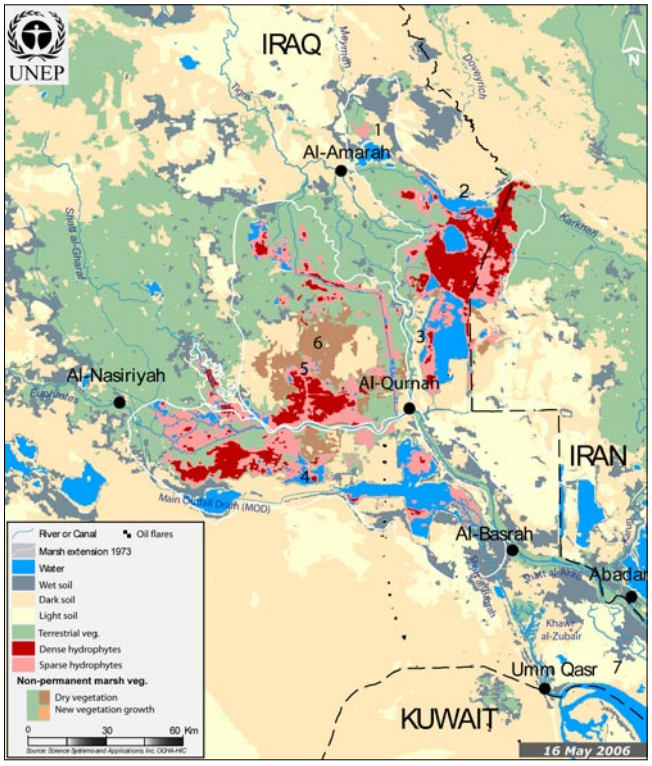
Iraq Marshlands Observation System

Since May 2003, remarkable and rapid environmental change has been taking place in the Iraqi Mesopotamian Marshlands. After over a decade of decline, in less than one year (May 2003 - March 2004), more than 20% of the original marshland area has been re-flooded.

During this critical phase, it is critical to monitor the distribution of the present reflooding and the nature of the associated ecological changes taking place. Systematic assessment of ongoing changes is essential to achieve a better understanding of the dynamics of the recovery process and to help support decision-makers and stakeholders undertake efficient rehabilitation measures.

The main goals of the IMOS are to:

- Develop and implement a monitoring system to systematically acquire, analyse and exchange information about changes in the Marshlands ecosystem;
- Develop informatio n products and services based on the data gathered to support management of the restoration process; and
- Evaluate the success of wetland restoration and its impacts on the regional environment, including that of the northern Persian Gulf.



During a first phase of the IMOS project, a team of GRID-Europe's Earth Observation Section explored the data sources available and the potential methododologies to extract pertinent information from satellite imagery. One of the IMOS requirements being the provision of vegetation and inundation maps on a weekly basis, the team developed a novel approach based on object extraction and classification from MODIS imagery, using the Definiens eCognition software.

Methodology

Segmentation is the sub-division of an image into separate regions. Throughout the segmentation procedure, the whole image is partitioned into objects, enerated following several adjustable criteria of homogeneity or heterogeneity in colour and shape. The optimal result is given by a weight of 0.1 and 0.9 applied to shape and colour. An equal weight was applied to the compactness and smoothness. A weight of 1 was applied to the red, blue, green, infrared bands and to the shapefile for a scale of 10.

Classification

Vegetation vs non-vegetation
NDVI was used to discriminate vegetation from non-vegetation. All the objects having a NDVI value higher than 0.14 are ascribed to the vegetation class. On the false colour image, the vegetation appears in various shades of red.

Sparse, Medium, Dense vegetation
Vegetation could be separated into 3 different levels (sparse, medium and dense), depending to the NDVI values . The criterion is:
[Sparse veg. < 0.2 < Medium veg. < 0.3 < Dense vegetation]

Sparse, medium, dense marsh marsh
To separate the marsh from the other vegetation, the shapefile corresponding to the delimitation of the marsh and the brightness were used. If an object is inside the delimitation of the marsh AND if its brightness is less than 1600, it is classified as marsh. Vegetation could be separated into 3 different levels: sparse, medium and dense. The criterion is: [Sparse, medium, dense marsh < 1600 AND Value of the delimination of the marsh=1]

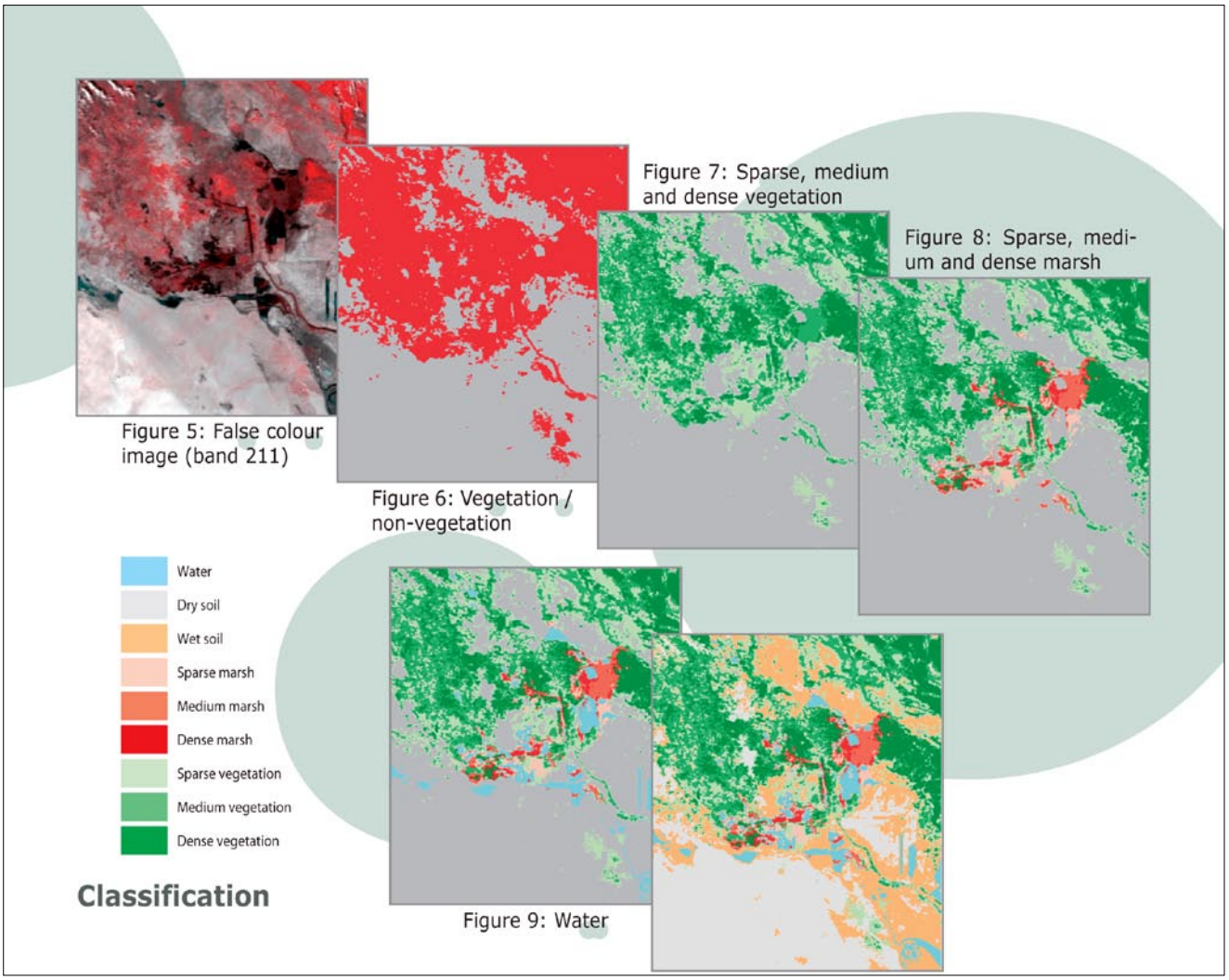
Water bodies vs Soil
Water and wet surfaces appear in black and dark grey on the NIR image because water absorbs energy at infrared wavelengths. Non-vegetation has been further subdivided into water and soil using the NIR image and according to the criterion [Soil < 1800 < Water]

Dark soil vs light soil
A subdivision of soil is possible in terms of darkness. The chosen cutoff is:
[Dark soil < 3100 < Light soil]

Apply the methodology in another image
The methodology was developed on the 5 March MODIS image, and then applied to the 3 and 18 february image. Some adjustments are needed because of the difference in brightness from one image to the other. The approximate time needed for the pre-processing and classification is about 1 hour.

Conclusion
These preliminary results are encouraging, and this approach will be applied on an operational basis to derive and archive land cover maps of the marshes (2003-2004), as well as weekly maps for 2005. Together with statistics on the water and vegetation surfaces, these maps will be delivered through a website to Iraqi partners and agencies active in the restoration of the marshlands.

The figure below shows the various steps followed to extract nine land cover classes at a resolution of 250 m.



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Founded in 1994 by Nobel Laureate Prof. Dr. Gerd Binnig, Definiens is a multi-national organization with headquarters in Munich, Germany and offices in the US and UK.

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