

## 4.3 Fraction of Absorbed Photosynthetically Active Radiation (FAPAR)

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Part of the radiation from the sun is absorbed by vegetation for growth. This is known as FAPAR or the Fraction of Absorbed Photosynthetically Active Radiation. Regular observations of FAPAR can help characterise the seasonal growth cycle of vegetation and monitor its inter-annual variability. It is useful for early warning of droughts and provides information on the efficiency of plants to absorb CO<sub>2</sub>. A related concept, vegetation phenology, is used to describe the study of the timing of recurring events (e.g. bud-burst) and their causes.

Photo: © Brian O'Connor



Artist's impression of Envisat. Source: ESA



### Measurements

FAPAR is not directly measurable, but is inferred from models describing the transfer of solar radiation in plant canopies. Ground-based reflectance measurements are made at local scales and for research studies and are very labour intensive. There is no long-term *in situ* monitoring programme in Ireland. Regional FAPAR estimates are generally based on observations from satellite sensors, which have the ability to measure the visible and infra-red radiation reflected by the Earth's surface on a regular basis.

'An analysis of FAPAR data for 2003 to 2009 has shown that it can be used to identify the start of spring in different land cover types.'

## Time-series and Trends

The time-series of FAPAR images (Fig. 4.6), based on data from *ENVISAT* MERIS, over Ireland in 2010 for the periods (a) 1–10 January; (b) 1–10 May; (c) 1–10 July; (d) 1–10 September illustrates how photosynthetic activity varies during the year. The red regions correspond to high photosynthetic activity, and yellow to white areas, indicate vegetation with a low degree of photosynthetic activity. An analysis of FAPAR data over Ireland for 2003 to 2009 has shown that it can be used to identify the start of spring in different land-cover types.

'Work is required to analyse existing satellite datasets fully and explore the relationship of FAPAR with vegetation phenology and other climate parameters.'

## Maintaining the Observations

Preliminary analysis of FAPAR data for Ireland for the period 2003 to 2009 has been carried out as part of a research project at University College Cork. Additional work is required to analyse existing satellite datasets fully and explore the relationships with vegetation phenology and other climate parameters: however, there are no programmes to carry this out at present.

### Further Information and Data Sources

O'Connor, B., Dwyer, E., Cawkwell, F. and Eklundh, L. (2012) Spatio-temporal patterns in vegetation start of season across the island of Ireland using the MERIS Global Vegetation Index, *ISPRS Journal of Photogrammetry and Remote Sensing*, Vol. 68, pp. 79–84.

Information on the JRC FAPAR project:

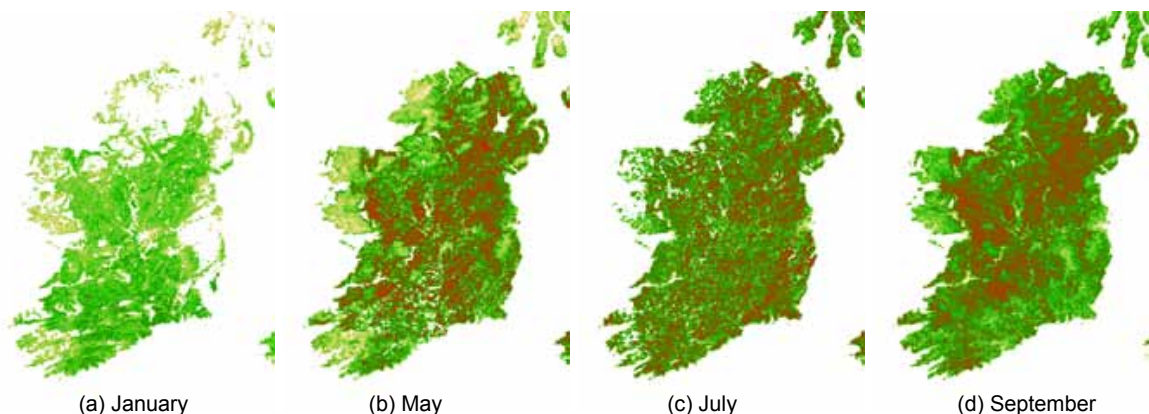
<http://fapar.jrc.ec.europa.eu/Home.php>

Information on the NASA MODIS FAPAR project:

[http://modis.gsfc.nasa.gov/data/dataproduct/dataproducts.php?MOD\\_NUMBER=15](http://modis.gsfc.nasa.gov/data/dataproduct/dataproducts.php?MOD_NUMBER=15)

Information on the CarboEurope IP project:

<http://www.carboeurope.org/>



**Figure 4.6.** Fraction of Absorbed Photosynthetically Active Radiation (FAPAR) derived from a series of *ENVISAT* MERIS images for four periods in 2010.