Improved understanding of the regional carbon balance in Europe
Annette Freibauer

The Kyoto Protocol has emphasized the urgency of understanding the biospheric carbon cycle and how it will affect our ability to avoid dangerous climate change. Indeed, large biospheric carbon reservoirs are vulnerable to climate change, land use and management. CarboEurope-IP, an ambitious European research project, aims at better understanding and quantifying the European carbon budget to solve an important element of the global puzzle. The project is the first initiative of this kind and will ensure that Europe remains at the cutting edge of carbon cycle science.

Scientific verification of the European carbon balance

The large uncertainties in the biospheric carbon balance call for targeted monitoring and an independent scientific check of sinks and sources to build confidence in the efficiency of mitigation measures. CarboEurope-IP will provide to the European Community an observation system to detect the regional changes in biospheric carbon stocks and fluxes. Moreover, CarboEurope-IP will create the scientific basis for a precise monitoring system of carbon stocks and fluxes for all European states. The project comes at a critical time when the Kyoto Protocol is likely to come into force, when countries are considering future emission reductions, and when the multiple functions of the biosphere are revisited in view of mitigation and adaptation to climate change.

CarboEurope-IP vision

The long-term goal is a comprehensive, predictive understanding of the earth system with its non-linearities and feedbacks at global, regional and local level. The complex interactions between human activities, terrestrial biosphere, oceans and atmosphere pose the main challenge on this path, which could lead towards a wiser management of elements of the global carbon cycle. We share this vision with major global programmes for systematic observations (IGCO) and analysis of human – biosphere interactions (GCP).

Integration – key word of CarboEurope-IP

CarboEurope-IP realizes the next step towards this vision. Integrating a multitude of methods and sites of observation enables us to view the carbon cycle in the clearest possible way on the scale of the European continent and its main regions. About 100 measurement sites extending over all climate regions and major ecosystem types allow the determination of biome and region specific carbon fluxes. In parallel, airborne and ground-based measurements of atmospheric trace gas concentrations establish an independent verification of the regional estimates. This network of intensive observations is integrated with novel models of the biosphere and the earth system in order to assess and predict the fate of the terrestrial carbon. One of our major challenges is to preserve the focus on processes while broadening the space and time scales (see below).

CarboEurope-IP aims at an advanced analytical tool to monitor and predict systematically the carbon flows in Europe. We envisage a carbon nowcasting system – similar to weather forecast – with integrated measurements and models that will provide guidance for carbon management in an operational mode. Key elements:

- Intercalibrated, harmonized, operational measurements in atmosphere and biosphere
- Remotely sensed data of biophysical parameters and carbon dioxide in atmosphere columns
- Online data transmission, routine data processing and quality control
- Central data archive or interface
- Mechanistic earth system models including the effects of management
- Models assimilating the data in online mode (i.e., use measured data directly to correct model output)

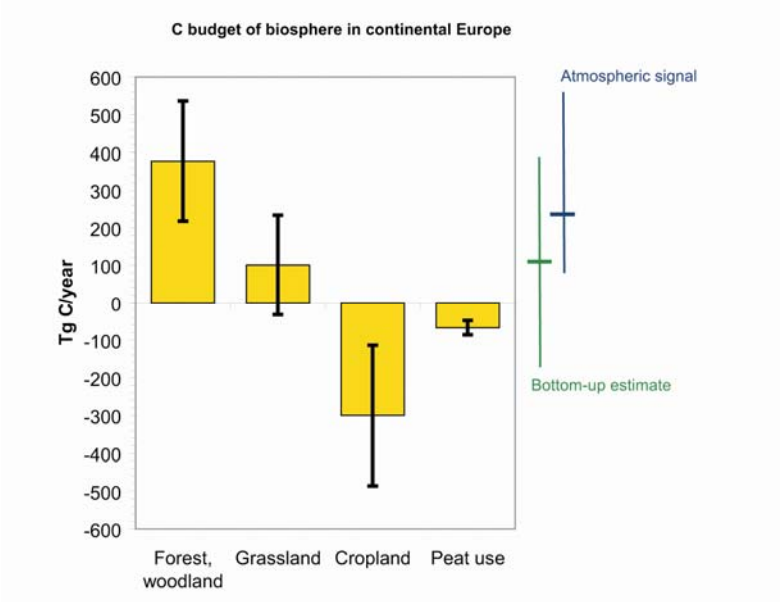
We also understand our mission as service to enhance the European citizens´ capabilities for the conservation and sustainable management of our precious, vulnerable biosphere.

CarboEurope-IP resources

Founded on eight years of intensifying international interdisciplinary cooperation, CarboEurope-IP has mobilized more than 150 European top senior scientists since January 2004. The project has a budget of more than 30 million Euro, of which 16 million Euro come as support from the European Commission, General Direction Research, under the Sixth Framework Programme. CarboEurope-IP engages 61 core institutes plus about 30 associated partners over a period of five years.

The European carbon balance – a delicate result of sinks and sources

As a first result, estimates of the carbon balance of the European terrestrial biosphere were obtained by inverse atmospheric CO_2 transport models (atmospheric signal) and by aggregating stock changes in terrestrial ecosystems (bottom-up estimate). Although there remain large uncertainties in both methods and unexplained divergence in the magnitude of the sink, the European biosphere was taking up between 135 and 205 million tons per year in the 1990s, the equivalent of 7 to 11% of the 1995 anthropogenic carbon emissions of Europe. This net sink results from a delicate balance between carbon uptake in forests, which is almost compensated by soil carbon losses from croplands and peat use (Janssens et al., 2003. Science 300, 1538, see below).



For further information please contact

Dr. Annette Freibauer
CarboEurope-IP Scientific Office
Max-Planck-Institute for Biogeochemistry
P.O. Box 10 01 64, 07701 Jena
Germany
Phone: +49-3641-576164
Fax: +49-3641-577100
E-mail: afreib@bgc-jena.mpg.de
Web: http://www.carboeurope.org/