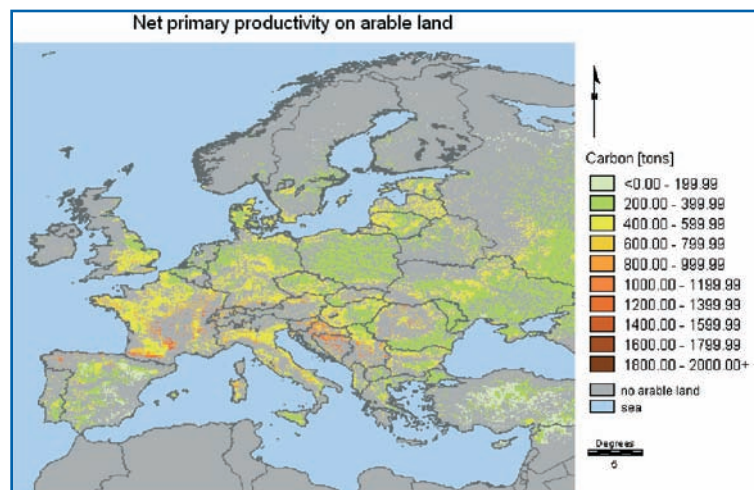


Bioenergy resource assessment

Description

At the German Aerospace Center (DLR) a methodology is developed analyzing the spatial distribution of biomass potentials with Geographical Information Systems (GIS, Gehrung & Scholz, 2007). Various remote sensing data is incorporated into this GIS tool. On the one hand data on land cover is used to assign various biomass fractions to their origin. Data sets such as PELCOM (Pan-European Land Use and Land Cover Monitoring) deliver information on land use in Europe at a high resolution. Specific biomass fractions are assigned to various land cover classes as more detailed information on the energy crop level is missing. Land cover classes used are e.g. arable land, grassland and forests and thus define the quality of biomass assessment in a given area.

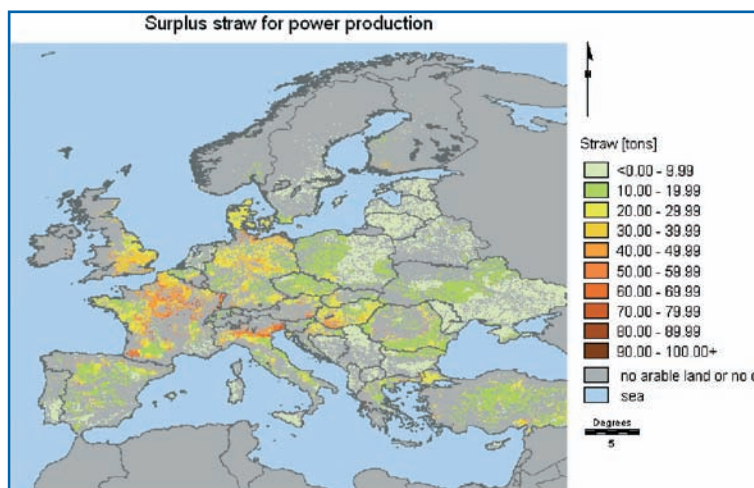
Based on a dynamic carbon cycle model BETHY/DLR (Wißkirchen und Günther, 2005) net primary productivity (NPP) and finally above ground biomass was estimated. Such a model is a special type of soil-vegetation-atmosphere-transfer (SVAT) model that makes estimates of the transfer of carbon from the atmosphere in the form of CO₂, to the earth in the form of C, commonly referred to as carbon fixation. The NPP model takes into account the photosynthetic processes, as well as the environmental conditions that affect photosynthesis.



Example of net primary productivity on arable land for 2005 derived from the BETHY/DLR model and EO data

Static inputs to the model, such as soil type or growth parameters associated with particular plants, come from existing databases. For variable inputs, such as vegetation state, NDVI and LAI from current satellite sensors are used. Daily atmospheric parameters as solar radiation, temperature and precipitation are obtained from the European Center of Medium Range Weather Forecasts (ECMWF). In some cases, the inputs required for the NPP models cannot be obtained directly from the sensor data, and must instead, be derived through some other models. Thus the NPP model, the static input databases, the satellite data, additional models, and suitable retrieval algorithms have to be merged together seamlessly into a single modelling chain.

The resulting distribution of NPP can be used in combination with forestry and agricultural statistics e.g. from EUROSTAT for deriving biomass energy potentials. Results have been obtained e.g. for surplus straw potentials from maize, rape, and cereals.



Example of surplus straw available for power production for 2005 derived from the BETHY/DLR model, EO and statistical data

References:

Gehring, J., Y. Scholz, Evaluating the benefit of simulated NPP data for modelling the spatial distribution of bioenergy potentials in Europe, submitted to Biomass & Bioenergy, 2007

Wißkirchen, K., K.P. Günther, Modeling the Net Primary Productivity of European land cover classes using remote sensing data. Geophysical Research Abstracts, Vol 7, 05450, 2005

Added value

GEO allows the provision of EO based vegetation monitoring to be used in services specifically adapted to user's needs in the bioenergy sector.

Relevance to GEO

This activity contributes to EN-07-01 (Management of Energy Sources) as it supports the development of EO services for resource assessment and monitoring of the bioenergy resource. The collaboration between energy system research and remote sensing specialists at DLR made this interdisciplinary work possible. Results are included in system analysis and policy planning tools in the energy system analysis research work at DLR (reference to EN-07-03, Energy Policy Planning).

Participants

DLR (D) – German Remote Sensing Data Center and Institute of Technical Thermodynamics, System Analysis Group

Experience from this work is reported to GEOSS also via the Energy Community of Practise.

Current Status and Next Steps

The methodology will be extended to more energy crops and applied to further years and regions.

A gap in remote sensing data is existing as there are no land cover classifications distinguishing between different energy crops. Therefore, statistical data from EUROSTAT with only rough spatial resolution is used. This could be replaced by improved land cover classifications in future.