ECV T12

BIOMASS

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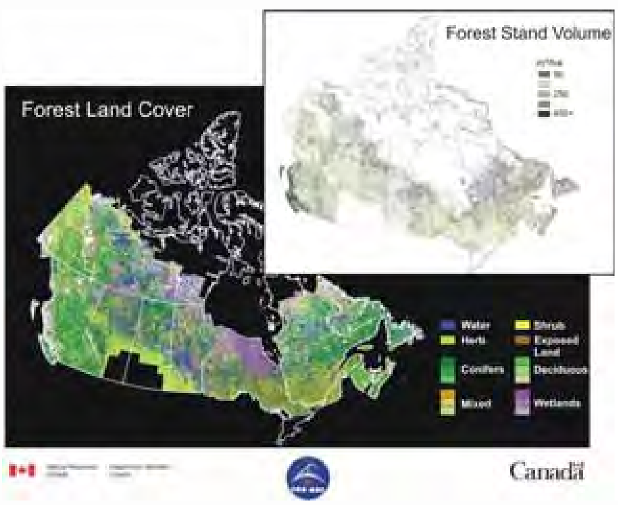
DEFINITION

Biomass is defined as mass of all organic matter per unit area at particular time (reported in g/m^2 or kg/ha). It plays two major roles in the climate system: (i) photosynthesis withdraws CO_2 from the atmosphere and stores it as biomass; (ii) the quantity of biomass consumed by fire affects CO_2, other trace gases and aerosol emissions.

Estimates of biomass change (due to land use and management practices or natural processes) enable a direct measurement of carbon sequestration or loss (as long as associated changes in soil carbon are accounted for) and can help to quantify the human induced impacts on global climate change and validate carbon-cycle models.

Carbon emission from deforestation is the largest source of greenhouse gas emissions in developing countries.



Example of a Landsat-type national product is the Earth Observation for Sustainable Development (EOSD) land cover map of the forested areas of Canada. The inset map depicts forest volume distribution, derived from integrating land cover with climate and Canada forest inventory data
(*Source*: R. Hall and E. Arsenault, Natural Resources Canada, Canadian Forest Service)

ECV IMPORTANCE

Global assessment of biomass and its dynamics are essential inputs to climate change forecasting models and adaptation strategies. The importance of biomass as an Essential Climate Variable is due to both to its role as a carbon sink during photosynthesis process and its growing use for generation of bioenergy. Sustainable management of biomass sources, in particular forests, which store most of the Earth's biomass, contributes to reduction of carbon dioxide in the atmosphere, mitigation of climate change and environmental protection.

MONITORING OF BIOMASS

In general, there are four main approaches to monitoring biomass:

- destructive sampling;
- non-destructive sampling, such as forest inventories;
- inference from remote sensing, and
- models.

In practice, the monitoring of biomass depends primarily on inventory information, even at regional and global levels. Remote sensing data can support inventory approaches by informing on current conditions and changes in forests.

AVAILABLE OBSERVATIONS

Most countries have operational methodologies for woody biomass inventories, typically using field-based surveys, or a combination of remote sensing and field-based observations. Such national data typically form the basis for the annual reporting on forest resources (i.e. in the context of the UNFCCC). In contrast, biomass information is uncertain for many developing countries, which are often those undergoing the fastest rates of deforestation.

Biomass is a major repository of carbon, which constitutes about half of its dry weight

National inventories differ greatly in definitions, standards and quality, and the detailed information available at national level is normally unavailable internationally. Some regional harmonization efforts, such the European Forest Inventory, lead to improved regional information. Nevertheless, biases and uncertainties in these summary values are not quantified.

At the global level, FAO regularly monitors the world's forests through a Global Forest Resources Assessment. It is based on countries' reports and remote sensing assessment at sampling sites. FAO also conducts land cover mapping in developing countries based on remote sensing and using the Land Cover Classification System (LCCS). Furthermore, there are number of initiatives and networks that undertake *in situ* measurement initiatives. Many of these networks can be viewed in the Terrestrial Ecosystem Monitoring Sites (TEMS) database, an international directory of sites and networks that carry out long-term, terrestrial *in situ* monitoring and research activities.

Potential for estimating biomass from space has been demonstrated in a number of research projects. However, improvement, development and implementation of approaches that integrate field and satellite based observations for the estimation of biomass are required. Remote observations (combined with *in situ* data) may be particularly useful in developing countries where the largest uncertainties in biomass estimates and carbon sequestration or loss exist. Particular direct biomass estimation potentials result from vegetation LIDAR observation. In addition, the JAXA ALOS-PALSAR L-band (24 cm wavelength) satellite radar currently in orbit should be able to supply information on the lower range of biomass (up to 50-80 t/ha). The BIOMASS mission currently under study for launch around 2014 by ESA uses a longer wavelength (68 cm) that should be able to sense higher levels of biomass.

FUNDING SITUATION

Resources are required to maintain and extend *in situ* capabilities and space-based observation assets to provide baseline data of worldwide consistency and availability. Capacity particularly needs to be built in developing countries. International cooperation and communication on biomass monitoring is required to standardize methodology, provide effective technology transfer and advisory services to developing countries, and coordinate national efforts, in order to develop long-term continuity and consistency in worldwide biomass monitoring. It is estimated that a budget of €210 000 would be required to initiate the required international cooperation activities over the next two years (this will cover the standardization of methodologies, technology transfer and capacity building activities).

RELATED LINKS:

Biomass standards: www.fao.org/gtos/ECV-T12.html | **FAO FRA:** www.fao.org/forestry/site/fra/en | **TEMS:** www.fao.org/gtos/tems
Amazon Forest Inventory Network: www.geog.leeds.ac.uk/projects/rainfor
WRI global database: http://earthtrends.wri.org/gsearch.php?va=map&kw=biomass&theme=0