



CDP Theme

Bioeconomy and Forests

Background on the JRC research in the thematic field

The Bioeconomy Unit provides scientific support to several EU policies¹ related to the sustainable production, as well as the use, of biological resources and their conversion to value added products, such as construction material, food, feed, bioenergy and bio-based products. The JRC has developed research in the field of forest assessment and monitoring since more than 10 years. Moreover, a group devoted to supply chain assessment is in place since 2006.

The three main areas of research of the Bioeconomy unit of the JRC are related to:

- 1) **Sustainable management of forests and forest resources by developing a knowledge base to protect our natural capital and the services it provides.** Forests face both competing demands for economic and ecological services, and threats, such as climate change and others environmental threats. Therefore, we develop novel methods to monitor forest resources and carbon emissions. In the tropics, these methods focus on deforestation and forest degradation. In Europe, we investigate, among others, how climate change and biotic disturbance agents, like pests, affect resilience in European forest ecosystems, by researching both the early detection of their effects, as well as longer term scenarios. This research is key for ensuring conservation and correct management of forest natural capital under different demand and potential pressures.
- 2) **Development of methods and models to monitor forest resources and carbon emissions/removals and to improve our knowledge of biomass supply, demand, and flows (including waste) both at EU and global levels.** JRC is in charge of assessing and modeling EU forests and the forest-based sector in support of the EU Bioeconomy Strategy², and is also responsible of the EU greenhouse gas (GHG)

¹ Bioeconomy (COM (2012) 60); 7th Environment Action Plan (Decision No 1386/2013/EU); Forestry (COM(2013) 659); EU forest strategy (COM (2013) 342); Plant Health law (Directive [2000/29/EC](#)); Building the single market for green products (COM(2013)196); Better regulation (COM(2015)215); Waste Framework Directive (2008/98/EC); circular economy and food waste (COM(2015) 614); EU GHG monitoring mechanism (525/2013 and 749/2014); LULUCF (529/2013; LULUCF legislative proposal COM(2016) 479)

² <http://ec.europa.eu/research/bioeconomy/index.cfm?pg=policy&lib=strategy> and COM(2012) 60 final

- inventory for the forest sector. In this context, we study the interactions with agriculture and other bio-based sectors (e.g. bioenergy, bio-based industry) and we develop methods to assess the sustainability of forest-based supply chains. Furthermore, research activities are focused on the understanding of the key processes that regulate the mitigation potential of the forest sector (carbon stock change of the forest and of the harvested wood products together with material and energy substitution) in the context of EU and international climate policies.
- 3) **Assessment of environmental benefits and burdens associated to the production and consumption of products along supply chains, applying life cycle assessment (LCA) methods.** The Bioeconomy unit is in charge of LCA modelling development and methodological improvements and is hosting the European Platform on LCA since 2006. Traditionally, LCA has been mainly applied to industrial system and the application to agricultural and forest sectors is still an area where major developments are needed due to the key importance of those sectors and the relative immature level of methodological development so far. Those are the areas and where JRC effort is focused.

Ongoing key projects and research

Specifically, with regard to the sustainable management of forests and forest resources, the Bioeconomy unit is handling projects dealing with monitoring tree health. The projects develop methods to monitor forests at the level of individual trees, using remote sensing methodologies across a range of spatial and temporal scales. This allows linking remote sensing data to the ecophysiological and biological processes that determine tree health, and particularly the pests and diseases that can cause damage from individual leaves to entire forests. The work aims at detecting the earliest stages of stress that are invisible to the human eye, to mapping conspicuous crown damage. By taking a “big-data” approach, the unit is conducting these analyses across entire landscapes, providing a unique detailed view of the drivers of forest health across scales. Currently, the tree health monitoring projects deal with the spread and impact of the Bursaphelenchus xylophilus, and Xylella fastidiosa, two of the quarantine pests that pose the major threat to European forest resources, and agriculture, respectively.

The JRC main contribution to the EU Bioeconomy strategy is provided by the Bioeconomy project. The JRC periodically provides the European Commission services with data, processed information, models and analyses of EU and global biomass supply and demand and its sustainability. In this context, the project is developing the overarching knowledge base on biomass supply, demand and flows at the EU and global levels, with a higher level of detail for Europe. This will provide a basis on which to assess the sustainability and impacts linked to the production and use of biomass, and the competition and synergies between sectors with regard to biomass resources. The analysis also includes the prospective analysis of future scenarios

with short-term (2020), medium-term (2030) and long-term (2050) horizons, a topic of high scientific interest.

The Forest and climate project provides scientific support to the policy makers in the European Commission and the Member States on the monitoring, reporting and verification of GHG emissions/removals from the Land Use, Land-Use Change and Forestry (LULUCF) sector. The JRC also contributes to the design of LULUCF-related policies at EU and international level (i.e. the Paris Agreement), and supports the integrated modelling of forest carbon dynamics at EU Member State level (including harvested wood products) through the forest Carbon Budget Model. Furthermore, the project is focused on assessing the recent, current and future land-climate interactions, and the combined (biogeochemical and biophysical) impacts of land-use change on climate.

On-going JRC projects related to Life Cycle Assessment (LCA) embrace several scales of assessment: from micro scale (e.g. goods, services, organizations), to meso scale (e.g. industrial sectors) and macro scale (e.g. EU-wide policy options). For example, the JRC is supporting the development and improvement of the Environmental Footprint methodology, and is involved in research activities related to the assessment of environmental impact of EU consumption in key areas such as food, mobility, housing, including their evaluation against planetary boundaries.

The senior staff of the LCA group is engaged in supervision of PhD thesis and participate to the evaluation committee of PhD's defenses. Moreover, five PhD students have been directly hosted in the group at the JRC.

Building on the leading role that the Bioeconomy unit has in the field, the CDP proposals address the development of novel and advanced methods for supporting the sustainability assessments of the management and use of natural resources in the context of the EU Bioeconomy in general and of the forest based sector in particular. To this end, PhD proposals intend to apply and improve novel approaches based on Life Cycle Assessment (LCA) and real time monitoring techniques.

Selected output for science and policy

Policy reports:

1. Grassi G., Dentener F. (2015) Quantifying the contribution of the Land Use sector to the Paris Climate Agreement; EUR 27561; doi 10.2788/096422 (Science for policy report)
2. Pilli R, Fiorese G, Abad Viñas R, Rossi S, Priwitzer T, Hiederer R, Baranzelli C, Lavalle C, Grassi G.; LULUCF contribution to the 2030 EU climate and energy policy; EUR 28025; Luxemburg (Luxemburg): Publications Office of the European Union, 2016; JRC102498; doi:10.2788/01911 (JRC technical report, with high policy relevance)

3. Wolf MA, Pant R, Chomkham Sri K, Sala S, Pennington D. (2011). International Reference Life Cycle Data System (ILCD) Handbook - Towards more sustainable production and consumption for a resource-efficient Europe. JRC Reference Report. European Commission

Peer reviewed papers:

1. Achard, F., Beuchle, R., Mayaux, P., Stibig, H.J., Bodart, C., Brink, A., Carboni, S., Desclée, B., Donnay, F., Eva, H.D. and Lupi, A., 2014. Determination of tropical deforestation rates and related carbon losses from 1990 to 2010. *Global change biology*, 20(8), pp.2540-2554.
2. Alkama, R., and A. Cescatti (2016) Biophysical climate impacts of recent changes in global forest cover, *Science*, 351(6273), 600-604. doi:10.1126/science.aac8083
3. Jonsson R, Rinaldi F, Rätty M, Sallnäs O (2016). Integrating forest-based industry and forest resource modeling. *iForest* (early view). – doi: 10.3832/ifor1961-009 [online 2016-08-12]
4. Laurance, W. F., Achard, F., Peedell, S., & Schmitt, S. (2016). Big data, big opportunities. *Frontiers in Ecology and the Environment*, 14(7), 347-347.
5. McDowell, N.G., Coops, N.C., Beck, P.S., Chambers, J.Q., Gangodagamage, C., Hicke, J.A., Huang, C.Y., Kennedy, R., Krofcheck, D.J., Litvak, M. and Meddens, A.J., 2015. Global satellite monitoring of climate-induced vegetation disturbances. *Trends in plant science*, 20(2), pp.114-123. <http://dx.doi.org/10.1016/j.tplants.2014.10.008>
6. Pilli R., Grassi G., Kurz W.A., Moris JV., Abad Viñas R. (2016) Modelling forest carbon stock changes as affected by harvest and natural disturbances. II. EU-level analysis. *Carbon Balance Management* 11:20 DOI 10.1186/s13021-016-0059-4
7. Pilli, R., Fiorese, G., Grassi, G. (2015) EU mitigation potential of harvested wood products *Carbon Balance and Management*, 10:6 doi:10.1186/s13021-015-0016-7
8. Sala, S., McLaren, S. J., Notarnicola, B., Saouter, E., Sonesson, U. (2016). In quest of reducing the environmental impacts of food production and consumption. *Journal of Cleaner Production* <http://dx.doi.org/10.1016/j.jclepro.2016.09.054>
9. Sala S., Benini L., Mancini L., Pant R. (2015) Integrated assessment of environmental impact of Europe in 2010: data sources and extrapolation strategies for calculating normalisation factors. *International Journal of LCA*, 20(11):1568-1585; DOI: 10.1007/s11367-015-0958-8
10. Strona, G., & Lafferty, K. D. (2016). Environmental change makes robust ecological networks fragile. *Nature Communications*, 7.

Hosting Directorate

[Directorate: Sustainable Resources \(DIR D\)](#)