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Sustainability Impact Assessment of two forest-based bioenergy production systems related to mitigation and adaption to Climate Change

Nahia Gartzia-Bengoetxea (1), Ander Arias-González (1), and Diana Tuomasjukka (2)

(1) NEIKER-Tecnalia, 812 Bizkaia Science and Technology Park, 48160 Derio, Bizkaia, Spain (ngartzia@neiker.eus), (2) European Forest Institute, Yliopistokatu, 6, 80100 Joensuu, Finland

New forest management strategies are necessary to resist and adapt to Climate Change (CC) and to maintain ecosystem functions such as forest productivity, water storage and biomass production. The increased use of forest-based biomass for energy generation as well as the application of combustion or pyrolysis co-products such as ash or biochar back into forest soils is being suggested as a CC mitigation and adaptation strategy while trying to fulfil the targets of both: (i) Europe 2020 growth strategy in relation to CC and energy sustainability and (ii) EU Action Plan for the Circular Economy.

The energy stored in harvested biomass can be released through combustion and used for energy generation to enable national energy security (reduced oil dependence) and the substitution of fossil fuel by renewable biomass can decrease the emission of greenhouse gases.In the end, the wood-ash produced in the process can return to the forest soil to replace the nutrients exported by harvesting. Another way to use biomass in this green circular framework is to pyrolyse it. Pyrolysis of the biomass produce a carbon-rich product (biochar) that can increase carbon sequestration in the soils and liquid and gas co-products of biomass pyrolysis can be used for energy generation or other fuel use thereby offsetting fossil fuel consumption and so avoiding greenhouse gas emissions. Both biomass based energy systems differ in the amount of energy produced, in the co-product (biochar or wood ash) returned to the field, and in societal impacts they have.

The Tool for Sustainability Impact Assessment (ToSIA) was used for modelling both energy production systems. ToSIA integrates several different methods, and allows a quantification and objective comparison of economic, environmental and social impacts in a sustainability impact assessment for different decision alternatives/scenarios. We will interpret the results in order to support the bioenergy planning in temperate forests under the light of its implications for different policy aims and concerns.