Tropentag, September 18-21, 2016, Vienna, Austria

"Solidarity in a competing world — fair use of resources"

Modelling the Carbon Dynamics of Tropical Forest Ecosystem in the Amhara Region of Ethiopia

Beyene Belay[1], Christopher Thurnher[1], Kibruyesfa Sisay[1], Tesfaye Teklehaymanot[2], Khlot Gebrehana[2], Sibhatu Abera[2], Hadera Kahesay[2], Hubert Hasenauer[1]

[1] *University of Natural Resources and Life Sciences (BOKU), Inst. of Silviculture, Austria*
[2] *Amhara Agricultural Research Institute, Forestry Research Directorate, Ethiopia*

Abstract

Improving the current world´s forest carbon sequestration potential through afforestation and reforestation while maintaining the existing forest carbon stock has been given a lot of attention to combat ever-increasing climate change. However, the way to measure the amount of carbon stored through different afforestation initiatives and carbon loss to the atmosphere in deforestation and forest degradation is still a debated issue. Hence, process based models are important in monitoring and reporting and verification (MRV) of forest carbon dynamics and effective implementation of Reducing Emission from Deforestation and forest Degradation (REDD). The purpose of this paper is to adapt the ecosystem model biome-BGC model to mimic Ethiopian forest dynamics and to estimate carbon sequestration potentials in rehabilitation of degraded areas through reforestation and afforestation activities. Thirty-two year daily climate data, physical site parameters (elevation and latitude), soil physical properties (soil texture and soil effective depth), pre-industrial and industrial nitrogen deposition, and evergreen broadleaved ecophysiological parameters were used as drivers and inputs to biome-BGC. For model calibration and validation, above and belowground carbon and terrestrial net primary productivity (NPP) were estimated from vegetation data collected in 156 sample plots of four natural forests (i.e. 56 in Katassi, 33 in Gelawdiwos, 48 in Tara Gedam and 19 in Mahibere Silasse). The above ground carbon stock was derived from the aboveground biomass calculated using an allometric biomass function whereas NPP was determined from core increment samples. The model with default Ecophysiological parameters was found to be limited in explaining Ethiopian forest ecosystem carbon dynamics. It overestimated stem carbon but underestimate the NPP compared to the terrestrial result. Finally, new model parameters were parametrized in a way to predict the Ethiopian forest ecosystem carbon dynamics.

Keywords: BGC model, forest carbon, model validation, parametrisation

Contact Address: Beyene Belay, University of Natural Resources and Life Sciences (BOKU), Forest and Soil Sciences, Peter-Jordan Straße 82, 1190 Vienna, Austria, e-mail: beyene.belay@students.boku.ac.at