

Ecosystem sustainability of 2 degrees celsius scenario using BECCS

KATO, Etsushi^{1*} ; YAMAGATA, Yoshiki¹

¹National Institute for Environmental Studies

Bioenergy with Carbon Capture and Storage (BECCS) is a key component of mitigation strategies in the future socio-economic scenarios to keep mean global temperature rise below 2 °C above pre-industrial, which would require net negative fossil fuel emissions in the end of the 21st century. Large scale BECCS requires additional production of biofuels, which could potentially cause substantial carbon emissions from the land-use change. Developing sustainable low carbon scenarios requires careful consideration of the land-use implications involving large scale BECCS.

We use a global terrestrial biogeochemical cycle model to evaluate effects of land-use change in RCP2.6, which is a scenario with net negative fossil fuel emissions aiming to keep the 2 °C temperature target used in CMIP5. We also use a global crop model to examine BECCS attainability in the land-use scenario of RCP2.6. In the evaluation, we consider deployment of bioenergy with both first-generation second-generation biofuels.

Our analysis reveals that first generation bioenergy crop production would not be sufficient to achieve the required BECCS of RCP2.6 scenario even if we consider the higher fertilizer and irrigation use cases. It would require more than doubling the area for bioenergy crops around 2050 assumed in RCP2.6, however, such scenarios implicitly induce large scale land-use changes that emit significant amount of carbon from deforestation.

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