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An integrated Biophysical CGE model to provide Sustainable Development Goal insights

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Future projected changes in the energy system will inevitably result in changes to the level of appropriation of environmental resources, particularly land and water, and this will have wider implications for environmental sustainability, and may affect other sectors of the economy. An integrated climate, land, energy and water (CLEW) system will provide useful insights, particularly with regard to the environmental sustainability. However, it will require adequate integration with other tools to detect economic impacts and broaden the scope for policy analysis. A computable general equilibrium (CGE) model is a well suited tool to channel impacts, as detected in a CLEW analysis, onto all sectors of the economy, and evaluate trade-offs and synergies, including those of possible policy responses. This paper will show an application of such integration in a single-country CGE model with the following key characteristics. Climate is partly exogenous (as proxied by temperature and rainfall) and partly endogenous (as proxied by emissions generated by different sectors) and has an impact on endogenous variables such as land productivity and labor productivity. Land is a factor of production used in agricultural and forestry activities which can be of various types if land use alternatives (e.g., deforestation) are to be considered. Energy is an input to the production process of all economic sectors and a consumption good for households. Because it is possible to allow for substitution among different energy sources (e.g. renewable vs non-renewable) in the generation of electricity, the production process of energy products can consider the use of natural resources such as oil and water. Water, data permitting, can be considered as an input into the production process of agricultural sectors, which is particularly relevant in case of irrigation. It can also be considered as a determinant of total factor productivity in hydro-power generation. The integration of a CLEW system and a CGE model can be critical to inform analyses on different climate impacts and ways to “secure” pathways of sustainable natural resource use and energy generation. Cost and benefits for establishing sustainable pathways through different investments and their macroeconomic feasibility and impacts on economic growth and employment are also captured. This information is critical to inform strategies to achieve sustainable development goals.