

A Study on the Water-Biomass-Livestock-Energy Nexus for the Joint Credit Mechanism (JCM) in Mongolia

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Background/Objectives/Methods

Mongolia's GDP grew 3.8 times and the agricultural production grew 2.4 times from 2001 to 2010. Mongolia also experienced an accelerated urbanization during the last decades. It was found that the rapid increase of energy use due to urbanization and economic development caused the sharp growth of CO₂ emissions during last decades in Mongolia. Mongolia and Japan signed a bilateral document for the introduction of the Joint Credit Mechanism (JCM) on January 8th, 2013 (<https://www.jcm.go.jp/mn-jp/about>). It is urgently required for us to develop MRV (Measurement, Reporting and Verification) methodologies for evaluating effects of GHG emission reductions or removals by applying low carbon technologies, mitigation actions & adaptation strategies.

In this study, we have developed a framework of Water-Biomass-Livestock-Energy Nexus to estimate CO₂ emissions from energy use and CO₂ sequestration by ecosystem at first, and then, to evaluate effects of CO₂ emission reductions or removals by applying low carbon technologies, mitigation actions & adaptation strategies. To achieve those objectives, we have developed a Water-Biomass-Livestock-Energy Nexus framework (Figure 1). For estimating CO₂ emissions, we accepted the revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. However, for estimating CO₂ sequestration, we developed an ecosystem model based on Biome-BGC by using satellite data of AVHRR and MODIS, the local GIS database of DEM, land use and soils, as well as field observations of meteorological and hydrological factors, for which we have established an integrated monitoring system network since 2006.

Results/Conclusions/Suggestions

It was found that the rapid increase of energy use caused the sharp growth of CO₂ emissions during last decades in Mongolia. However, we evaluated the vulnerabilities caused by climate change in Mongolia and found that the fragile steppe ecosystems are being affected not only by rapid global warming, but also by increased grazing pressures from livestock husbandry. Our estimation shows that global warming and anthropogenic activities might exacerbate the degradation of permafrost, and cause the water deficit over land surface, and then led a decrease in both biomass productivity and its carrying capacity, which finally caused a decrease of CO₂ sequestration by ecosystem (Figure 2).

For the purpose of ensuring the country's sustainable development and reducing or removing the CO₂ emissions from energy use, we suggested several adaptation strategies, which include: 1) to educate herds to reduce livestock numbers in accordance with local grassland carrying capacity; 2) to promote sustainable agriculture through enhancement of water allocation and water-saving technologies; and 3) to improve energy use efficiency and develop renewable energy technologies, such as the Film-solar Power System for Gel and Renewable Energy Refrigeration System.

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Keywords: Joint Credit Mechanism (JCM), Water-Biomass-Livestock-Energy Nexus, Adaptation Strategies

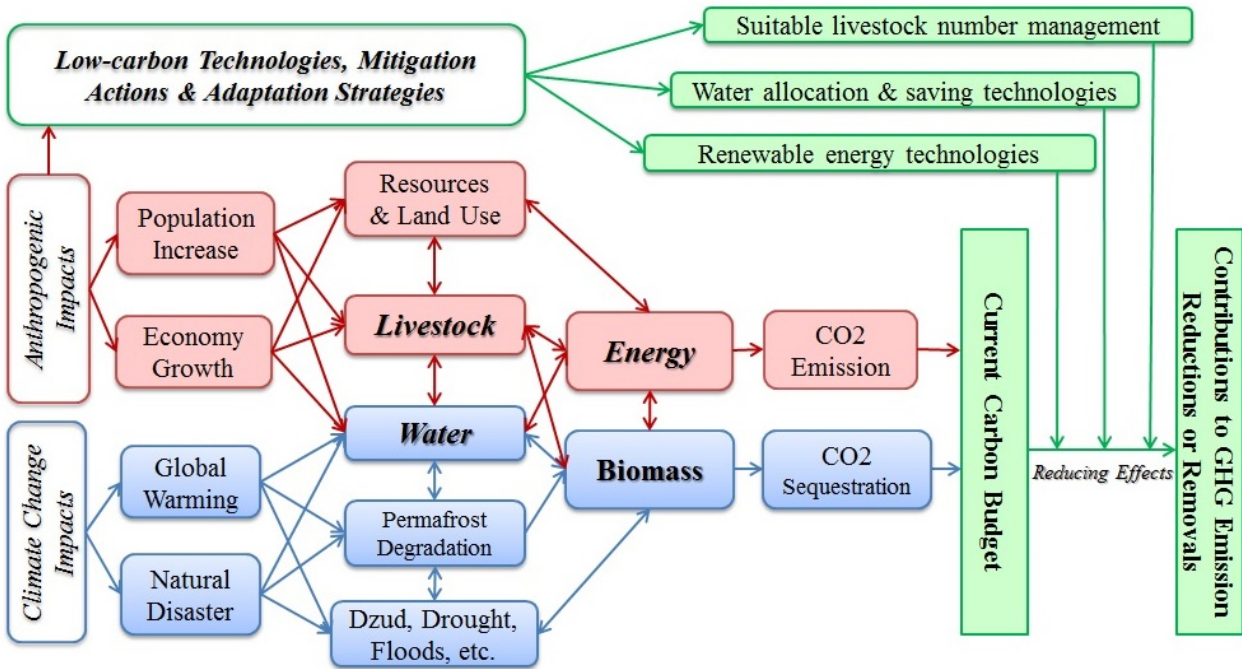


Figure 1 A framework of Water-Biomass-Livestock-Energy Nexus for JCM

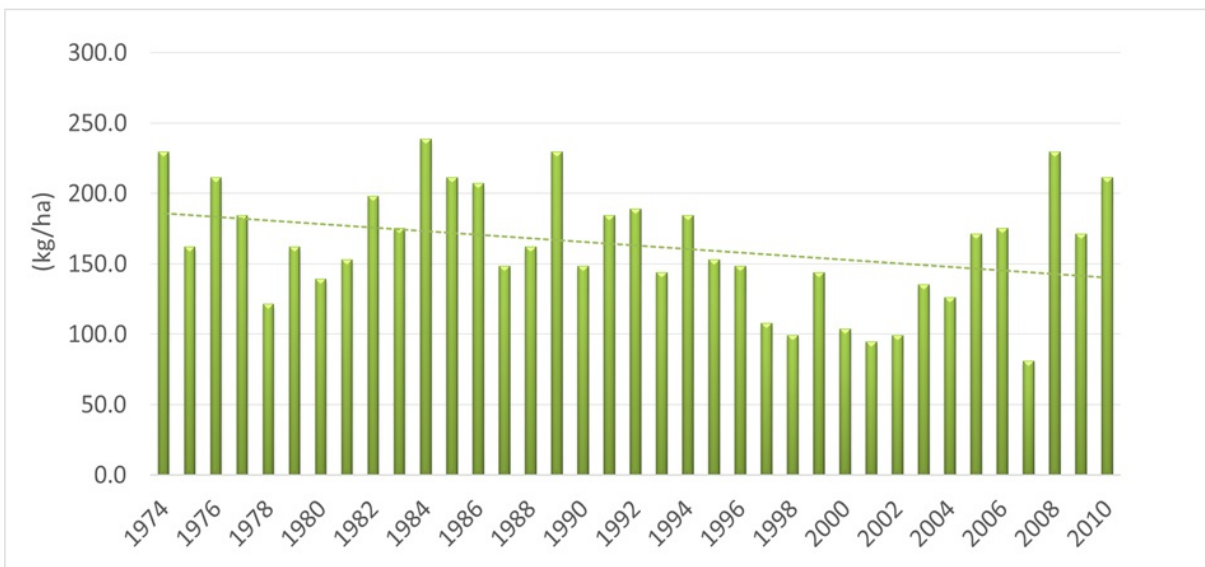


Figure 2 Changes in CO2 sequestration by ecosystem in Mongolia