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The impact of Climate Change and Land use/land Cover Change (LUCC) on Carbon Storage in Arid and Semi-Arid Regions of China

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Abstract : Arid and semiarid areas of China (ASAC) have experienced significant land-use/cover changes (LUCC), along with intensified climate change. However, LUCC and climate changes and their individual and interactive effects on carbon stocks have not yet been fully understood in the ASAC. This study analyses the carbon stocks in the ASAC during 1980 - 2020 using the specific arid ecosystem model (AEM), and investigates the effects of LUCC and climate change on carbon stock trends. The results indicate that in the past 41 years, the ASAC carbon pool experienced an overall growth trend, with an increase of 182.03 g C/m2. Climatic factors (+291.99 g C/m2), especially the increase in precipitation, were the main drivers of the carbon pool increase. LUCC decreased the carbon pool (-112.27 g C/m2), mainly due to the decrease in grassland area (-2.77%). The climate-induced carbon sinks were distributed in northern Xinjiang, on the Ordos Plateau, and in Northeast China, while the LUCC-induced carbon sinks mainly occurred on the Ordos Plateau and the North China Plain, resulting in a net decrease in carbon sequestration in these regions according to carbon pool measurements. The study revealed that the combination of climate variability, LUCC, and increasing atmospheric CO2 concentration resulted in an increase of approximately 182.03 g C/m2, which was mainly distributed in eastern Inner Mongolia and the western Qinghai-Tibet Plateau. Our findings are essential for improving theoretical guidance to protect the ecological environment, rationally plan land use, and understand the sustainable development of arid and semiarid zones.

Keywords : AEM, climate change, LUCC, carbon stocks
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