

EGU24-18453, updated on 20 May 2024

<https://doi.org/10.5194/egusphere-egu24-18453>

EGU General Assembly 2024

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Analysis of South Korea's 3S Forest Management Pathways for Carbon Neutrality Achievement

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In recent years, global climate change has emerged as a critical issue, exerting widespread impacts across various sectors. In response, the Intergovernmental Panel on Climate Change (IPCC) has emphasized the urgency of preparing for a 2°C temperature rise by focusing on greenhouse gas reduction strategies and the vital role of forests as carbon sinks. Aligning with international efforts, South Korea has formulated the "2050 Carbon Neutrality Strategy" and presented corresponding strategies in the forestry sector. This research utilizes the Korean Dynamic Forest Growth Model to explore forest management pathways aimed at achieving carbon neutrality through the aspects of sequestration, storage, and substitution (3S). The study incorporates climate change scenarios and forest policies to select appropriate management pathways. The assessment of various scenarios revealed that the combination of the SSP1 climate change scenario, clear-cutting, thinning of approximately 200,000 hectares, reforestation with suitable species, and ensuring a maximum forest road accessibility of 1 km produced significant and meaningful results across all three aspects of forest management (sequestration, storage, and substitution). As a result, sequestration of 28.49 million tCO₂ yr⁻¹, a storage of 2.1 billion tCO₂ yr⁻¹, and the substitution 7.92 million m³ of harvested wood products (HWP) in the 2050. Furthermore, the 3S forest management approach is expected to contribute to mitigating tree-age imbalances and provide resilience against the impacts of climate change. In conclusion, this study is meaningful in that it suggested a spatio-temporal forest management path by reflecting the environmental characteristics of Korea for achieving carbon neutrality. This is considered to be able to contribute to local government carbon neutrality achievement plans and national policies.