Tropentag, September 10-12, 2025, hybrid conference

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Modelling forest policy impacts on households and forest dynamics with landis-ii: the case of walnut forests in kyzyl-unkur village, kyrgyzstan

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Abstract

The walnut-fruit forests in southern Kyrgyzstan have been, and continue to be, a significant source of livelihood for forest-dependent households since the early 1990s, following the collapse of the Soviet Union and the country's transition to independence. In recent years, a variety of policy approaches, such as conservation restrictions and voluntary certification schemes, have been introduced to promote sustainable forest use and improve the forest ecosystem health. However, their long-term socio-ecological implications, especially in the local context, remain unclear.

This study applies an ex-ante analysis of these forest policy interventions using the spatially explicit LANDIS-II forest landscape simulation model and its agent-based extension, SOSIEL (Sotnik, 2021). A long-term simulation of forest growth dynamics in the Kyzyl-Unkur region (over 40, 60, 80, and 100 years) was conducted using a virtual forest landscape constructed from ecological data adapted from Cantarello et al. (2014). Household decision-making was modeled through the SOSIEL agent-based extension of LANDIS-II, using household typologies derived from a survey of 501 households based on socio-economic characteristics and the degrees of forest dependency.

Four policy scenarios, specific to the local context, were selected and refined based on the priorities identified during the household survey in Kyzyl-Unkur village in 2022: business-as-usual NTFP collection, harvesting according to the voluntary certification standards, full conservation area restrictions, and a mixed forest-park model with conditional access.

The model setup shows that each policy scenario could lead to different patterns of forest use and household access. This study presents preliminary LANDIS-II simulation results as part of the doctoral research on ex-ante analysis of forest governance policies under data-limited conditions.

Keywords: Agent-based modelling, Central Asia, forest policy, Kyrgyzstan, non-timber forest products, ntfp certification

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