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| **Comprehensive analysis of thirty years of land change in Georgia: forest degradation, land-use patterns, and drivers** |
| In this talk, we present results from a study, funded by the NASA Land-Cover and Land-Use Change program, of thirty years of environmental change in the country of Georgia. The country, a former Soviet Union Republic, has experienced more political, economic and social change in the last 30 years than most countries. But the environmental implications of these extreme events remain largely unknown – the region is understudied, no national forest inventory has been completed in 20 years, and previous research in the area conducted by the authors were not successful. The latter statement is because of forest degradation. After the collapse of the Soviet Union, much of the forestry infrastructure broke down and people resorted to chopping down individual trees. The result was in many parts of the country a reduction in forest biomass but not to the point of a change in land cover. This type of forest degradation, which was either gradual over decades or abrupt, could not be readily identified using the methods and data at our disposal at the time. In the recent study, we had full access to the Landsat archive in combination with computing power. By using monitoring methods that are based on time series analysis, we were able to capture and identify the gradual processes driven by small scale activities that are so characteristic of the post-Soviet Georgian landscape. We developed an approach (“CCDC-SMA”) that combines time series analysis and spectral mixture analysis running on Google Earth Engine for monitoring abrupt and gradual forest degradation. By using this approach, we found that forest degradation was significantly larger than the area estimate of deforestation; 3,541 ± 556 km2 (11% of the forest area in 1987) compared to 158 ± 98 km2 from 1987 to 2020. The prevailing narrative is that legal and illegal cutting of trees for fuelwood is primarily responsible for this process. Yet, since independence from the Soviet Union in 1991, the country has undergone rapid socioeconomic and institutional changes which have not been explored as drivers of forest change. To further our understanding of the underlying causes, we combined forest disturbance estimates, Georgian statistical data, and historical institutional change data to examine socioeconomic drivers of forest degradation. We found that higher winter temperature and drought were associated with higher degradation at the regional scale, while major institutional changes and drought were associated with higher forest degradation at the national level. Access to natural gas, the major energy alternative to fuelwood, had no significant association with degradation. Our results challenge the narrative that poverty and a lack of alternative energy infrastructure drive forest degradation and suggest that government policies banning household fuelwood cutting, including the new Forest Code of 2020, may not reduce forest degradation. Given these results, improved data on wood harvesting and more research on the commercial drivers of degradation and their links to economic and political reforms is needed to better inform forest policy in the region, especially given ongoing risks from climate change. |