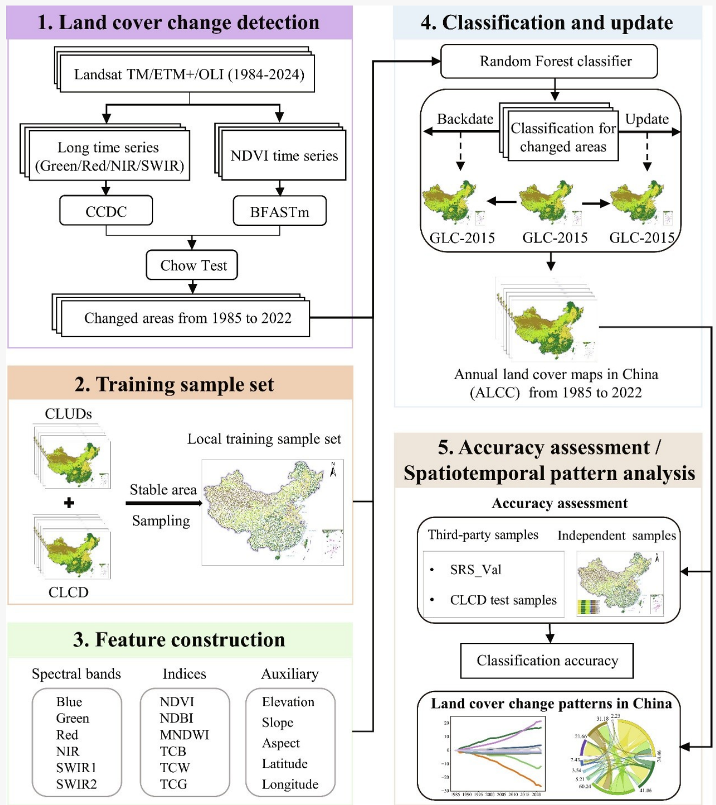
Smarter maps reveal four decades of change

GA, UNITED STATES, April 2, 2026 /EINPresswire.com/ -- Tracking land cover over long time periods is essential for understanding climate, ecosystems, and human development, yet many annual maps are inconsistent from year to year. This study presents a new long-term land cover dataset for China, covering 1985 to 2022, using an ensemble change-detection strategy and adaptive classification. The result is a more reliable picture of how cropland, forests, water, grassland, and built-up land have changed across nearly four decades.



The framework for producing ALCC.

Land cover maps are widely used in climate modeling, biodiversity conservation, environmental assessment, and policy design. However, many existing products are created independently each year, which can introduce artificial fluctuations and false land transitions. Coarse-resolution datasets also struggle in fragmented and heterogeneous landscapes, especially in urban and mixed-use regions. Even high-resolution annual products often face problems with interannual inconsistency, noisy classification results, and uncertainty in detecting real change. Based on these challenges, there is a clear need for in-depth research on long-term, temporally consistent, fine-resolution land cover mapping.

Researchers from Sun Yat-sen University, together with collaborators from Shenzhen Polytechnic University, Southwest Petroleum University, Guangzhou University, and related institutes, published this study on February 27, 2026 in the Journal of Remote Sensing. The team addressed a major problem in Earth observation: how to build annual land cover maps that are not only detailed, but also consistent across time. Their new product, called annual land cover maps for China (ALCC), provides annual 30-meter land cover maps for China from 1985 to 2022.

The ALCC dataset achieved a mean overall accuracy of 81.18% ± 0.79% nationwide and exceeded 72% in all seven geographical regions tested. It outperformed four existing land cover products, including China land cover dataset (CLCD), classification system (GLC_FCS30D), Annual China Land Use/Cover Datasets (CLUD-A), and European Space Agency Climate Change Initiative Land Cover (ESA-CCI LC). In areas where earlier products strongly disagreed, ALCC showed especially large gains, improving accuracy by 8.52% to 34.24% in moderately inconsistent areas and 22.83% to 29.10% in highly inconsistent areas. The study also found major long-term shifts across China, including expansion of impervious surfaces by 270.16%, water by 20.71%, and forest by 7.12%, while cropland declined by 11.28% and grassland by 4.44%.

The innovation lies in combining three change-detection tools rather than relying on one. The researchers integrated Continuous Change Detection and Classification (CCDC), Breaks For Additive Seasonal and Trend (BFAST) Monitor, and the Chow Test to capture different forms of land cover change while filtering out false breaks in Landsat time series. CCDC was effective for many disturbance types but could miss some small urban expansions. BFASTm was stronger in detecting certain abrupt changes, especially in cropland and settlements, but weaker for forest regrowth. The Chow Test was then used to reject spurious breakpoints and keep only statistically supported changes. This ensemble strategy raised change-detection accuracy to 80.22%, compared with 71.15% for CCDC alone and 77.75% for BFASTm alone. For annual map updating, the team used Landsat surface reflectance from 1984 to 2024, six spectral bands, multiple spectral indices, terrain variables, and geographic features. A local random forest classifier with 200 trees was trained separately for each 4° × 4° block and for each year, allowing the system to adapt to regional and annual variation.

The study suggests that improving temporal consistency is just as important as improving classification accuracy. By reducing false year-to-year fluctuations and capturing more genuine land transitions, ALCC offers a more trustworthy record of China's environmental change. The authors note that such a framework can support future updates as new satellite observations become available and can serve as a stable reference for ecological and land management analysis.

The team processed Landsat 5, 7, and 8 surface reflectance imagery on Google Earth Engine, using cloud-masked observations from 1984 to 2024. Stable training samples were automatically extracted from existing land cover products, then filtered spatially to improve reliability. Features for classification included spectral bands, NDVI, built-up and water indices, tasseled cap components, elevation, slope, aspect, latitude, and longitude. Accuracy was assessed using independent validation samples plus third-party datasets such as CLCD test samples and SRS_Val.

ALCC offers an important foundation for environmental monitoring, climate modeling, ecosystem assessment, and sustainable land management in China. Because the framework can be updated as new remote sensing data arrive, it could support near-future monitoring of urbanization, ecological restoration, agricultural restructuring, and water dynamics. More broadly, the study provides a scalable strategy for other countries seeking long-term, consistent land cover records, helping governments and researchers better understand how landscapes evolve under both human pressure and environmental change.

References
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