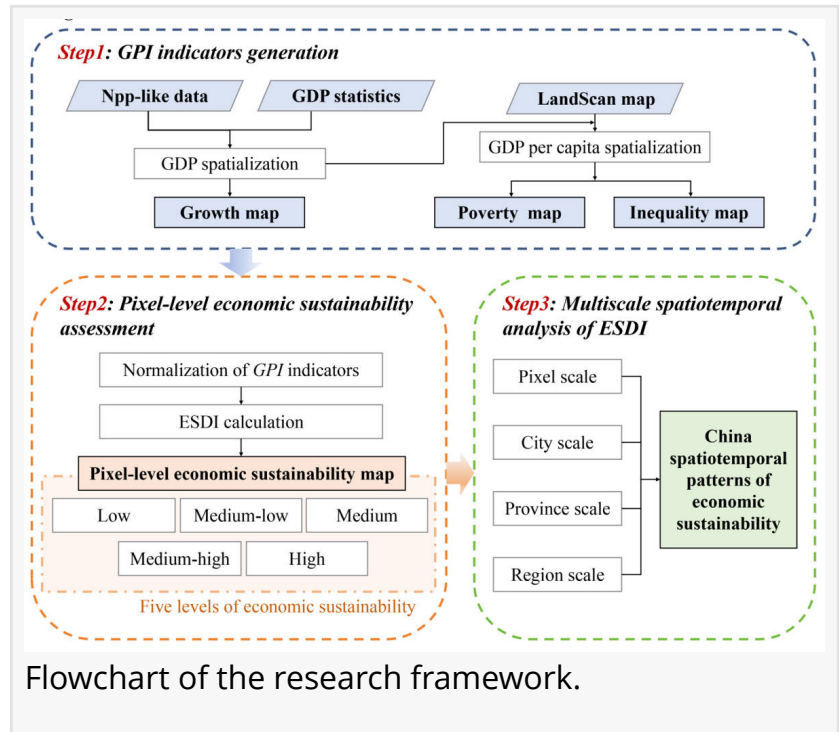


Satellite lights map sustainable growth

GA, UNITED STATES, July 7, 2026

[/EINPresswire.com/](https://EINPresswire.com/) -- A new remote-sensing framework has produced long-term, high-resolution maps of China's economic sustainability from 2001 to 2021. By combining nighttime light data with economic and population information, the study goes beyond gross domestic product alone and assesses growth, poverty, and inequality together. The results provide a finer view of where sustainable economic progress has advanced, where gaps remain, and how future policy can support more balanced regional [development](#).



Economic sustainability is essential for high-quality development, but it is difficult to measure accurately across large regions and long periods. Traditional economic statistics are often collected by administrative units, making them less effective for capturing local variation, remote areas, and rapid changes. Nighttime light (NTL) remote sensing offers broad coverage, frequent updates, and strong links with human activity. However, many previous NTL-based studies focused mainly on gross domestic product (GDP), poverty, or inequality as single indicators, which provides only a partial picture of sustainable development. Due to these challenges, in-depth research is needed on high-resolution, multi-dimensional assessment of economic sustainability.

Researchers from Tongji University and the Guangzhou Institute of Geography, Guangdong Academy of Sciences reported (DOI: [10.34133/remotesensing.1054](https://doi.org/10.34133/remotesensing.1054)) the study in *Journal of Remote Sensing* on 7 May 2026. The article presents a new way to monitor economic sustainability at fine spatial resolution. The study addresses a key challenge in regional development analysis: how to evaluate not only economic growth, but also poverty reduction and inequality, in a consistent mapping framework.

The study developed an assessment framework based on the “growth, poverty, and inequality” (GPI) trilemma and related United Nations Sustainable Development Goals (SDGs). Using this

framework, the researchers generated China's first long-term, high-resolution economic sustainability maps and analyzed patterns at pixel, city, provincial, and regional scales. The results show that more than 317 million people moved out of low-sustainability areas between 2001 and 2021. Eastern China achieved the largest increase, central China showed the strongest growth potential, western China developed steadily, while parts of northeastern China faced weaker or negative growth.

The maps showed clear spatial and temporal differences in China's economic sustainability. Although low-sustainability areas still covered more than 90% of China's land area during the study period, regions at medium, medium-high, and high sustainability levels expanded by 3.0-, 7.4-, and 4.9-fold, respectively, by 2021. High-sustainability zones increased from 0.32% of the national area in 2001 to 176,401 km² in 2021. Population patterns also changed markedly. The share of people living in low-sustainability areas fell from 77.61% to 39.23%, while the share in medium-high sustainability areas rose from 11.72% to 41.75%. In 2021, more than 41.7% of the population lived in only 4.1% of China's land area at the medium-high sustainability level. Provincial economic sustainability linkages increased by 111.26%, suggesting stronger regional connections, even though development imbalance remained.

“This study provides a new way to observe economic sustainability from space,” the research team said. “By integrating growth, poverty, and inequality into one mapping framework, we can identify not only where economic activity is increasing, but also whether development is becoming more balanced. These maps can support more targeted regional policies and help guide sustainable development planning.”

The researchers used a long-term NTL dataset from 2000 to 2021, integrating Defense Meteorological Satellite Program-Operational Linescan System (DMSP-OLS) and Visible Infrared Imaging Radiometer Suite from the Suomi National Polar-orbiting Partnership (NPP/VIIRS) data into an NPP-like annual product. They combined these data with provincial GDP statistics, LandScan population data, and administrative boundary information. GDP growth, poverty level, and inequality were normalized and integrated into an Economic Sustainable Development Index (ESDI).

The framework could be extended to other countries and regions where timely and fine-scale economic data are limited. With updated NTL, economic, and population datasets, policymakers could monitor the effects of urbanization, regional strategies, disasters, public health emergencies, and global shocks on sustainable development. The approach may also support progress tracking for SDGs related to poverty reduction, inclusive growth, and reduced inequality. Future studies could integrate additional social, environmental, and industrial indicators to improve decision-making for balanced development.

References

DOI

10.34133/remotesensing.1054

Original Source URL

<https://doi.org/10.34133/remotesensing.1054>

Funding information

This study was supported by the National Natural Science Foundation of China (project no. 42201376), the Fundamental Research Funds for the Central Universities (project no. 2023-3-YB-12), the Open Fund Program of Yunnan Key Laboratory of Intelligent Monitoring and Spatiotemporal Big Data Governance of Natural Resources (project no. 202449CE340023), GDAS' Project of Science and Technology Development (project no. 2023GDASZH-2023010101), and Shanghai Key Laboratory of Urban Regeneration and Spatial Optimization Technology.

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