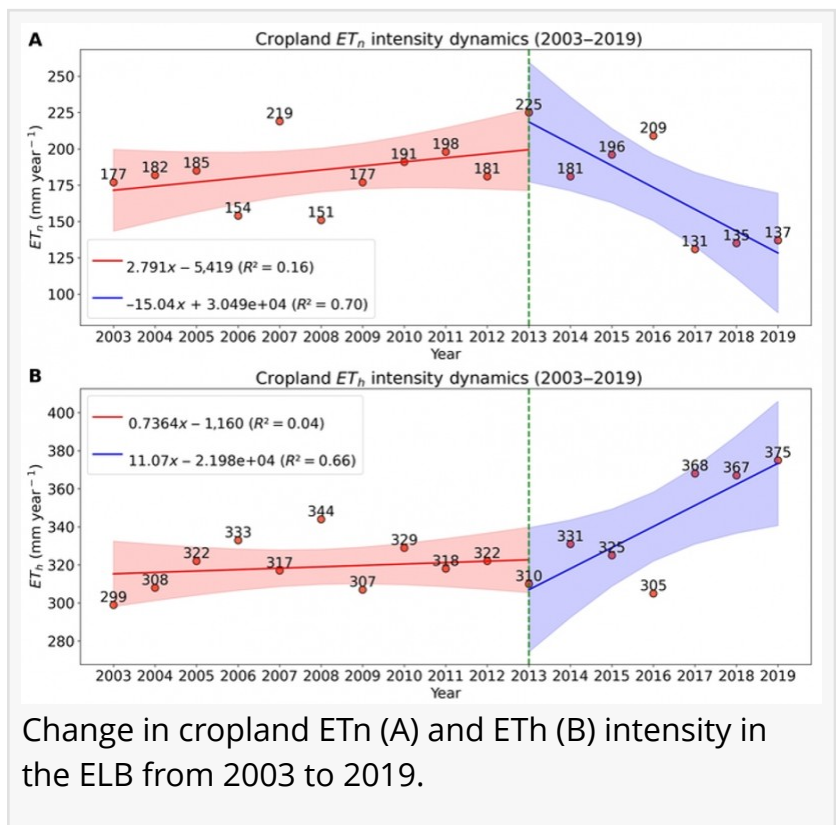


# New model tracks agricultural impact on lake ecosystems

FAYETTEVILLE, GA, UNITED STATES, May 23, 2025 /EINPresswire.com/ -- A recent study has unveiled an innovative data-driven model that disentangles human-induced and natural water consumption in croplands, shedding new light on the sustainability of arid lake ecosystems.

Drylands, covering 42% of the Earth's land surface and supporting 38% of the global population, are at the forefront of the battle for scarce water resources. The relentless expansion of agriculture has placed immense pressure on these fragile ecosystems, with many tail-end lakes shrinking or vanishing entirely due to excessive irrigation. The urgency to develop advanced monitoring and management strategies has never been greater, as sustainable water use becomes a key determinant of food security and ecological balance in arid regions.



Published in [Journal of Remote Sensing](https://doi.org/10.34133/remotesensing.0496) on 1 Apr, 2025, a new study (DOI: [10.34133/remotesensing.0496](https://doi.org/10.34133/remotesensing.0496)) by researchers from the Chinese Academy of Sciences and international collaborators presents a cutting-edge model capable of isolating natural and human-driven water consumption in croplands. The study focuses on the Ebinur Lake Basin in China, an arid region where agricultural growth has increasingly strained water resources. By leveraging remote sensing and machine learning, the model provides unprecedented clarity on water usage patterns, offering actionable insights for sustainable resource management.

At the heart of this research is a sophisticated approach to distinguishing cropland evapotranspiration (ET) into its natural ( $ET_n$ ) and human-induced ( $ET_{th}$ ) components. The model demonstrated remarkable accuracy, with  $R^2$  values between 0.88 and 0.96, revealing that by

2019, human activities were responsible for 77% of cropland water consumption. A striking finding was that restoring Ebinur Lake to its optimal surface area of 800 km<sup>2</sup> would require an additional 0.29 km<sup>3</sup> of water annually—a stark indicator of the toll agricultural expansion has taken on regional water reserves.

Utilizing Sentinel-2 satellite imagery, [deep learning](#), and machine learning algorithms, the researchers monitored cropland and lake dynamics from 2003 to 2019. A random forest regressor was trained to model the relationship between environmental factors and natural ET, achieving high predictive accuracy. The study found that cropland in the Ebinur Lake Basin expanded by 50.65% over the study period, driving a 61% surge in total water consumption. Notably, ET<sub>h</sub> saw a sharp increase after 2013, correlating with a rapid rise in irrigated farmland. These findings were rigorously validated using water level data from the DAHITI database and surface water measurements from the Global Surface Water Dataset (GSWD).

“Our model provides a transformative tool for understanding the intricate interactions between human activities and natural processes in agricultural water consumption, and its impact on water storage of the end-tail lakes in dryland” said Dr. Hongwei Zeng, the study’s lead author. “This is a crucial step toward achieving sustainable water management in arid regions, where the delicate balance between agriculture and ecosystem preservation is becoming increasingly precarious.”

By combining high-resolution satellite data with advanced machine learning techniques, the study offers a new paradigm for water resource management. The model’s ability to quantify and distinguish between natural and human-driven water use can inform policies aimed at curbing excessive irrigation while ensuring food security. Looking ahead, potential applications include real-time water monitoring, optimized irrigation strategies, and proactive conservation efforts to prevent lake desiccation in water-stressed regions such as Central Asia and beyond.

This research marks a pivotal step toward sustainable water management in arid environments, offering a data-driven pathway to tackling one of the most pressing environmental challenges of our time.

## References

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