



# **HOT NEWS**

**09, 2026**



## CONTENTS

|                                                                                                                                            |              |
|--------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>The 9th International Conference on Estuaries and Coasts Held in Qinzhou</b>                                                            | <b>01-06</b> |
| <b>WASWAC Deputy President and Deltares Researcher Give Talks at IWHR Global Vision Forum</b>                                              | <b>07</b>    |
| <b>Greening Lands, Feeding People: UN Awards Three Restoration Flagships at UNCCD COP17</b>                                                | <b>08-09</b> |
| <b>FAO at COP17: New Report Warns Soil Degradation Worsening as Adoption of Proven Solutions Lags</b>                                      | <b>10-11</b> |
| <b>Cash Crops Make Desert Control Profitable</b>                                                                                           | <b>12-14</b> |
| <b>Rill Erosion Dynamics in Smallholder Farming Systems of Wet Tropical Africa</b>                                                         | <b>15-17</b> |
| <b>Coupled Geomorphic and Climate-driven Biogeochemical Processes Regulate Soil Organic Carbon Stocks in Agricultural Terraces</b>         | <b>18-19</b> |
| <b>Rapid Solar Energy Development in Deserts: A Missing Element in Desertification Control and Achieving Sustainable Development Goals</b> | <b>20-21</b> |
| <b>Contents of Issue 4, 2026 for IJSR</b>                                                                                                  | <b>22-24</b> |

**Editor: Pengfei DU**

**Assistant Editor: Songdi YANG**

## The 9th International Conference on Estuaries and Coasts Held in Qinzhou



The 9th International Conference on Estuaries and Coasts (ICEC), co-hosted by China Institute of Water Resources and Hydropower Research (IWHR), Qinzhou Municipal People's Government, Department of Water Resources of Guangxi Zhuang Autonomous Region, Department of Transportation of Guangxi Zhuang Autonomous Region, was held in Qinzhou, Guangxi Zhuang Autonomous Region, China, from 22 to 26 September.

The conference adopted the theme "Estuaries and Coasts under Modern Civilizations, Entering a New Era of Artificial Intelligence", attracted around 300 experts and scholars from 22 countries.

Mr. Rusheng Huang, Deputy Chairman of the People's Government of Guangxi Zhuang Autonomous Region; Prof. Hongwu Tang, Member of the Chinese Academy of Engineering and President of Sun Yat-sen University; Prof. Jianhua Wang, president of IWHR and Director of the International Research and Training Centre on Erosion and Sedimentation (IRTCES); Mr. Xianghui Zeng, Deputy Director-General of the Department of International Cooperation, Science and Technology of the Ministry of Water Resources (MWR); Mr. Yucheng Li, Mayor of the People's Government of Qinzhou City; Mr. Ke Liu, Director of the Department of Transport of Guangxi

Zhuang Autonomous Region; Mr. Xing Gan, Deputy Director of the Department of Water Resources of Guangxi Zhuang Autonomous Region; Prof. Philippe Gourbesville, President of the International Association for Hydro-Environment Engineering and Research (IAHR); and Prof. Ioan Nistor, Fellow of the Canadian Academy of Engineering, University of Ottawa, attended the opening ceremony. Mr. Abou Amani, Director, Assistant Director-General for Natural Sciences at UNESCO, and Ms. Cristiane Collet Battiston, Chairperson of the Intergovernmental Hydrological Programme (IHP) Council, and Director of Brazil's National Water and Sanitation Agency (ANA), delivered pre-recorded video remarks.

Mr. Rusheng Huang stated that Guangxi carries out integrated land and sea management and systematic governance, prioritizes ecological protection and green development, strengthens coordinated governance of river basins and bays, coordinates soil and water conservation in upstream areas, pollution control in midstream reaches, and estuary remediation downstream. Meantime, Guangxi improves the marine disaster prevention and mitigation system to continuously boost coastal ecological and safety resilience. He expected that this conference will serve as a bridge to

deepen exchanges and cooperation between Guangxi and global experts and scholars in estuaries and coasts research, and promote the application of advanced theories and innovative technologies for estuaries and coasts science in Guangxi.



Mr. Rusheng Huang addressed the opening ceremony

Prof. Jianhua Wang noted that the development of estuaries and coasts is highly consistent with multiple goals of the UN 2030 Agenda for Sustainable Development. Against the backdrop of global climate change, this conference responds to practical hot topics including coastal economic development, disaster prevention and control, and coastal wetland conservation. It also reflects the trend of digital technologies empowering hydrological

research. He hopes participants produce research outputs of both theoretical merit and practical relevance, and offer new approaches for the sustainable management of estuaries and coasts globally.



Prof. Jianhua Wang addressed the opening ceremony

Mr. Xianghui Zeng noted that the MWR attaches importance to the protection and management of estuaries and coasts. It has systematically rolled out integrated river basin-estuary-coastal governance practices nationwide, which have effectively stabilized the river regime and water-sediment regime of key estuaries. The share of good-quality water in China's coasts waters has risen steadily for years, and flood and disaster resilience in estuaries and coasts areas has improved substan-

tially. The future of estuaries and coasts concerns the shared wellbeing of all humanity.



Mr. Xianghui Zeng addressed the opening ceremony

Mr. Yucheng Li said that as a new member of the global estuaries and coasts community, Qinzhou stood ready to host researchers, curate datasets and guard blue carbon resources. He invited participants to jointly explore the formulation of the Pinglu Canal Estuary Open Observation Programme, launch the water-sediment, ecological and shipping data collection programme, and establish a Qinzhou field station for young scholars.



Mr. Yucheng Li addressed the opening ceremony

Mr. Abou Amani said the conference embodied a vision emphasizing scientific innovation, integrated water resources management and resilience building. It offered new opportunities to better understand, monitor and manage



Mr. Abou Amani addressed the opening ceremony

the dynamics of water and sediment in estuaries and coasts. It supported UNESCO's priority work in hydrological science to study estuaries and coasts using a holistic perspective.

Ms. Cristiane Collet Battiston said the conference aligns closely with the mission of UNESCO's Intergovernmental Hydrological Programme (IHP). It calls for scientific understanding of hydrodynamic processes, sediment transport and morphological evolution in estuaries, coasts and deltas, strengthened monitoring and early warning, and protection of water dependent ecosystems to support water resources management in estuaries and coasts.



Ms. Cristiane Collet Battiston addressed the opening ceremony

Prof. Philippe Gourbesville said that protecting estuarine ecosystems was key to safeguarding modern civilization and urban security against floods and a range of current extreme hazards. The Pinglu Canal navigation

operation offered a vivid practical example for climate change adaptation and mitigation, nature-based solutions, and efforts to boost resilience to floods and droughts.



Prof. Philippe Gourbesville addressed the opening ceremony

The conference released the Qinzhou Initiative for the Sustainable Development of Global Estuaries and Coasts. It called for enhanced academic exchanges, stronger empirical scientific support for the governance of estuaries and coasts, and joint efforts to build a safer, more prosperous and more resilient future for global estuaries and coasts.

In representative keynote presentations, Prof. Hongwu Tang delivered *"New Trends in Pearl River Estuary Evolution and Governance Consid-*

*erations"*, Mr. Ke Liu presented *"New Estuary of Man-made Canals and A New Phase of Urban Development"*, Mr. Xing Gan presented *"Building a Safe, Resilient, Ocean-oriented Modern Water Network for Bagui"*, Prof. Ioan Nistor presented *"Can We Design Against Extreme Hydrodynamic Events?"*, Prof. Edwin P.L. Elias presented *"Learning from the Netherlands: A Full-Scale Laboratory for Coastal Science, Management and Climate Adaptation"*.

The ICEC was initiated by IRTCES in 2003 and had been successfully held for 9 sessions.

Focusing on four themes including "Artificial Intelligence Technology and Innovation in Estuarine and Coastal Zones", "Natural Processes and Mechanisms in Estuarine and Coastal Zones", "Ecological Protection and Sustainable Development of Estuarine and Coastal Zones", "Culture, Economy and Governance of Estuaries and Coasts", this session has received more than 120 papers. During the event, 10 keynote presentations, 16 invited talks and 60 presentations were arranged alongside 48 poster displays. Field visits were organized to the Madao Hub of the Pinglu Canal, the automated Qinzhou sea-rail intermodal trains and the comprehensive ecological restoration project along the Jingu shoreline.

Prof. Yunzhong Jiang, Deputy President of IWHR, presided the opening ceremony.



Prof. Yunzhong Jiang presided the opening ceremony

Prof. Seyed Hamidreza Sadeghi, Deputy President of WASWAC, was invited to attend the conference.

## WASWAC Deputy President and Deltares Researcher Give Talks at IWHR Global Vision Forum



On 28 September, Prof. Seyed Hamidreza Sadeghi, Deputy President of WASWAC, Associate Editor of ISWCR, and Prof. Edwin P.L. Elias, senior researcher at Deltares, the Netherlands, were invited by the State key laboratory of water cycle and water security to deliver lectures.

Prof. Sadeghi spoke on *“Diagnosing Watershed Health: From High-Dimensional Noise to High-Impact Intervention”*. Prof. Elias presented *“Learning from the Netherlands: A Full-Scale La-*

*boratory for Coastal Science, Management and Climate Adaptation”*.

Dozens of researchers and graduate students from China Institute of Water Resources and Hydropower Research and Beijing Normal University, attended the academic lecture and engaged in lively discussions with the two speakers.

## Greening Lands, Feeding People: UN Awards Three Restoration Flagships at UNCCD COP17

On 26 August 2026, the UN today awarded three new World Restoration Flagships in Brazil, the Sahel region, and the Kingdom of Saudi Arabia. The initiatives are strengthening landscape productivity by restoring degraded ecosystems in regions facing drought, desertification, and climate change.

Jointly led by the UN Environment Programme (UNEP) and the Food and Agriculture Organization of the United Nations (FAO), the awards are announced under the UN Decade on Ecosystem Restoration (2021–2030) and presented during a high-level event at the 17th Session of the Conference of the Parties to the UN Convention to Combat Desertification (UNCCD COP17). In committing to restore almost 5 million hectares by 2030 – an area equal to nearly 7 million football fields – the three flagships awarded contribute to global commitments to restore a total of one billion hectares by 2030.

“The impacts of climate change, drought and desertification, as well as ongoing geopolitical tensions, are hitting global food systems hard,” said Inger Andersen, Executive Director of UNEP. “Investing in healthy land is one of our strongest defenses against these threats.

The three initiatives recognized today show that restoring ecosystems brings significant benefits for all – including food security, new jobs, and greater resilience for millions of people.”

1. Brazil restores the Cerrado – the world’s most biodiverse savanna

Brazil’s Cerrado is the world’s most biodiverse tropical savannah. The Araticum Initiative “Restoring Brazil’s Cerrado Savannah” brings together over 180 organizations, Indigenous Peoples, local communities, farmers, researchers, and government institutions to support restoration projects across nine Brazilian states. This is done through natural regeneration, direct seeding, restoration and agroforestry with native species.

As of June 2026, over 27,000 hectares have been placed under restoration, while seeds from more than 150 native plant species have been collected and used in restoration activities. The initiative aims to bring 2 million hectares under restoration by 2030.

2. Saudi Arabia’s restoration of arid landscapes

Saudi Arabia’s National Greening Program aims to transform degraded landscapes across

rangelands, forests, deserts, urban areas and coastal ecosystems, including mangroves. With a target of restoring 2.5 million hectares and planting 215 million trees by 2030, while generating up to 187,000 jobs and improving urban air quality, it contributes to the Kingdom's national goal of restoring 40 million hectares and planting 10 billion trees by 2100.

Led by the National Center for Vegetation Cover Development and Combating Desertification, by June 2026 the programme had brought 1 million hectares of degraded land under restoration and planted 159 million trees. Restoration activities include reforestation, natural regeneration, controlled grazing, reintroduction of native wildlife species including Arabian oryx, gazelles and ibex, rain-water harvesting, and the use of treated wastewater to support restoration in water-scarce landscapes.

### 3. Sahel initiative links restoration with food security and resilience

Across the Sahel, conflict, land degradation, drought, food insecurity and climate change are placing mounting pressure on ecosystems and communities. The Sahel Integrated Resilience Initiative, implemented across Burkina Faso, Chad, Mali, Mauritania, and Niger, is restoring degraded land while strengthening

livelihoods and food systems. This includes support for cross border refugees from war-torn Sudan.

The initiative, led by the UN World Food Programme, had already restored more than 335,000 hectares of degraded land by June 2026 and aims to restore 470,000 hectares by 2030. Combining land rehabilitation techniques, soil and water management, livelihood support, and school feeding programmes, the initiative has benefitted more than 4 million people across the region.

The three new World Restoration Flagships join a growing network of 27 restoration initiatives recognized under the UN Decade on Ecosystem Restoration. The initiatives awarded showcase the best examples of large-scale and long-term ecosystem restoration in any country or region.

### News Source

<https://www.unep.org/news-and-stories/press-release/greening-lands-feeding-people-un-awards-three-restoration-flagships>

## FAO at COP17: New Report Warns Soil Degradation Worsening as Adoption of Proven Solutions Lags



Soil degradation is continuing to worsen in many parts of the world, while proven practices to protect and restore soils are still not being adopted at the pace and scale required, according to a major new global assessment launched today by the Food and Agriculture Organization of the United Nations (FAO).

The Status of the World's Soil Resources 2026 report, alongside new guidance developed jointly with the United Nations Convention to Combat Desertification (UNCCD), was presented at the seventeenth session of the Conference of the Parties to the UNCCD (COP17).

Together, the two publications combine new evidence on the state of the world's soils with practical guidance to accelerate action and help countries avoid, reduce and reverse agricultural land and soil degradation.

The report finds that proven sustainable soil management practices are still not being adopted at the pace and scale required. More than half of the regional and subregional assessments reviewed indicate low or very low adoption. 58 percent report a deteriorating trend since 2015, and only around 10 percent report improvement.

The report complements the global assessment first published in 2015 by FAO through the Global Soil Partnership and with scientific guidance from the Intergovernmental Technical Panel on Soils. It draws on scientific literature published between 2015 and 2025 and extensive expertise from 75 countries.

Proven practices, including reduced tillage, integrated nutrient management, crop diversification, cover crops, organic amendments and agroforestry, can mitigate soil threats while sustaining or improving agricultural productivity. The challenge is to scale up their adoption at the required pace.

“We have much better evidence today about the pressures facing the world’s soils – and about the practices that can protect and restore them. But this report makes clear that proven solutions are still not being adopted at the pace and scale required. The priority now is to give countries, farmers and other land users the knowledge, capacity and incentives they need to put those solutions into practice,” said FAO Deputy Director-General Beth Bechdol.

The report calls for coordinated and sustained action at all levels, guided by five priorities:

1. strengthening soil governance and legal frameworks.

2. promoting education, capacity development and knowledge exchange.

3. improving soil monitoring through harmonized data, indicators and assessment methods.

4. strengthening incentives for the adoption of sustainable soil management.

5. fostering inclusive, multidisciplinary and multistakeholder decision-making.

The second publication launched, *Living Soils, Productive Lands, Resilient Landscapes - Guidance on Avoiding, Reducing and Reversing Agricultural Land and Soil Degradation*, was developed jointly by FAO and UNCCD. It places agricultural land at the centre of countries' efforts to achieve land degradation neutrality and addresses a long-standing gap: agricultural landscapes have often remained underrepresented despite accounting for the majority of human-induced land degradation.

#### News Source

<https://www.fao.org/global-soil-partnership/resources/news/details/fao-at-cop17--new-report-warns-soil-degradation-worsening-as-adoption-of-proven-solutions-lags/en>

## Cash Crops Make Desert Control Profitable



The world's longest desert-encircling ecological barrier has entered a major harvest and production phase, signaling a successful transition from pure sand control to a high-value agricultural economy along the rim of the Taklimakan Desert.

Following the historic completion of the 3,046-kilometer sand-blocking green belt in November 2024, Northwest China's Xinjiang Uygur autonomous region has intensified efforts to transform once-barren dunes into productive farmland. According to the regional forestry and grassland administration, the region has now cultivated approximately 722,000 hectares of desert cash crops, generating a total output value of 29 billion yuan (\$4.26 billion) and creating 300,000 stable, long-term jobs for

local residents.

A key example of this ecological turnaround is the 2,767-hectare Wanhua Yuan sand-control demonstration zone in Yutian county, the site where the final stretches of the trans-desert loop were closed. Today, rows of purple-pink drought-resistant roses and traditional Chinese medicinal herbs serve as a living shield separating the desert from vulnerable interior farmlands.

The Wanhua Yuan zone is part of the ongoing sixth phase of the Three-North Shelterbelt Forest Program, a major ecological afforestation project spanning northwestern, northern and northeastern China.

Launched in 1978, the program has increased forest coverage in these regions from 5.05 per-

cent in 1977 to 13.84 percent by the end of its fifth phase in 2020, while bringing 61 percent of soil erosion areas under control.

According to the Xinjiang regional forestry and grassland administration, Xinjiang has planted vegetation over 4.04 million hectares under the program since 2021. Compared with 2022, the region's desertified land area has decreased by 5,300 square kilometers and its sandified land area has shrunk by 1,500 sq km. Natural oases have expanded by 600 sq km, while artificial oases have grown by 44,900 sq km.

Wei Zicheng, Party secretary of Aoyitugelake township, where the Wanhua Yuan zone is located, said rose bushes have been planted across 206 hectares on both sides of an asphalt road and contracted to 172 farming households.

In just one and a half years, the bushes have grown to about 70 centimeters tall, with luxuriant leaves and vibrant blossoms. These drought-resistant rose varieties have extensive root systems that help stabilize sand and retain soil moisture. Local residents say sandstorms have become noticeably milder.

Wei said that while the roses bloomed only sporadically last year, they are flowering in

large patches this year and beginning to generate returns. Rose buds can be processed into flower tea and essential oils, petals can be made into rose jam, and pruned branches and leaves can be crushed and returned to the soil as organic fertilizer.

Yutian's dry climate, long sunshine hours and large day-night temperature differences are well suited to rose cultivation. According to Alim Mamatrozi, director of the county's forestry and grassland administration, Yutian had planted more than 5,333 hectares of roses by 2025, producing 11,400 metric tons of fresh flowers with an output value of 236 million yuan and benefiting 5,441 households through increased income.

The county has a long history of cultivating roses in desert areas, turning the crop into a pillar industry supported by a complete value chain from field to factory. Deep-processing enterprises have further expanded the industry's value. Last year, locally produced rose essential oils entered the high-end French market.

Since 2024, intercropping models that combine trees with shrubs or shrubs with medicinal herbs have been promoted across Yutian, improving sand control while increasing eco-

conomic returns. It is common to find cistanche growing on the roots of tamarisk and saxaul trees, while some tamarisk plantations are intercropped with Chinese skullcap. Both cistanche and Chinese skullcap are medicinal herbs.

Over the past two months, 148 hectares of tamarisk at Wanhuyuan were interplanted with mugwort. Moxa products derived from mugwort are popular in the traditional Chinese medicine market, while moxibustion continues to enjoy widespread acceptance, indicating strong market potential.

Alim Mamatrozi said mugwort is both drought and cold resistant, making it well-suited to the zone's loose, well-drained sandy soil. Once planted, it can grow steadily for eight to 10 years and be harvested two to three times a year. Its extensive root system helps stabilize sand and soil while contributing to ecological restoration.

He said annual fresh mugwort yields are estimated at 22.5 to 30 tons per hectare, generating revenue of 22,500 to 30,000 yuan per hectare. Part of the investment can be recovered in the first year, with stable profitability expected from the second year onward.

At the center of the 22,000-hectare Tiandong

comprehensive desert-control demonstration zone, about 40 km from Wanhuyuan, 2,000 hectares of straw grids have been laid to reduce wind erosion, stabilize sand and protect approximately 333 hectares of desert roses planted in May along both sides of the zone's main road. The roses are intercropped with blackberry lily, Chinese skullcap and liquorice. Tiandong is also part of the sixth phase of the Three-North program.

During the planting season, about 80 workers were employed on-site each day to plow land, plant crops, apply fertilizer and operate and maintain irrigation systems, earning additional income in the process.

For tall sand dunes, an innovative local approach has been adopted. The dunes have been reshaped into terraces with slopes of about 30 degrees and heights of three to five meters, reinforced with straw grids. The method reduces costs, shortens land preparation time and doubles sand-control efficiency.

#### News Source

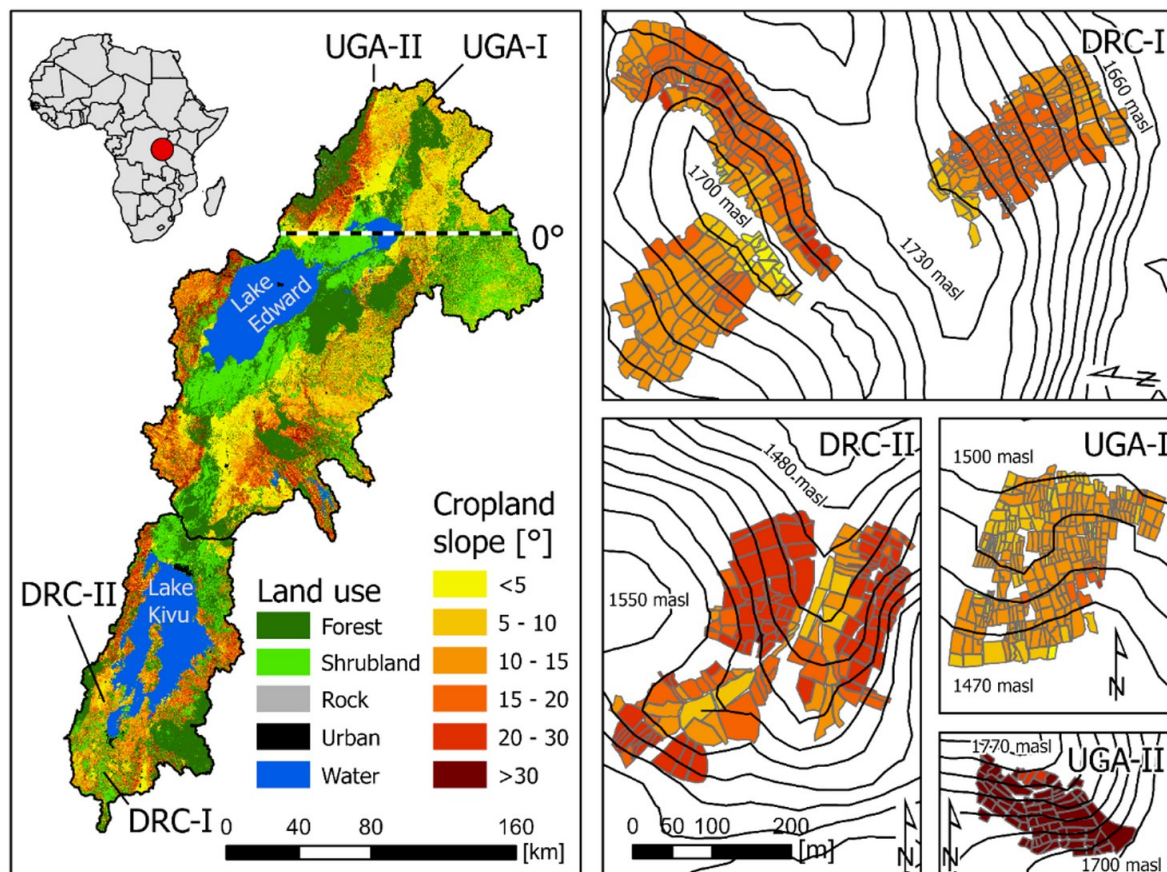
[https://www.chinadaily.com.cn/a/202606/24/WS6a3b2b1ba310986e2b461869\\_1.html](https://www.chinadaily.com.cn/a/202606/24/WS6a3b2b1ba310986e2b461869_1.html)

## Rill Erosion Dynamics in Smallholder Farming Systems of Wet Tropical Africa

Tropical Africa is globally one of the most sensitive regions to accelerated soil erosion, and much of its cropland is characterised by a substantial yield gap. In particular, the White Nile-Congo ridge (NiCo) region of the eastern Democratic Republic of the Congo (DR Congo) and Uganda is a hotspot for issues relating to food security driven by soil degradation due to steep terrain, highly erosive rainfall and low soil cover. Most soil erosion studies in the region are based on plot or large-scale modelling. Both approaches lack information on inter-field connectivity processes, which are especially important in smallholder farming systems with average field sizes below 0.1 ha. To address this knowledge gap, an unmanned aerial vehicle (UAV) based high-spatial and temporal-resolution monitoring campaign was carried out over four smallholder farming areas within the eastern DR Congo and western Uganda, with substantial differences in cropland management and productivity. The campaign covered 833 individual fields, which were monitored up to twice per month (for two years) using UAV-based aerial photography to provide insight into event-based rill erosion processes and

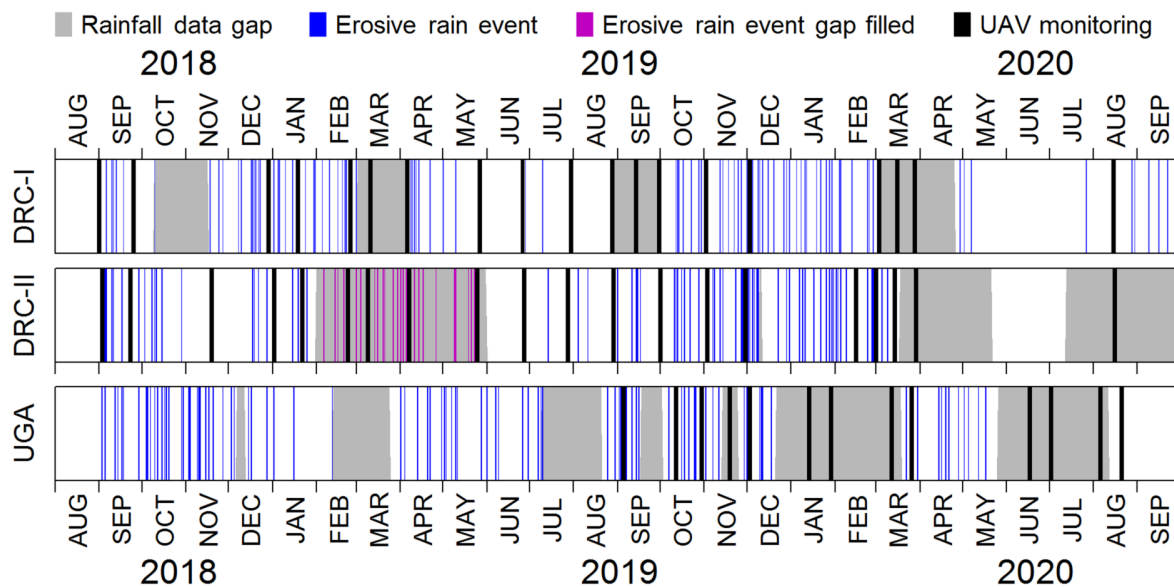
landscape connectivity. The aerial photography data were classified according to field conditions: (i) dense vegetation cover, (ii) low vegetation cover or bare soil without signs of rill erosion, (iii) low vegetation cover or bare soil with signs of rill erosion. Land-use patchiness associated with smallholder farming systems was found to reduce inter-field connectivity and to promote highly localised rill development. Furthermore, rill erosion in the NiCo region is not an episodic process but takes place regularly during the rainy season due to frequent storm events falling on bare soil in fields left fallow for individual cultivation periods. Soil erosion dynamics of smallholder farming regions in the study area, therefore, pose unresolved challenges regarding their implementation in large-scale predictions.

The data shows that cropland rill erosion in the NiCo region is taking place regularly. This is caused by a high frequency of erosive rainfall events that occur roughly every 4 days during rainy season (about 20 events within 3 months). As a result, fields with recent rill development were identified for the majority of the monitoring dates (newly developed rills/



total monitoring dates: DRC-I 17/18; DRC-II 6/14; UGA I & II 9/14). However, it was observed that rill formation is highly localised and does not incise across multiple fields. Often, fields under visually similar conditions do not develop rills on the same monitoring date and the same impact of erosive rainfall. Hence, only a small fraction of fields developed new rills between monitoring dates where erosive rainfall took place (DRC-I: 5.6%; DRC-II: 15.4%; UGA-I and II: 9.8%). The ordinal logistic regression analysis showed that the effects of soil cover, soil structure, and

the slope length factor were negligible, as indicated by z-values between  $-1.3$  and  $1.3$ , indicating very limited influence on the probability of rill erosion severity. Slope is the only factor substantially impacting the likelihood of rill development. Especially the probability of heavy rill erosion is positively correlated with slope steepness. However, very steep slopes ( $> 30^\circ$ ,  $n = 71$ ) are almost exclusively located at the study site UGA-II. Hence, rill erosion development is not just simply triggered by erosive rainfall meeting low soil cover conditions on a steep slope or long erosive



slope length. Another potential control is the time since the last tillage operation, which is a relevant parameter for soil erodibility and soil susceptibility to rill erosion as observed in the mid-latitudes due to a weakened soil structure that benefits soil detachment. Unfortunately, the visual identification of tilling actions, even from high-resolution and high-recurrence aerial imagery, was hardly possible due to timely post-tillage soil surface smoothing by a high rainfall frequency. Beyond the factors already mentioned, rill erosion can be influenced by a range of variables, including microtopography, root density and structure of different crops, crop types and rotation, soil structure, soil fauna and antecedent soil moisture. The interactions and roles of these mechanisms call for further research, including the integra-

tion of ground-based field and soil condition monitoring. Nevertheless, the results of this study suggest that model-based soil erosion predictions for regions under smallholder farming may call for parameterisations that go beyond standard paradigms and assumptions associated with the occurrence of erosional events and the features they form along hillslopes.

### Article Source

<https://www.nature.com/articles/s41598-026-50821-7>

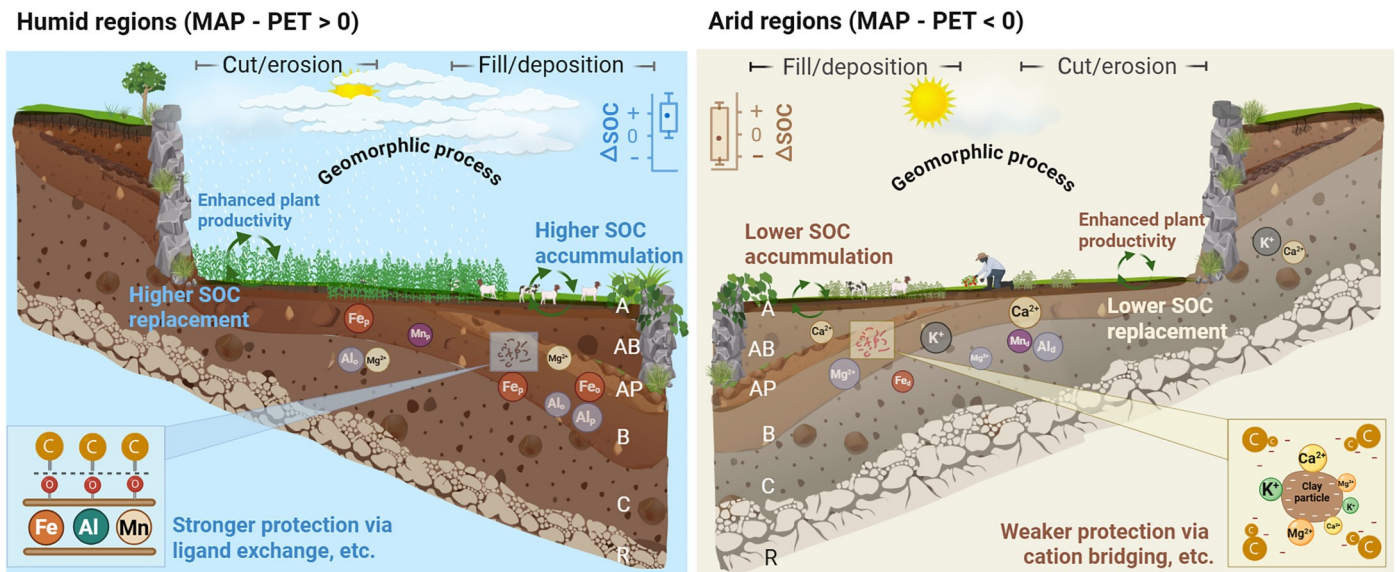
## Coupled Geomorphic and Climate-driven Biogeochemical Processes Regulate Soil Organic Carbon Stocks in Agricultural Terraces

Agricultural terraces are among the most widespread human-made landforms. They profoundly reshape soil landscapes and influence the carbon cycle, yet the extent and drivers of their impact remain highly uncertain. By integrating field observations from 14 well-drained terrace landforms across a climatic-geochemical gradient with a data synthesis, we show that changes in soil organic carbon (SOC) stocks after terracing are governed by two coupled C turnover-geomorphic processes: replacement of lost topsoil C at eroding positions and stabilization of buried SOC at depositional positions. Climate strongly modulates these processes by shaping soil geochemistry and plant productivity, which in turn control SOC replacement and stabilization within terraces. Thus, terracing effects on SOC stocks shift from consistently positive in humid regions to mixed (positive and negative) outcomes in dry regions. This study establishes a framework for elucidating SOC dynamics in well-drained terrace systems and provides a scientific basis for targeted management strategies to enhance C sequestration in agricultural terraces globally.

Our findings reveal that soil redistribution

during terrace construction functions as a “geomorphic pump,” coordinating the interaction of soil geochemistry and plant productivity to determine the magnitude and direction of terracing’s impact on SOC stocks. On the one hand, SOC accumulation occurs in the fill/deposition positions during terrace formation, with a greater magnitude observed in humid regions than in arid regions. This is attributed to the stronger SOC protection in humid (i.e., ligand exchange) compared to arid (i.e., cation bridging) climates, driven by variations in soil weathering and geochemistry under contrasting climate conditions. Consequently, the buried and deposited SOC in the fill/deposition positions of terraces in humid regions can be effectively preserved, but not in the arid regions. On the other hand, SOC lost due to topsoil removal in the cut/erosion positions during terrace excavation can be replaced by new plant-derived C inputs, with the replacement being significantly greater in humid regions compared to arid regions. These interplays, driven by geomorphic processes during and after terracing and strongly modulated by climate-dependent biogeochemical processes, result in a significantly

higher increase in SOC stocks in terraces of humid than arid regions.



A: Topsoil; AB: colluvial soil; AP: previous A horizon; B: subsoil; C: parent material; R: bedrock

A mechanistic framework elucidating the geomorphic–biogeochemical processes regulating SOC stock changes in agricultural terraces across climate regions.

The magnitude of SOC change due to terracing ( $\Delta$ SOC) is controlled by two key coupled C turnover–geomorphic processes: (i) the replacement of lost topsoil C at cut/erosion positions and (ii) the stabilization of buried SOC at fill/deposition positions within terrace sequences. These interplays are strongly modulated by climate through its influence on plant productivity and soil development, which in turn influences SOC replacement and stabilization within terraces, leading to significant differences in  $\Delta$ SOC between humid and arid regions. Terracing enhances plant productivity and fresh C inputs, providing a fundamental foundation for changing SOC stocks. In humid regions, higher moisture availability enhances mineral weathering, forming terraced soils rich in reactive metal oxides (Fe<sub>o</sub>, Al<sub>o</sub>, Mn<sub>o</sub>, Fe<sub>p</sub>, Al<sub>p</sub>, and Mn<sub>p</sub>). This provides stronger protection for SOC in terraces. In contrast, limited moisture restricts weathering in arid regions, forming terraced soils rich in base cations (Ca<sup>2+</sup>, Mg<sup>2+</sup>, and K<sup>+</sup>) or highly crystallized oxides (Fe<sub>d</sub>, Al<sub>d</sub>, and Mn<sub>d</sub>) with weaker SOC protection. Consequently, terraces in different climate regions differ in their capacity to sequester new plant-derived C, as reflected in regional differences in SOC replacement at the cut/erosion positions and SOC accumulation at the fill/deposition of terrace sequences. This mechanistic framework explains the observed clear shift in terracing effects on SOC stocks—from consistently positive in humid regions to mixed (both positive and negative) outcomes in dry regions.

## Article Source

<https://www.science.org/doi/10.1126/sciadv.aea8560>

## Rapid Solar Energy Development in Deserts: A Missing Element in Desertification Control and Achieving Sustainable Development Goals

Global desertification has attracted growing attention with Wang et al. recently highlighting land-use strategies for combating desertification and contributing to the Sustainable Development Goals (SDGs) 1, 2, and 6. However, their analysis omits the rapid growth of large-scale solar energy development in deserts and its sweeping implications for the SDGs. With their low land costs and intense insolation, many deserts worldwide now host massive

solar farms that bolster Affordable and Clean Energy (SDG 7). For example, utility-scale photovoltaic (PV) installations in China's arid northern deserts expanded from nearly zero in 2011 to over 700 km<sup>2</sup> in 2023. This boom is not unique to China—similar large PV projects are underway across the Middle East, North Africa, and North America. Their potential benefits extend far beyond clean power.



No Poverty (SDG 1): Solar infrastructure in deserts can stimulate economic growth and improve local livelihoods. Desert-based PV programs in China have already improved residents' welfare and spurred social prosperity in fragile sandy ecosystems. By creating jobs in construction and maintenance, solar farms provide new revenue streams in impoverished drylands. To fully realize SDG 1 gains,

policymakers should integrate supportive measures including training, grid access, and revenue sharing for local communities—otherwise, poverty-reduction impacts of solar plants may be limited.

Zero Hunger (SDG 2) and Clean Water (SDG 6): Far from competing with agriculture, desert solar can partner with it. Colocating PV with grassland and livestock (agrivoltaics) can

provide reciprocal benefits in water-scarce environments. By retaining soil moisture, solar arrays can make desert farming more resilient and productive. Solar-powered irrigation is another game changer: Solar pumps and smart drip systems can improve water-use efficiency by up to 70% and increase crop yields by 15 to 40%, directly contributing to SDGs 2 and 6. Furthermore, solar-powered desalination can advance SDG 6 while simultaneously supporting SDGs 1, 2, and 7. This is exemplified by recent initiatives in the United Arab Emirates.

**Fighting Desertification:** Integrating solar energy into antidesertification programs can create positive feedback for land restoration. PV installations can physically aid land recovery—large solar farms in China’s deserts have increased vegetation cover (greening ~30% of project area) by shading soil and providing wind breaks. This “solar greening,” together with deliberate revegetation beneath and around photovoltaic arrays, can stabilize dunes and mitigate soil erosion. Modeling suggests that extensive PV installations in the Sahara could not only generate ample low-carbon electricity but also double rainfall and vegetation in the neighboring Sahel—

potentially rejuvenating one of the most vulnerable dryland regions. However, very large desert arrays may also have other climate feedback (e.g., changing surface albedo and wind regimes) that warrant careful assessment and management.

Future research should explicitly consider large-scale solar development in deserts as an integral component of sustainable dryland management. Aligning renewable-energy deployment (SDG 13: Taking urgent action to combat climate change and its impacts) with established land-restoration initiatives could enable desert regions to function as engines of sustainable development rather than persistent zones of vulnerability.

#### Article Source

<https://www.pnas.org/doi/10.1073/pnas.2601509123>

## Contents of Issue 4, 2026 for IJSR

---

### **Bed shear stress estimation of shallow and wide flows over sandy beds in transitionally rough regime at threshold conditions using velocity characteristics**

Reza Shahmohammadi, Jueyi Sui, Hossein Afzalimehr

Pages 535-560

<https://www.sciencedirect.com/science/article/pii/S1001627926000193>

### **Hydrodynamic effects of riparian vegetation in an anabranching-confined transition reach in the middle Yarlung Tsangpo River**

Jiayi Ma, Zhiwei Li, Yunshuo Cheng, Yuchi You, Weiwei Yao

Pages 561-576

<https://www.sciencedirect.com/science/article/pii/S1001627926000168>

### **Effects of roots and canopy of *Medicago sativa* L. on soil and water conservation for steep spoil heaps**

Baoyang Sun, Jianming Li, Jinqian Huang, Wenfeng Ding, ... Wensheng Xu

Pages 577-590

<https://www.sciencedirect.com/science/article/pii/S1001627926000314>

### **Sediment trapping efficiency and grain size distribution: Influence of cascading check dam systems on the debris flow movement process**

Jinshui Wang, Jiangang Chen, Chenyuan Wang, Dandan Li, ... Haitao Liu

Pages 591-604

<https://www.sciencedirect.com/science/article/pii/S1001627926000156>

### **Economic superiority of biological over structural soil and water conservation measures: A cost-benefit analysis in the Taham watershed, Iran**

Roghayeh Mohamadlou, Saeed Najafi, Hossein Kheirfam, Morteza Molaei

Pages 605-613

<https://www.sciencedirect.com/science/article/pii/S1001627926000132>

**Analytical and experimental study on sediment wash-off from urban road surface under rain-fall runoff**

Taotao Zhang, Bin Luan, Yang Xiao, Chi Zhang, ... Chen Xu

Pages 614-625

<https://www.sciencedirect.com/science/article/pii/S100162792600020X>

**Estimating monthly suspended sediment load of the Brahmaputra River by integrating machine learning models with unsupervised outlier detection**

Md Abdur Rahim, Shuang Liu, Kaiheng Hu, Hao Li, ... Md Anwarul Abedin

Pages 626-643

<https://www.sciencedirect.com/science/article/pii/S100162792600034X>

**Uncovering the mechanisms of cross-shore sediment transport through interpretable machine learning with limited laboratory data**

Weikai Tan, Caihao Yuan, Yuan Xu, Alessandro Stocchino

Pages 644-660

<https://www.sciencedirect.com/science/article/pii/S1001627926000338>

**Sediment-mediated eutrophication in coastal lagoons: A systematic review of benthic nutrient fluxes and management implications**

Akilou Amadou Socohou, Metogbe Belfrid Djihouessi, Beatrix Amen Tigo, Romaric Christian Marc Hekpazo, ... Martin Pépin Aina

Pages 661-673

<https://www.sciencedirect.com/science/article/pii/S100162792600017X>

**Influence of flow unsteadiness on local scour at bridge piers: An energy-based perspective**

Qigang Chen, Jiacheng Li, Pengfei Li, Qiang Zhong

Pages 674-687

<https://www.sciencedirect.com/science/article/pii/S1001627926000284>

**Potential utilization of marine sediments from the neritic zone as adsorbents for dye and heavy metal removal: A comprehensive review for supporting sustainable development goals**

Yudha Gusti Wibowo, Dedy Anwar, Arif Rohman, Hana Safitri, ... Anis Tatik Maryani

Pages 688-708

<https://www.sciencedirect.com/science/article/pii/S1001627926000181>

**Effectiveness of bioengineering and geosynthetic integration for riverbank erosion control: A case study along the Mae Taeng River, Chiang Mai, Thailand**

Krairoj Mahannopkul, Surat Semmad, Panich Voottipruex, Siriphat Maneekeaw

Pages 709-725

<https://www.sciencedirect.com/science/article/pii/S1001627926000211>

## **WASWAC Councilors**

|                              |                            |                         |
|------------------------------|----------------------------|-------------------------|
| Abdulvahed Khaledi Darvishan | Ivan Blinkov               | Qingbin Pan             |
| Alfred Hartemink             | Ivan Minchev               | Rachid Mrabet           |
| Annie Melinda Paz-Alberto    | Jorge A. Delgado           | Sergey Chalov           |
| Arora Sanjay                 | José Alfonso Gomez         | Sevilay Hacıyakupoglu   |
| Baoyuan Liu                  | Laura Bertha Reyes Sanchez | Seyed Hamidreza Sadeghi |
| Bořivoj Šarapatka            | Lillian Øygarden           | Shabbir Ahmad Shahid    |
| Carmelo Dazzi                | Mahmoud A. Abdelfattah     | Shachi Pandey           |
| Chinapatana Sukvibool        | Mark Nearing               | Stefanos Stefanidis     |
| Clemencia Licona Manzur      | Michael Maerker            | Thomas W. Goddard       |
| Dennis C. Flanagan           | Moshood Tijani             | Tijana Vulević          |
| Duihu Ning                   | Nigussie Haregeweyn Ayehu  | Tolga Görüm             |
| Eli Pavlova-Traykova         | Nikola Živanović           | Valentin Golosov        |
| Fei Wang                     | Panos Panagos              | Velibor Spalevic        |
| Fenli Zheng                  | Paola Andrea Campitelli    | Wanwisa.Pansak          |
| Goran Skataric               | Paulo Tarso S. Oliveira    | Xiubin He               |
| Ian Hannam                   | Qin Chen                   | Zachary Gichuru Mainuri |

## **WASWAC Advisors**

|                         |                      |                      |
|-------------------------|----------------------|----------------------|
| Chihua Huang            | Ildefonso Pla Sentis | Roberto A. Peiretti  |
| Coen Ritsema            | James Owino          | Rosa M. Poch         |
| Des E. Walling          | Jean Poesen          | Surinder Singh Kukal |
| Dingqiang Li            | Kingshuk Roy         | Syaiful Anwar        |
| Donald C.Reicosky       | Machito Mihara       | Ted L. Napier        |
| Faouzi Bekkaoui         | Mike Fullen          | William Critchley    |
| Franco Obando-Moncayo   | Miroslav Dumbrovsky  | Xiaoying Liu         |
| Gustavo Henrique Merten | Peter Strauss        |                      |
| Hans Hurni              | Rattan Lal           |                      |

## **WASWAC Honor Presidents**

|                 |                |        |
|-----------------|----------------|--------|
| Jose Luis Rubio | Miodrag Zlatic | Rui Li |
|-----------------|----------------|--------|

(Names are arranged in alphabetical order)



**The Secretariat of WASWAC**  
**No.20 Chegongzhuang Road West**  
**Beijing 100048 P.R.China**  
**Website: [www.waswac.org.cn](http://www.waswac.org.cn)**  
**Tel.: +86 10 6878 6579**  
**Fax.: +86 10 6841 1174**  
**Email: [waswac@foxmail.com](mailto:waswac@foxmail.com)**  
**[waswac@vip.163.com](mailto:waswac@vip.163.com)**