W A S W A C

HOT NEWS

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WASWAC

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Chinese New Year Message of WASWAC

Solid Ground: Earth's Soils Reveal Climate, Biodiversity & Food Security Solutions

By Deborah Bossio

Two of the biggest crises facing the planet—climate change and nature loss—have one hard-hitting solution in common: better food production. But until we reimagine and renew our food systems, they remain among the world's top sources of carbon emissions and a major threat to all life on Earth.

The list of options for spurring transformation is long and, importantly, not mutually exclusive. Ideally, a host of solutions will play out differently in different places, guided by ambitious targets. My colleagues and I are exploring, researching and elevating solutions that span the breadth of the food systems, but the one that is right under our feet is also the one most often overlooked.

Soil carbon represents one-quarter of the potential of natural climate solutions—it's 9 percent of the mitigation potential of forests, 72 percent for wetlands and 47 percent for agriculture and grasslands. What's more, holding carbon underground in soil prevents further carbon emissions, removes carbon dioxide from the atmosphere and supplies ecosystem services to farmers.

As public and private sector leaders consider how to feed a growing population, they need effective tools to facilitate the conversation, to increase ambitions and design locally relevant solutions. Enter Soils Revealed: A new platform to facilitate understanding, discussion, ambition setting and investment for soil carbon protection and restoration.

Here are a few key ways decision-makers can use Soils Revealed to see the potential of soil carbon.

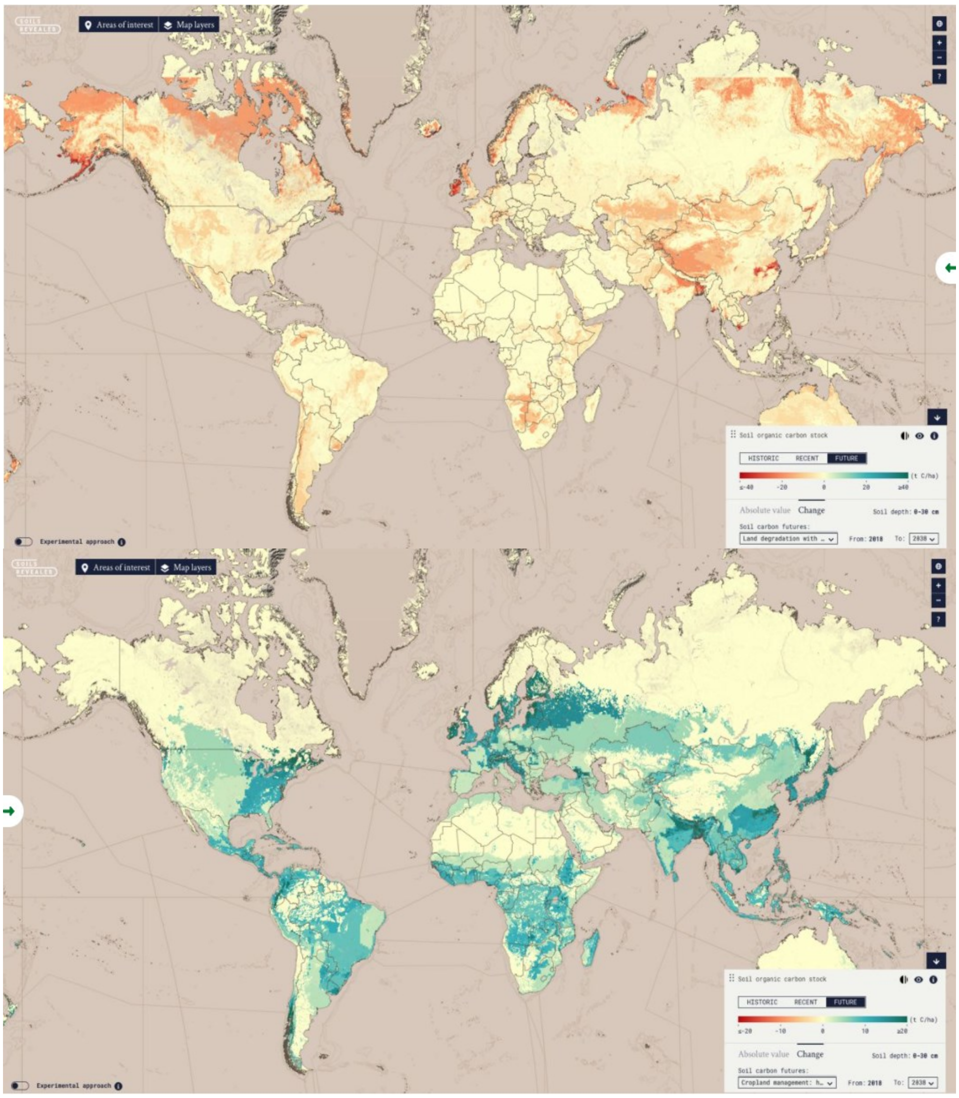
See that soils aren't static.

For far too long, most people have seen soils as a static resource, thus missing the chance to harness the full potential of soil organic carbon. Our new platform reveals how sequestered carbon stores have fluctuated over time—a first for soil science. Users can toggle between historic, recent and future scenarios on the interface to visualize three different time series data sets.

What's more, Soils Revealed gives us a window into how distinct decisions we make about land management today could impact our future. In the map below, for instance, we see that even a business-as-usual path of

"land degradation with no forest conversion" (upper) could lead to the loss of carbon stocks in the near future. In the US alone, it is estimated that continuing conventional crop management will result in an additional loss of 3.54 PgC (the equivalent of 2.5 times the country's total emissions in 2018) over the next 20 years, and a missed opportunity for climate action, nature and people alike.

But alternative and better futures are also clear. In the maps below (lower), we see that improved cropland management—in this case, cover cropping and minimum tillage, a basic recipe of regenerative agriculture—reveals shades of teal that represent the potential for rich new soil organic carbon stores in 2038.



Soils Revealed gives us a window into how distinct decisions we make about land management today could impact our future. The map on the left represents future soil carbon change with "business-as-usual" land degradation. The right shows what's possible if we focus on regenerative agricultural practices. © Vizzuality

See how society is managing our soils.

One key to identifying the best conservation approach for a specific region is observing how land use changes soil carbon stores. By understanding how we have lost soil carbon due to poor land management in the past, we can imagine the opportunity to rebuild this resource.

Numerous studies have estimated the total global technical potential of soil carbon sequestration in present-day croplands and pasture lands to be between about 2 and 5 Gt CO2 per year, if they're managed right. At the upper end, that's equivalent to the NDC ambition of the US, Indonesia, Brazil, Germany and South Africa combined.

As a soil scientist, I see opportunity all over this map. Take the midwestern United States, Europe, India and China, where croplands are extensive. Here, regenerative farming can not only store carbon in the soil, but also help clean water, make farming more resilient and improve farmers' bottom line.

I see the potential in countries like Kenya and Mongolia, where working with communities to help manage grazing lands better can store carbon in soil across large areas, sustaining local livelihoods and protecting biodiversity while also providing climate mitigation. I can even visualize opportunities we cannot yet map at the global level when I think about places like Colombia, where farmers are planting trees and improving pastures with leguminous forage crops and live fencing, which not only helps save forests but also increases the productivity of their lands.

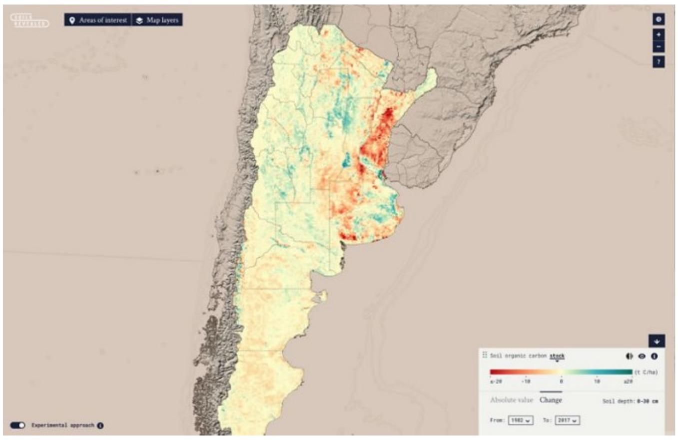
I also see where we can protect carbon that is already in the soil by foregoing agricultural development in certain places, which is equally important for both climate and biodiversity. By not plowing up grasslands to plant crops in Montana and the Dakotas, for instance, we can protect native plants and birds while supporting ranchers' livelihoods as land stewards.

These sustainable alternatives for food producers are also opportunities for policymakers, who can accelerate the much-needed transformation of our food systems. With Soils Revealed, decision-makers can now home in on areas of greatest potential in their regions and support policies that encourage healthy soils—be it for the benefit of climate mitigation or more resilient farms.

See the future of soil organic carbon monitoring.

In Argentina, we may be gazing into the future of soil carbon monitoring. For the first time ever, a modeling approach is combining time-stamped field measurements with ad-

vanced machine learning to create time-series maps based on ground data, an approach the Soils Revealed partnership and The National Agricultural Technology Institute (INTA) in Argentina tested for our platform. This extensive data shows that the agricultural regions of Buenos Aires and Entre Rio have lost the most soil carbon nationally in the last 20 years, and thus potentially have the most to gain.



For the first time ever, a modeling approach is combining time-stamped field measurements with advanced machine learning to create time-series maps based on ground data. © Vizzuality

Though still in its early stages, time-series modeling using field observations and advanced machine learning will become more and more useful as data flows increase. We are currently inviting new data partnerships to enrich the effort leading up to the global rollout of this new approach in 2021.

See the big picture.

There's so much to see when you dig deep beneath the surface. Here's the big takeaway: More carbon exists in soils on a global scale than in all vegetation and the atmosphere combined. This means that increasing organic carbon in soil by a relatively small amount can make a large contribution to the needed carbon removal.

While Soils Revealed focuses specifically on the few scenarios that are currently possible through IPCC Tier 1 accounting—entailing the least complex methodology of three tiers—the platform provides detail down to 250 meters for some maps. Our objective is to permit even sub-national decision-makers to observe how historic losses have affected their domain, visualize soil carbon storage projections, and choose a course for sustainable management or restoration.

Soil carbon isn't a silver bullet, and it won't be easy to transform a sector—but it is possible. Indeed, there is no panacea for the crises we're facing; only solutions that can help accelerate our action. And in seeing soils like soil scientists—with an awareness of the multitudinous benefits of soil organic carbon—our societies can begin to build a more sustainable food system on a strong foundation, and just maybe, begin to sense the true value of the ground beneath our feet.

Sources: *https://www.nature.org/en-us/what-we-do/our-insights/perspectives/soils-revealed-climate-biodiversity-food-solutions/*

Research shows more riparian buffer strips can protect our waterways

by Eric Hamilton

A new study suggests we may have more opportunities to protect our waterways. That's because one system for keeping too many nutrients out of streams could be used more widely than it is now.

Known as saturated riparian buffer strips, the system slows down and redirects water coming off farm fields. Water passes through a strip of land planted with native plants (the buffer). The technique allows more nitrogen to get absorbed by plants or turn into nitrogen in the air. The system is affordable and fairly simple, and it can remove up to 92% of nitrate, a form of nitrogen.

Without edge-of-field technologies like buffer strips, farmland often spills excess nutrients from fertilizers into nearby streams. Those nutrients degrade water quality and can kill wildlife. But one effective way to reduce the spread of nutrients is a special buffer between crops and streams.

The new study discovered that these buffers could be installed in more places than previously thought. By expanding the sites where the buffers are placed, farmers could protect more of their local streams. "Limiting nutrient transport off of fields and into waterbodies prevents overgrowth of harmful algae and protects in-stream ecosystems," says Loulou Dickey, researcher at Iowa State University, who led the research.

The study was recently published in the Journal of Environmental Quality, a publication of the American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America.

Current guidelines limit where the riparian buffers should be installed. One big concern is that the redirected flow of water will weaken the streambank. If the streambank erodes and falls into the stream, it hurts water quality and

A saturated riparian buffer protects nearby streams from fertilizer nutrients leaching off farm fields. A strip of native plants and trees helps absorb nitrogen that would otherwise make its way into local waterways. Credit: Loulou Dickey

damages the land. The buffers are limited to banks that are not too tall, in hopes this pro-

tects the banks from damage.

Dickey's team tested the assumption about bank height. They also looked at how adding in a new riparian buffer affected streambank stability. They combined real-world data collection with models of hundreds of possible scenarios. "We wanted to help practitioners and designers to make determinations about site suitability in the future," says Dickey. "Therefore, we needed to include a wide range of possible site conditions."

The team found that most streambanks turned out fine once the farmer added a new riparian buffer. Only in about three percent of the scenarios did the new water's flow through the soil endanger the stability of the bank. The conditions where the bank failed included sandy soils that didn't hold together very well and riparian buffers that were less than six feet wide. Those situations are unlikely to happen in the real world, says Dickey.

The biggest predictor of a failing streambank was one that was already unstable. "If the streambank is already failing, it is likely to continue to do so, but if the bank is relatively stable, it will likely remain stable even with saturated riparian buffer flow," Dickey says.

The height of the streambank also didn't predict the future stability. Instead, a bank that was too steep was more likely to fail. Steep streambanks have always been at risk of erosion. The takeaway is that many sites that used to be off limits could be good candidates for new riparian buffers.

"I hope our work will give farmers and landowners the confidence to install more saturat-

ed riparian buffer strips," says Dickey. "I also hope farmers know how grateful we are to have the opportunity to study these practices because of their support."

Expanding the use of the saturated riparian buffer could give farmers a straightforward and cost-effective way to protect their land's water quality. That's a boon for the farmer - and for everyone downstream.

This work was supported by Iowa NRCS grant no. NR186114XXXXG006 from the USDA. Loulou Dickey was supported in part by the National Science Foundation under grant no. DGE-1828942 during work on this research.

Sources: *https://www.soils.org/news/science-news/research-shows-more-riparian-buffer-strips-can-protect-our-waterways*

Plastic pollution is also pervasive in our agricultural soils

by FAO, the United Nations

The scourge of unsightly images of plastic refuse littering our beaches and oceans always receives much attention. But a new report by the Food and Agriculture Organization of the United Nations (FAO) suggests that the land we use to grow our food is contaminated with far larger quantities of plastic pollution, posing an even greater threat to food security, people's health, and the environment.

The report, "Assessment of agricultural plastics and their sustainability: a call for action," is the first global report of its kind by FAO and contains some startling numbers.

According to data collated by the agency's experts, agricultural value chains each year use 12.5 million tons of plastic products. A further 37.3 million tons are used in food packaging. The crop production and livestock sectors were found to be the largest users, accounting for 10.2 million tons per year collectively, followed by fisheries and aquaculture with 2.1 million tons, and forestry with 0.2 million tons. Asia was estimated to be the largest user of plastics in agricultural production, accounting for almost half of global usage.In the absence of viable alternatives, demand for plastic in agriculture is only set to increase.

According to industry experts, for instance, global demand for greenhouse, mulching and silage films will increase by 50 percent, from 6.1 million tons in 2018 to 9.5 million tons in 2030.

Credit: FAO/Cristina Aldehuela

Such trends make it essential to balance the costs and benefits of plastic. Of increasing concern are microplastics, which have the potential of adversely affecting human health. While there are gaps in the data, they shouldn't be used as an excuse not to act, FAO warned.

"This report serves as a loud call to coordinated and decisive action to facilitate good management practices and curb the disastrous use

of plastics across the agricultural sectors," FAO Deputy Director-General Maria Helena Semedo said in the report's forward.

The report was presented today at a virtual event in conjunction with World Soil Day.

The good

Plastics have become ubiquitous since their widespread introduction in the 1950s, and it is difficult today to envisage life without them.

In agriculture, plastic products greatly help productivity. Mulch films, for instance, are used to cover the soil to reduce weed growth, the need for pesticides, fertilizer and irrigation; tunnel and greenhouse films and nets protect and boost plant growth, extend cropping seasons and increase yields; coatings on fertilizers, pesticides and seeds control the rate of release of chemicals or improve germination; tree guards protect young seedlings and saplings against damage by animals and provide a microclimate that enhances growth.

Moreover, plastic products help reduce food losses and waste, and maintain its nutritional qualities throughout a myriad of value chains, thereby improving food security and reducing greenhouse gas (GHG) emissions.

The bad and the ugly

Unfortunately, the very properties that make plastics so useful create problems when they reach the end of their intended lives.

The diversity of polymers and additives blended into plastics make their sorting and recycling more difficult. Being man-made, there are few microorganisms capable of degrading polymers, meaning that once in the environment, they may fragment and remain there for decades. Of the estimated 6.3 billion tons of plastics produced up to 2015, almost 80 percent has not been disposed of properly.

Once in the natural environment, plastics can cause harm in several ways. The effects of large plastic items on marine fauna have been well documented. However, as these plastics begin to disintegrate and degrade, their impacts begin to be exerted at the cellular level, affecting not only individual organisms but

also, potentially, entire ecosystems.

Microplastics (plastics less than 5 mm in size) are thought to present specific risks to animal health, but recent studies have detected traces of microplastic particles in human feces and placentas. There is also evidence of mother-to-fetus transmission of much smaller nanoplastics in rats.

While most scientific research on plastics pollution has been directed at aquatic ecosystems, especially oceans, FAO experts found that agricultural soils are thought to receive far greater quantities of microplastics. Since 93 percent of global agricultural activities take place on land, there is an obvious need for further investigation in this area.

Key recommendations

The absence of viable alternatives makes it impossible for plastics to be banned. And there are no silver bullets for eliminating their drawbacks.

Instead, the report identifies several solutions based on the 6R model (Refuse, Redesign, Reduce, Reuse, Recycle, and Recover). Agricultural plastic products identified as having a high potential for environmental harm that should be targeted as a matter of priority include non-biodegradable polymer coated fertilizers and mulching films.

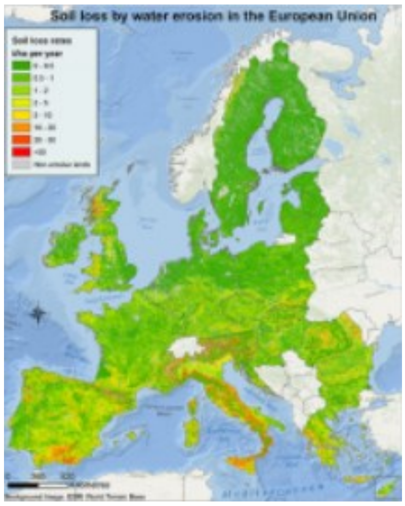
The report also recommends developing a comprehensive voluntary code of conduct to cover all aspects of plastics throughout agri-food value chains and calls for more research, especially on the health impact of micro- and nanoplastics.

"FAO will continue to play an important role in dealing with the issue of agricultural plastics holistically within the context of food security, nutrition, food safety, biodiversity and sustainable agriculture," Semedo said.

Sources: *https://phys.org/news/2021-12-plastic-pollution-pervasive-agricultural-soils.html*

Data: Soil erosion by water (RUSLE2015)

Description: At a resolution of 100m, this is the most detailed assessment yet of soil erosion by water for the EU. The study applied a modified version of the Revised Universal Soil Loss Equation (RUSLE) model, RUSLE 2015, which delivers improved estimates based on higher resolution (100 m compared to 1 km) peer-reviewed inputs of rainfall, soil, topography, land use and management from the year 2010 (the latest year for which most of the input factors are estimated). The model can be used to predict the effect of a range of policy scenarios. It is also replicable, comparable and can be extended to model other regions. All the input layers (Rainfall erosivity, Soil Erodibility, Cover-Management, Topography and Support Practices) have been peer reviewed and published as well.



Spatial Coverage: European Union 28 Member States

Resolution: 100m

Time Reference: 2010, 2016

Format: Raster (Grid)

Projection: ETRS89 Lambert Azimuthal Equal Area

Input data: LUCAS Topsoil, European Soil Database, Lucas Earth Observations, Rainfall Erosivity Database at European Scale (REDES), CORINE Land Cover 2006, COPERNICUS Remote Sensing, EUROSTAT (statistics on Crops, Tillage, Plant residues, cover crops), Digital Elevation Model (DEM) at 25m, Good Agricultural Environmental Condition (GAEC).

More Information: RUSLE2015

Additional data: Rainfall erosivity (R-factor), Soil Erodibility (K-factor), Topography (LS-factor), Cover Management (C-factor), Support Practices (P-factor) data are also available for download in the corresponding pages.

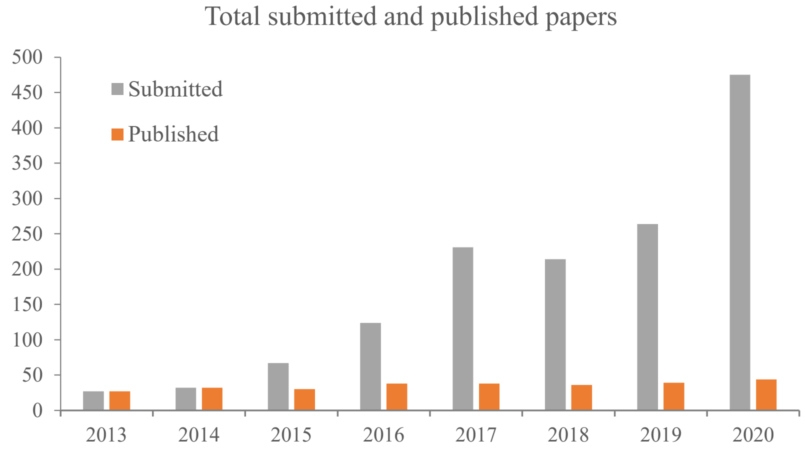
Release Date: 1/9/2015

More details: https://esdac.jrc.ec.europa.eu/content/soil-erosion-water-rusle2015

Updated submission data of ISWCR in December 2021

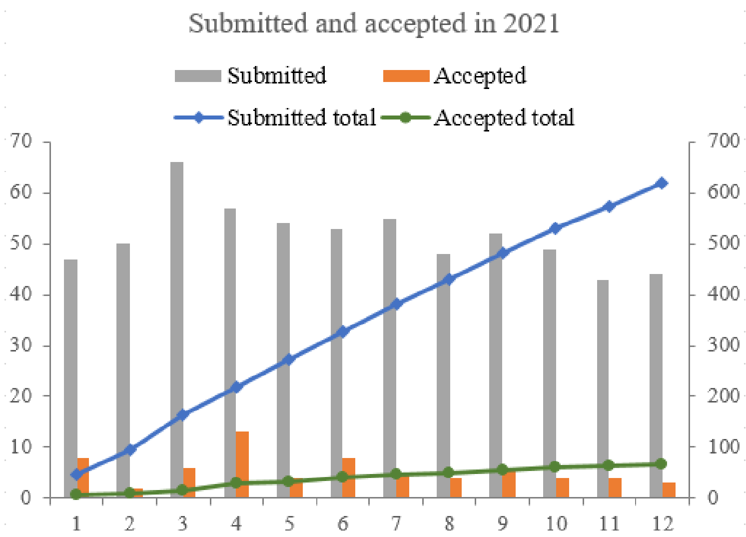
Annual Volume of Submissions and Publishing since 2013

Year	Published	Submitted
2013	27	27
2014	32	32
2015	30	67
2016	38	124
2017	38	231
2018	36	214
2019	39	264
2020	44	475
2021	55	618



Monthly Submissions & Acceptance in the current year (2021)

Month	Submitted	Accepted
1	47	8
2	50	2
3	66	6
4	57	13
5	54	4
6	53	8
7	55	5
8	48	4
9	52	6
10	49	4
11	43	4
12	44	3



The International Soil and Water Conservation Research (ISWCR), initiated in June 2013, is a quarterly academic journal in English and publishes in Science Direct of Elsevier with open access globally. Since initiation, ISWCR has developed rapidly and established a good reputation in both international academia and publishing industry. It was indexed by Chinese Science Citation Database (CSCD) in April 2015, covered by SCOPUS in January 2017, and was indexed by Emerging Sources Citation Index (ESCI) of Clarivate Analytics in October 2017. In July 2019, ISWCR was officially indexed by SCIE. The Impact factor of ISWCR is 3.770 in 2019, and **6.027 in 2020.**

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Changes in hydrologic components from a mid-sized plots induced by rill erosion due to cyanobacterization

Atefeh Jafarpoor, Seyed Hamidreza Sadeghi, Behrouz Zarei Darki, Mehdi Homaee

Pages 143-148

A detailed reconstruction of changes in the factors and parameters of soil erosion over the past 250 years in the forest zone of European Russia (Moscow region)

Andrey Zhidkin, Daria Fomicheva, Nadezhda Ivanova, Tomáš Dostál, ... Josef Krása

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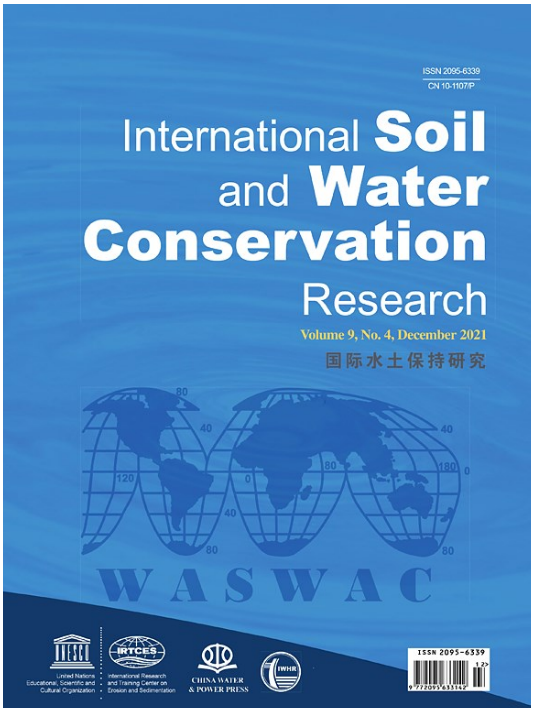

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Papers Published in the ***International Journal of Sediment Research*** Volume 37, No. 1, 2022
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