WASWAC

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Abou Amani, Director of the Division of Water Sciences of UNESCO and Secretary of UNESCO-IHP, visited IRTCES

On September 13, Abou Amani, Director of the Division of Water Sciences of UNESCO and Secretary of UNESCO-IHP, visited IRTCES to discuss and exchange views on the priority areas of the ninth phase of UNESCO-IHP, and to deepen the cooperation with the China Institute of Water Resources and Hydropower Research (IWHR) and the IRTCES. Prof. Peng Jing, President of IWHR and Director of IRTCES, met with Mr. Abou Amani and presided over the meeting, while Prof. Pan Qingbin and Prof. Zhang Jianli, Deputy Directors of IRTCES, as well as relevant persons in IRTCES, in International Cooperation Department of IWHR and relevant experts participated in the meeting.

Prof. Peng Jing said that the IWHR and UNESCO have maintained close communication and cooperation for a long time, and the IRTCES that affiliated to IWHR is the first category 2 center in the world jointly established by the Chinese government and UNESCO. Prof. Peng introduced the recent development of IWHR and IRTCES, and exchanged views on the cooperation in the fields of important academic conferences, professional training, open science and data, popularization of science education, water culture, etc. She expected that the two sides would continue to deepen the cooperation, strengthen the dissemination of science and knowledge, and promote the output of substantive results, so

as to make contributions to the support of the United Nations sustainable development goals related to water and the ninth phase of the UNESCO-IHP program.

Director Amani thanked the IWHR and IRTCES for the warm reception and congratulated for the fruitful achievements. He said that UNESCO strongly advocates multilateralism and prioritizes support for open science. Sedimentation and soil and water conservation are closely related to production, life and ecology, and knowledge dissemination and open research on sedimentation and soil and water conservation should be further strengthened under the combined influence of global climate change and human activities. He shared the objectives and path of the ninth phase of UNESCO-IHP, and said that the International Sediment Initiative (ISI) undertaken by IRTCES needs to further accumulate global wisdom, focus on knowledge dissemination and popularization of science, and further cultivate the consensus that the conservation and use of sediment, soil and water conservation is the protection of the earth.

The participants discussed the new challenges faced by the world, such as climate change, the sharing of China's experience in water management, UNESCO's requirements for the Flagship Program, the organization and operation management of ISI, UNESCO's partnership, popularization of water science education, and the activities of IRTCES's 40th anniversary next year, and so on.

Impact of Climate Change on Ecosystems

Prof. Dr. Velibor Spalević

N: Crisis on the Shores of Seas, Lakes, Rivers, and Mountain Peaks: Climate Change's effect on our Aquatic Ecosystems. Over the last three decades, the water levels in more than half of the world's lakes have seen a significant decline.

PN: Urgent and decisive action at the local level is imperative to address the root causes – climate change and unsustainable water usage. The preservation of our lakes is not solely an environmental concern; these bodies of water are intricately linked to the livelihoods of millions of people worldwide, including most of us in Montenegro," emphasizes Spalević.

PODGORICA - Given the escalating impact of climate change, immediate action is imperative to safeguard our lake ecosystems and ensure sustainable access to water resources for both current and future generations. According to a report reproduced by WASWAC Hot News (Issue 6, 2023), in which Prof. Dr. Velibor Spalević serves as a youth committee member, more than half of the world's largest lakes have diminished over the past three decades, resulting in the loss of approximately 600 cubic kilometers of water.

As he conveyed to Pobjeda, it is vital to swiftly implement measures at the local level to protect our water sources. He highlights that this issue is of paramount concern for individuals who rely on these lakes for drinking water and irrigation.

"Climate change leads to more frequent and prolonged droughts, making it imperative for decision-makers to prioritize initiatives aimed at enhancing the resilience of water systems and implementing adaptation strategies to safeguard communities and ecosystems," Professor Spalević declared.

He emphasizes that the escalating desiccation of lakes poses a substantial threat to the ecosystems and communities residing in their vicinity. Decision-makers must acknowledge the gravity of this issue and take deliberate actions to address its underlying causes. The impact of climate change on lakes cannot be disregarded.

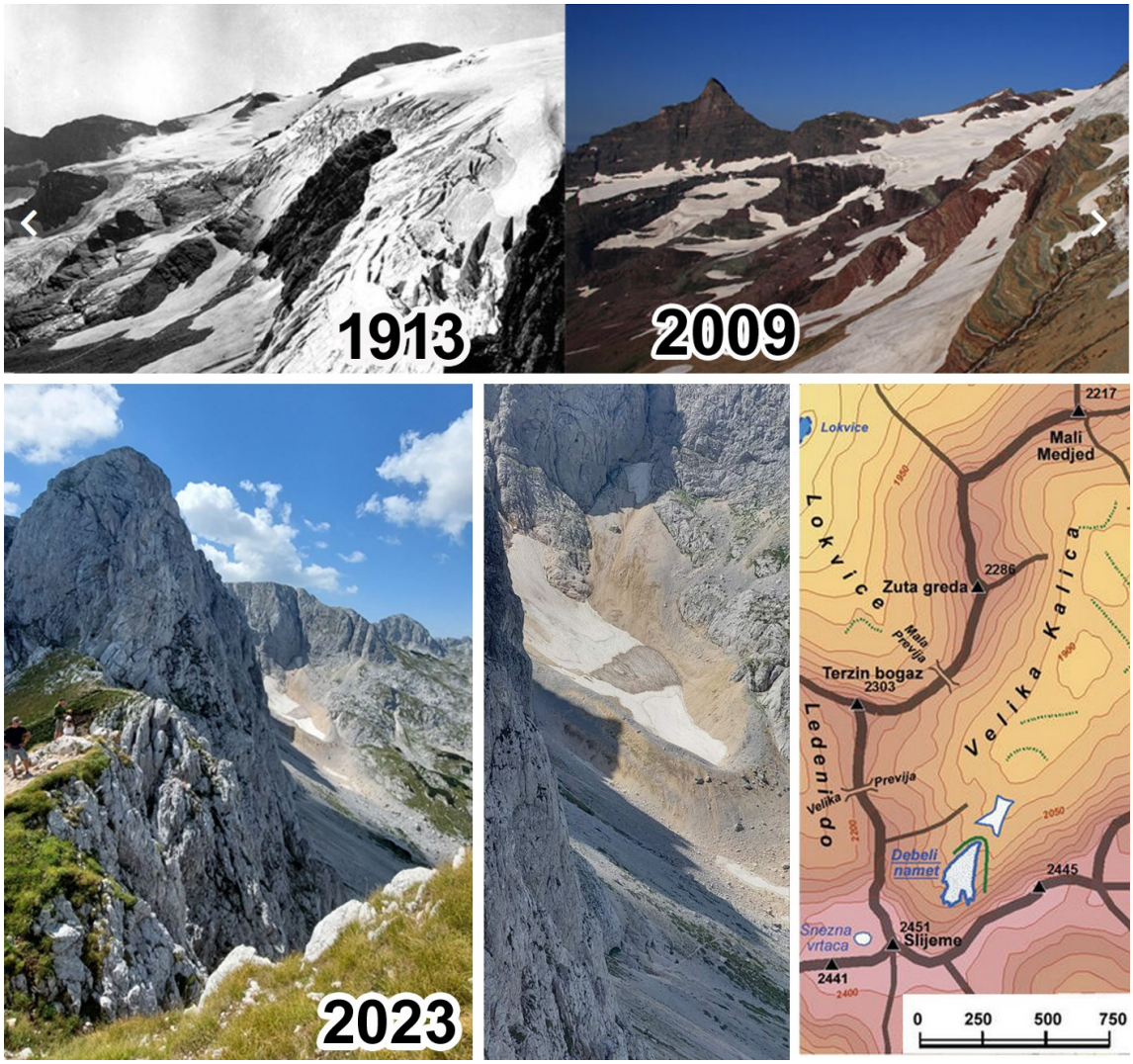
-Dried-up lakes pose a significant problem for local ecosystems and migratory birds, and can eventually become a source of unhealthy dust storms. This alarming trend of shrinking lakes affects approximately one-quarter of the Earth's population residing in these lake basin regions experiencing water loss. It is imperative that we take immediate and coordinated action at the local level to address the root causes – the impact of climate change and unsustainable water use. The preservation of our lakes is not merely an environmental concern; it has a direct bearing on the livelihoods of millions of people globally, including most of us in Montenegro, and the delicate equilibrium of our ecosystems. The responsibility for safeguarding these vital water bodies for present and future generations is shared, and we must collectively take positive steps forward," emphasizes Spalević.

He explains that during dry periods, certain riverbeds partially or completely dry up, leaving only specific portions of the riverbed with water, becoming essential refuges for fish and other aquatic life. However, research indicates that these water pockets are at risk of becoming filled with sediments – eroded soil. This exerts considerable pressure on the aquatic ecosystems. When droughts occur, the water that flows into the river carries soil with it. Historically, during significant periodic floods, the soil sediments deposited in these water pockets would be washed away, and Spalević stated that the preservation of the ecosystem in lakes and coastal areas contributes to the protection of water resources,

biodiversity conservation, and the reduction of soil erosion effects.

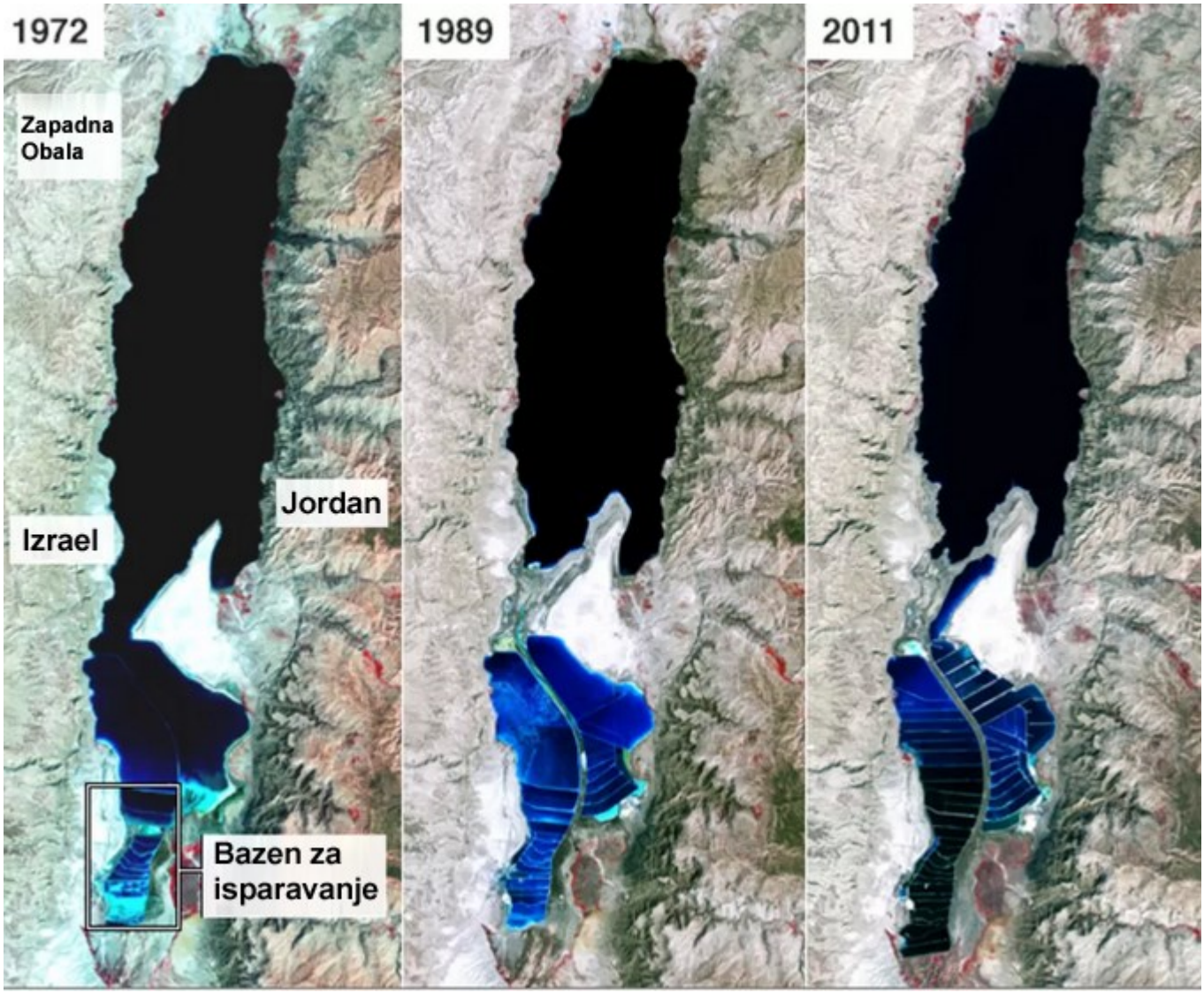
Spalević points out those studies from the 1990s suggested that as long as periodic flooding occurred, the removal of sediment from these water pockets was guaranteed, maintaining a natural balance in terms of aquatic life and sediment. However, the disappearance of native flora and fauna is currently observed in numerous locations due to sediment filling these water pockets, which are no longer being cleaned by periodic floods, as was the case at the end of the last century.

"In light of the concerning evidence of soil erosion filling our waterways and endangering critical river ecosystems, it is vital that we take immediate action to address or mitigate this issue. We must strive to preserve the delicate balance of life in our rivers and lakes, shielding them from the consequences of prolonged droughts, and working collaboratively to reduce the causes of soil erosion – such as production, transport, and sediment deposition – by promoting responsible practices in the comprehensive management of basins, land, and water.



We need to work together to ensure the resilience and proper condition of our rivers for the benefit of both nature and society," states Spalević. He also highlights that the intricate dynamics of these land degradation processes and the care of these ecosystems necessitate ongoing research and measurements.

"Understanding the processes of sediment accumulation and runoff is crucial for effective watershed management and flood damage control," says Spalević. "New research, both worldwide and within our own country, sheds light on this complex puzzle, and it's essential that we take steps to mitigate the impact of these processes on our watercourses."



"Given the current scenarios of climate change, we anticipate more frequent and prolonged droughts in our region," he continues.

"It is becoming increasingly important to implement measures that protect and maintain the functionality of watercourses in arid area.

These actions are necessary to preserve the diversity and vitality of the aquatic ecosystems and the people who rely on these waters for their livelihoods."

"By safeguarding our watercourses, we not only protect vital ecosystems and wildlife, but we also secure the water supply for communities facing more frequent and prolonged droughts due to climate change. Let our commitment to preserving our rivers and lakes be a testament to our dedication to a healthier planet and a brighter future for our people," Spalević asserts.

"The use of satellite imagery and scientific research has provided concrete evidence of the global decline in lake levels, with individual analyses conducted by scientists for the territory of Montenegro," he adds. "Soil erosion processes exacerbate this ecological problem, and effective management strategies are essential to reduce erosion intensity, sediment deposition in water bodies, and the intensity of maximum runoff from the basins. Let's prioritize resilience, adaptation, and the protection of our precious ecosystems and communities. Together, within the scientific community, we can chart the path to a more sustainable and resilient future for all," emphasizes Spalević.

He further explains that the implementation of sustainable integrated management systems in watersheds can alleviate pressure on water resources and reduce erosion intensity. "Proper watershed management helps preserve watercourses, reduce erosion, and mitigate maximum runoff. Water recycling can also provide additional water sources, currently utilized as municipal and industrial water. Preserving wetlands contributes to maintaining good water quality, as these areas serve as natural buffers during dry periods. Promoting awareness of water consumption and implementing effective water-saving measures can alleviate pressure on lakes and water resources," Spalević clarifies. "Moreover, international cooperation and interstate agreements on water resource management are essential for preserving water ecosystems."

"Increasing the utilization of renewable energy sources, such as solar and wind power, can alleviate the strain on water resources resulting from the construction of hydropower plants. I welcome the idea and the ongoing actions aimed at analyzing the issues affecting Biogradsko Lake and the Polimlje Region in our country. I hope that these efforts will partially slow down the observed degradation processes. The advantage in addressing these problems lies in the fact that we have already developed our own models that accurately describe these degradation processes.

Satellite observations and scientific research offer tangible evidence of the gradual decline in the lake's water level, along with changes in its shape and volume, which aid in understanding this issue. Conversely, the absence of effective erosion control measures and comprehensive land and water management in the basins can exacerbate the situation, leading to further depletion of our already imperiled water bodies in the country," explains Spalević.

He emphasizes that only through collaborative endeavors we can secure a more sustainable future for our lakes and the communities residing in these areas.

"As the contours of our world and our lives continuously evolve, with glaciers receding, lakes disappearing, and the equilibrium of ecosystems is on the edge of sustainability, we must remember that Earth is our shared home, enveloping us in nature's embrace. The evidence recorded by scientists in reports and captured in photographs transferred into data, serves as a reminder of our capacity to shape the future. We should not merely be passive spectators of this unfolding drama but active participants with the ability to address, protect, and preserve it. Every decision we make, every action we take, or our silence on these matters will reverberate through the ages, leaving an indelible mark on future generations' perception of us. This is a call to conscience, urging us to confront this challenge by embracing our roles and responsibilities. As we confront the challenges posed by climate change, let us be guided by the wisdom derived from scientific experiences – to integrate our current actions into the legacy of tomorrow. Our choices wield the power to either reshape the destiny of our world for the better or for the worse," Spalević concludes.

Box: Then and now - urgent action needed

Spalević highlights the critical issue of vanishing glaciers in the Prokletije Mountains and Durmitor, which are the southernmost glaciers in Europe. He explains that this concern is based on the examination of "repeated photographs" taken from precisely the same locations. In some other research of our colleagues, these photographs serve as a valuable tool for analyzing historical landscape changes, with some examples dating back, for example, to as early as 1887. This approach allows for a direct comparison between the landscapes of the past and the present. In some of the examples he presented, these photographs vividly showcase how glaciers have altered in shape, providing tangible evidence of the impact of climate change-induced warming, as documented in reports by fellow researchers in Glacier National Park.

Spalević advocates for the establishment of methods for regularly comparing photographs of the Prokletije Mountains and Durmitor glaciers. This would involve incorporating previous sporadic recordings into official databases, creating indisputable visual evidence of landscape changes driven by climate change. The transformation of these glaciers serves as a affecting reminder of the pressing need to combat climate change and safeguard our fragile ecosystems. It is crucial to give due attention to this visual testimony, using it as a compelling justification for immediate actions aimed at preserving our natural beauty for the benefit of both the current generation and those to come.

6 Društvo Ponedjeljak, 4. septembar 2023 | POBJEDA

Snažan uticaj klimatskih promjena na ekosisteme u našoj zemlji

Kriza na obalama mora, jezera, rijeka i planinskim vrhovima

Imperativ je da preduzmemo hitne i usklađene mjere na lokalnom nivou u borbi protiv osnovnih uzroka – uticaja klimatskih promjena i neodrživog korišćenja voda. Održivost naših jezera nije samo briga za našu okolinu i pejzaž: jezera su direktno povezana sa sredstvima za život miliona ljudi u svijetu, a većine nas u Crnoj Gori - poručuje Spalević

Velibor Spalević

PODGORICA - S obzirom na rastući uticaj klimatskih promjena, hitno treba djelovati kako bi se očuvali ekosistemi naših jezera i na taj način osigurao održiv pristup vodnim resursima za sadašnje i buduće generacije. Prema WASWAC istraživačima, u kojem je jedan od rukovodilaca i naučnih savjetnika prof. dr Velibor Spalević, više od polovine najvećih svjetskih jezera smanjilo se u posljednje tri decenije, izgubljeno je oko 600 kubnih kilometara vode.

DUGOTRAJNE SUŠE

Kako je on kazao Pobjedi, potrebno je preduzeti hitne mjere na lokalnom nivou kako bismo spasili naše vode. Ističe da je ovo veliki problem za ljude koji žive od tih jezera što se tiče vode za piće i navodnjavanje.

- Klimatske promjene dovode do čestih i dugotrajnijih suša, a donosioci odluka moraju dati prioritet mjerama za poboljšanje otpornosti vodnih sistema i implementirati strategije prilagođavanja za zaštitu zajednica i ekosistema - poručio je prof. Spalević.

On naglašava da sve veće isušivanje jezera predstavlja značajnu prijetnju i ekosistemima i zajednicama koje žive oko njih. Donosioci odluka moraju preporučiti održivost ovog problema i preduzeti održive mjere za rješavanje osnovnih uzroka. Uticaj klimatskih promjena na jezera ne može se zanemariti.

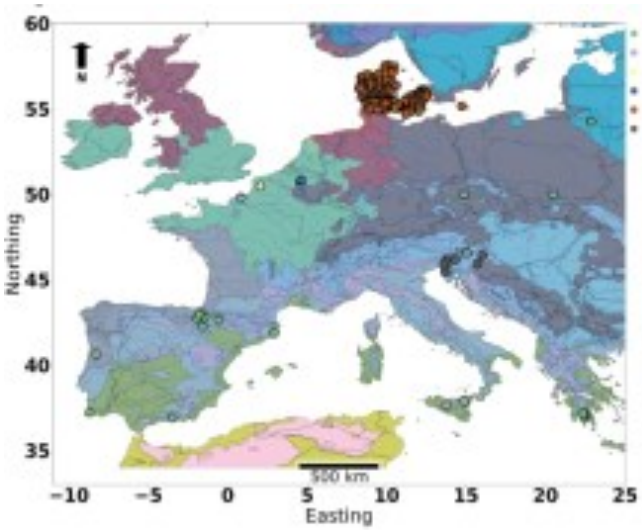
- Presušena jezera su problem što se tiče lokalnih ekosistema i ptica selica, a mogu čak vremenom postati izvor nezdravih oluja praha. Oko jedne četvrtine Zemljine populacije živi u ovim basenima sa gubicima vode jezera, suočeni sa ovim alarmantnim trendom smanjenja jezera. Imperativ je da preduzmemo hitne i usklađene mjere na lokalnom nivou u borbi protiv osnovnih uzroka – uticaja klimatskih promjena i neodrživog korišćenja voda. Održivost naših jezera nije samo briga za našu okolinu i pejzaž. Jezera su direktno povezana sa sredstvima za život miliona ljudi u svijetu, a većine nas u Crnoj Gori, upozorio delikatne razmjere ekosistema. Dijelimo odgovornost za očuvanje ovih vitalnih vodnih tijela za sadašnje i buduće generacije, a zajedno moramo napraviti pozitivne iskorake - poručuje Spalević.

Objašnjava da, tokom sušnih perioda, korita pojedinih rijeka presušuju dijelom ili u potpunosti, ostavljajući samo pojedine dijelove korita sa vodom kao jedina vlažna mjesta u usušenim koritima.

- Ribe i druga živa bića pokušavaju da se u ova vitalna skloništa. Ali istraživanja ukazuju da su ovi vodeni dispozitivi opasnost od popunjavanja sedimentima - erodiranim zemljištem. Ovo stvara veliki pritisak na živi svijet u rijekama. Kada dođe do suše, voda koja se izlivа u rijeku nosi zemljište sa sobom. U teoriji, zemljište natalo

EUropean SEDiments collaboration (EUSEDcollab) database

The EUropean SEDiments collaboration (EUSEDcollab) database contains a compilation of data contributions from monitored catchments spanning across multiple European institutions. The focus of the database is small to medium catchments, containing water discharge and sediment delivery time series measurements. These data can support research applications in soil erosion, sediment delivery and runoff studies. The compiled measurements allow insights into the processes governing soil erosion and sediment delivery across a spectrum of spatial and temporal scales. The data is aimed at multiple end-user applications, such as providing baseline information for further analytical studies and model application/development, allowing comparison with real measurements. As a user-orientated European Union Soil Observatory (EUSO) initiative, the contributed data is harmonised with a common metadata and time series structure to allow efficient reuse (for an example see: https://github.com/matfran/EUSEDcollab.git). This database aims to provide the research community with a starting point for new research opportunities in a range of sediment-related research avenues. To follow the wider variety of community activities arranged by the EUSO, the reader is directed to *https://esdac.jrc.ec.europa.eu/euso*



More information about EUSEDcollab network: You can also read the blog "Unlocking the potential of measured data to solve research priorities in soil erosion" developed in Springer Nature

Description

EUSEDcollab is available as a single repository containing multiple sub-folders with catchment data:

- ◇ METADATA: A series of files (.csv format) containing the completed metadata inputs for each catchment.
- ◇ Q_SSL: A time series (.csv format) containing time series of water discharge, suspended sediment concentration and total suspended sediment load.
- ◇ Q_SSL_QUALITY_CONTROL:(.json format

containing evaluations of the time series completeness with specific evaluations for the different dataset temporal structures. A description of each data quality check is given in (Data_quality_check_fields.xlsx).

- ◇ PRECIPITATION: Precipitation time series data from catchments with available measurements.
- ◇ SED_RATING_CURVES: Original sediment rating curve data from catchments with available data.
- ◇ ADDITIONAL_CATCHMENT_INFO: Other auxiliary information for each catchment e.g. catchment boundary information, land-use information, additional reports.

Each catchment is identifiable within the respective folders via the assigned ID number (ID_X) in the file name string. The Catchment_ID_assignment.csv file lists all catchments with their assigned ID number within the database.

Data collection

An initial phase of data collection was undertaken between 2020 and 2022 through the EUSO working group on Soil Erosion. The collection phase involved the identification and collection of multiple datasets through the formation of a collaborative network. EUSEDcollab is a continuing initiative aiming to bring together catchment data and researchers through a centralised platform.

Reference

Matthews F., Verstraeten G., Borrelli P., Vanmaercke M., Poesen J., Steegen A., Degré A., Rodríguez B.C., Bielders C., Franke C., Alary C., Zumr D., Patault E., Nadal-Romero E., Smolska E., Licciardello F., Swerts G., Thodsen H., Casalí J., Eslava J., Richet J.-B., Ouvry J.-F., Farguell J., Święchowicz J., Nunes J.P., Pak L.T., Liakos L., Campo-Bescós M.A., Żelazny M., Delaporte M., Pineux N., Henin N., Bezak N., Lana-Renault N., Tzoraki O., Giménez R., Li T., Zuazo V.H.D., Bagarello V., Pampalone V., Ferro V., Úbeda X., Panagos P. 2023. EUSEDcollab: a network of data from European catchments to monitor net soil erosion by water. Sci Data 10, 515. DOI: 10.1038/s41597-023-02393-8

Request Form

https://esdac.jrc.ec.europa.eu/content/EUSEDcollab#tabs-0-description=1

The European Law on Soil Monitoring

Edoardo A.C. Costantni
President of the International Union of Soil Sciences

On July 5, 2023, the European Commission published the Proposal for a Directive of the European Parliament and of the Council on soil monitoring and resilience (Soil Monitoring Law) COM(2023) 416 final 2023/0232 (COD).

Background: In April 2002, the Commission announced its intention to develop a Soil Protection Strategy and prepare the ground for a European soil legislation proposal. Subsequently, in 2006, the Commission adopted an initial proposal, but heated political debates took place in the EU Council under different presidencies. Ultimately, an agreement was not reached due to a minority of five Member States. As a result, the Commission withdrew its proposal in 2014. Meanwhile, soil degradation in Europe has worsened. Currently, 4.2% of the territory has been urbanized, mainly at the expense of agricultural land. Furthermore, soil degradation is compromising the long-term fertility of agricultural land. It is estimated that between 61% and 73% of agricultural land in the EU is affected by erosion, organic carbon loss, nutrient excesses (primarily nitrogen and phosphorus), compaction, or secondary salinization (or a combination of these threats). All of this causes serious environmental and economic damage. The Commission estimates that soil compaction alone can reduce crop yields by 2.5% to 15%. Additionally, over one billion tons of soil are lost annually due to erosion. Without sustainable soil management and actions to regenerate soils, it is feared that compromised soil health will become a central factor in future food security crises. Contaminated soils also affect food security. For example, around 21% of agricultural soils in the EU contain concentrations of cadmium in the topsoil that exceed the established limit for groundwater.

The European Commission believes that collective action is necessary, also because soil degradation costs the EU a total of around 74 billion euros per year. The directive falls within the framework of the European Green Deal and contributes to achieving the ambitions set by the EU Soil Strategy for 2030. The EU Soil Strategy is a key outcome of the EU Biodiversity Strategy for 2030 and establishes a framework and concrete measures to protect and restore soils and ensure their sustainable use. It also sets a vision and objectives to achieve healthy soils by 2050, with concrete actions by

2030. The aim of the proposed Directive is to contribute to addressing major social challenges, such as:

- Achieving climate neutrality and becoming resilient to climate change
- Reversing biodiversity loss and fulfilling international commitments on biodiversity
- Reducing pollution to levels no longer considered harmful to human health and the environment
- Fulfilling international commitments on neutrality in soil degradation

Specifically, the implementation of the proposal should ensure that soils throughout the EU are healthy by 2050 and managed sustainably to avoid further deterioration. The objective of this Directive proposal is to stop soil degradation, thereby ensuring that soils can provide multiple ecosystem services to meet environmental, social, and economic needs, while reducing soil pollution to levels no longer considered harmful to human health and the environment.

The operational objectives, on the other hand, are to establish measures to stop soil degradation and regenerate soil health, provide an effective framework for ensuring the implementation of the Directive, particularly through the obligation for Member States to assess soil health.

The directive establishes measures related to soil monitoring and evaluation; sustainable soil management; inventory and remediation of contaminated sites.

It is useful to remember that the Directive defines 'soil' as the top layer of the Earth's crust situated between the bedrock and the land surface, which is composed of mineral particles, organic matter, water, air and living organisms; while 'soil health' means the physical, chemical and biological condition of the soil determining its capacity to function as a vital living system and to provide ecosystem services.

The main activities that Member States will have to carry out are as follows:

(1) Defining soil health and establishing territorial soil districts, delineated based on soil type, climatic conditions, environmental zone, land use or land cover.

(2) Soil health monitoring: Member States will have to establish a monitoring framework based on soil districts. The monitoring framework will be based on soil health descriptors and criteria. A soil is considered healthy when the values of all soil descriptors meet the established criteria.

(3) Sustainable soil management: Member States will need to define sustainable soil management practices to be gradually implemented on all soils, as well as the practices that negatively impact soil health, which have

to be avoided. Based on the outcome of soil health assessments, they will also need to establish regeneration practices to be gradually implemented on unhealthy soils. Member States should establish mechanisms to recognize the efforts of landowners and soil managers in maintaining soil in healthy conditions, including soil health certification.

Regarding the reduction of soil consumption, Member States must avoid or minimize the loss of soil's capacity to provide ecosystem services, including food production, by reducing the area affected by urbanization, selecting areas where the loss of ecosystem services can be minimized, and implementing urbanization in a way that minimizes negative impacts on the soil. Member States must also compensate as much as possible for the loss of soil's capacity to provide ecosystem services caused by urbanization through appropriate interventions.

(4) Identification, registration, investigation, and assessment of contaminated sites.

(5) Restoration (regeneration) of soil health and remediation of contaminated sites.

The selected soil descriptors for assessing soil health play a crucial role in the implementation of the directive. Each descriptor has a threshold indicating the soil's health status. The descriptors common across the EU are salinization, erosion, organic carbon, and subsoil compaction. At the Member State level, the descriptors are nutrient content, contamination, and water retention capacity. Other descriptors without threshold criteria are acidification, surface soil compaction, biodiversity, and urbanization.

The water retention capacity descriptor is particularly interesting and innovative. The estimated value for the total water retention capacity of a soil district should exceed a minimum threshold per hydrographic basin or sub-basin. The minimum threshold will be determined by the Member State at the soil district and hydrographic basin or sub-basin level to mitigate the impacts of periods of drought and of flooding due to heavy rainfall. Actually, healthy soils can retain up to 25% of their mass in water, contributing to the prevention of disaster risks and acting as long-term reservoirs for recharging groundwater. The natural water storage capacity of resilient soils, wetlands, and forests exceeds what could be achieved through costly new artificial reservoirs.

The criteria used to assess soil health are also interesting, although they may not fit well with Mediterranean conditions. The carbon/clay ratio > 1/13 is too high for Mediterranean soils, which are often clay-rich. However, in

this case, Member States can adjust the threshold based on their conditions. Adjustment is not provided, though, for soil erosion, where the threshold between healthy and unhealthy soils is set at >2 tons/ha/year. This means that most Mediterranean soils cultivated even on gentle slopes are considered unhealthy. However, the criterion does not consider soil erosion caused by land leveling, slope modeling, and earth movements, which are activities responsible for significant soil losses, especially prior to planting tree crops.

The Commission expects that the proposed Directive will bring significant environmental benefits and improve soil health, with positive effects on water and air quality, biodiversity, climate, and food benefits.

It is also expected that the implementation of the proposal will create numerous opportunities for SMEs in terms of growth (e.g., investigation and remediation of contaminated sites, soil health consulting services, soil analysis laboratories) and innovation in designing and implementing sustainable soil management and restoration measures. Furthermore, the implementation of soil monitoring should create opportunities for research and development in companies providing soil surveys.

The directive includes some indicators to monitor its implementation:

- Number of soil health monitoring points.
- Proportion of EU territory where soils are in good health.
- Measures of sustainable soil management adopted.
- Measures of regeneration implemented.
- Number of potentially contaminated sites registered in dedicated national registers.
- Number of potentially contaminated sites investigated.
- Number of contaminated sites remediated or properly managed.

The proposed directive will enter into force after its adoption, but there will be a 2-year transition period for Member States to adopt and notify the laws, regulations, and administrative provisions necessary to comply with this directive. After the end of the transition period, Member States must establish adequate governance and a soil monitoring framework, including the determination of sampling points and the adoption of methodologies to establish soil districts and establish a register of potentially contaminated sites. It is also expected that coordinated action at the EU level will address potential distortions in the internal market and unfair competition among businesses, as some Member States have less stringent environmental requirements.

However, the directive allows Member States considerable flexibility to identify the most

appropriate measures and adapt the approach to local conditions. This is considered crucial to ensure that regional and local specificities in terms of soil variability, land use, climatic conditions, and socio-economic aspects can be adequately considered.

The estimated private costs of implementing sustainable management and restoration of agricultural and forest soil range from 28 to 38 billion euros per year. It is also estimated that 29 billion euros (distributed over 15 years) will be required for identifying and investigating contaminated sites, and 24.9 billion euros (distributed over 25 years) for remediation of contaminated sites.

Overall, the annual benefit derived from the costs avoided due to soil degradation is estimated at 550 billion euros, excluding contamination, which has an estimated benefit of 220 billion euros per year. During the evaluation period until 2060, the Commission calculates a public and private benefits-to-cost ratio of 1.7 for the implementation of the directive.

Beyond these positive and significant economic estimates, the Directive has the indisputable merit of drawing the attention of policymakers and public administrators to soil health, upon which the health of European citizens also depends. It represents a historical step forward in achieving public awareness of soil health, and it is certainly hoped that it will be approved by the European Parliament. The soil science community is immensely grateful to all those who have worked tirelessly for many years to achieve this significant outcome. We also acknowledge the contributions of soil scientists from all over the world, who have helped establish the knowledge foundation for this directive.

The directive remains open to adjustments, which can be based on the results of its application. Therefore, a further significant contribution from soil scientists will be needed in the coming years.

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Suraj Bhan (India)
Surinder Singh Kukal (India)
Syaiful Anwar (Indonesia)
Ted Napier (USA)
Tingwu Lei (China)
Valentin Golosov (Russia)
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