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Soil – natural carbon and water bank of the landscape

Second EUSO Stakeholders Forum, October 24, 2022

Factors of climate change – land use, land use change, soil quality and rainwater management

- **Pedosphere, Hydrosphere, Troposphere** – space of climate and climate change
- **Imbalance of main global water reservoirs** - sea level rise versus decrease of underground water reserves
- **Continual land use changes** – land take, soil sealing, deforestation, drying up land and desertification, changes in carbon cycle and storage
- **Rise of average global temperatures and anomalies of temperature rises** – influence of heat islands and increase of sensible heat footprint of the land use
- **Decrease of functioning vegetation and soil vegetation cover** – decrease of biotic regulation
- **Time and space changes of precipitations and rise of flood and drought events** - social and economic impacts

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Key indicators to check on an annual basis

change / cumulative impact

Indicators of soil health that decrease:

- **rainwater retention capacity of soil and landscape structures** – need to increase at least 50 m^3 / ha and more every five years
- **functioning vegetation cover of soil / vegetation cover of soil** – need to maximize photosynthesis as a landscape cover
- **change of the carbon content / organic material** – need for increase

Other negative impact indicators:

- **intensity and amount of soil erosion** – need to minimize
- **soil sealing and land take** – need to minimize
- **amount of channelled rainwater from area** – need to reduce
- **landscape sensible heat production** – need for decrease

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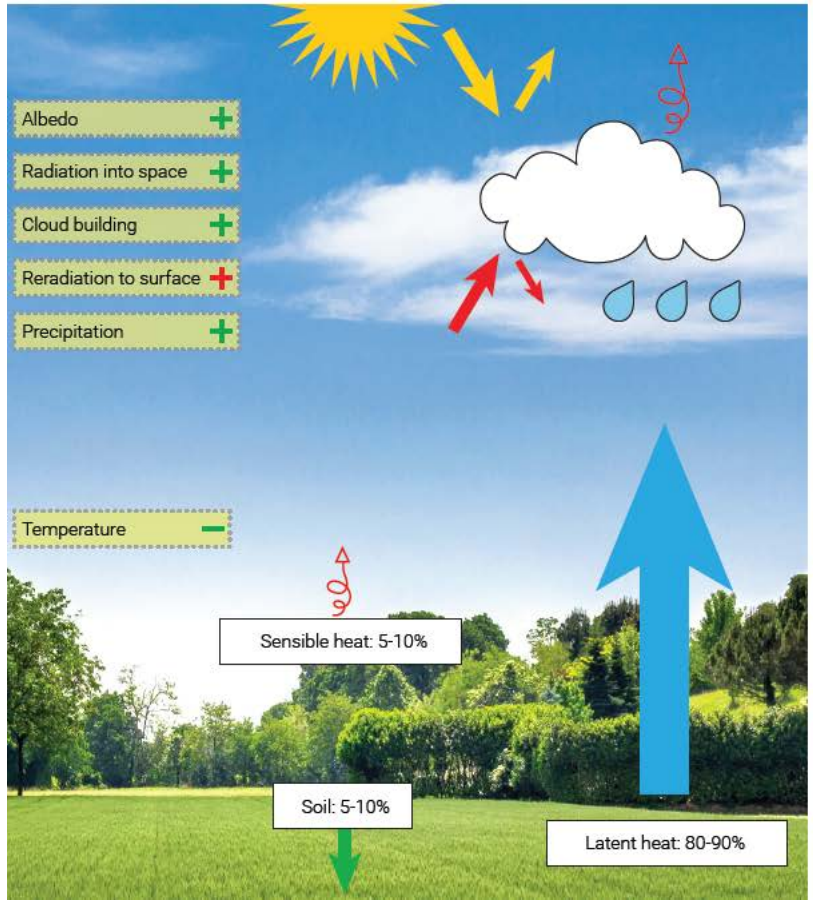
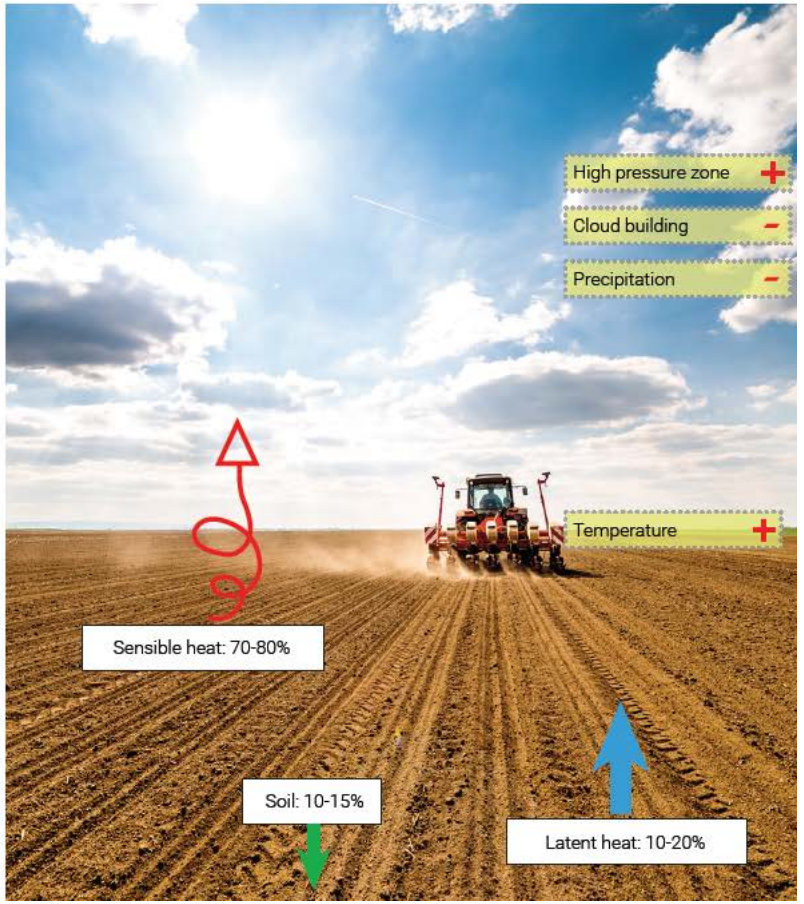
Soil, water and plants play a key role in managing temperatures





Changes of soil and rainwater distribution
Change of energy cycles in the troposphere

Heat impact of the land use is up to 100 times stronger (150-200 $W.m^{-2}$) than radiative forcing due rise of CO_2 (1-3 $W.m^{-2}$)

1,5 °C

Source: FORESIGHT Brief 025, UNEP, July 2021, Graphic: Stefan Schwarzer, UN Environment/GRID-Geneva

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Complex soil functions – soil ecosystem services

As reservoir for:

- Water (ground water and soil moisture) and carbon (above and underground carbon pool) – water retention capacity and carbon content decreases

As a basis for vegetation cover and space for soil biodiversity

- Plant production, forestry, biodiversity, soil vegetation cover – cooling of the landscape - share of vegetation cover and organic matter decreases

As a distributor of sunlight energy and rainwater

- Is affected by properties of soil, landscape structures and land use
- Lack of vegetation and water causes overheating of soil and landscape, spread of „heat islands“

As upper layer of plots – part of microcatchments and catchments

- Soil represents entry for all rainwater (100 %) in water cycle

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Need for sustainable cycles – Water cycle, Carbon cycle, Energy cycle, Nutrition cycle

New Water Paradigm / NEXUS approach

There is continual loss of soil organic material and water retention capacity of the landscape for decades. We need to slow down this process and reverse it.

Water retention capacity of soil and landscape structures and cumulative impact of sensible heat production of land use is not a subject of regular monitoring and evaluation. We have verified ways to measure, recalculate and assess it.

In practice we do not support and maintain ecosystem services of soil and landscapes in a permanent and effective way. We decided to change it.

By implementation of soil adaptation and management measures and rainwater management we are able to reduce a variety of risks, our sensible heat footprint and turn soil degradation to soil renewal. **We can ensure sustainable cycles.**

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Valuing and funding soil and landscape ecosystem services

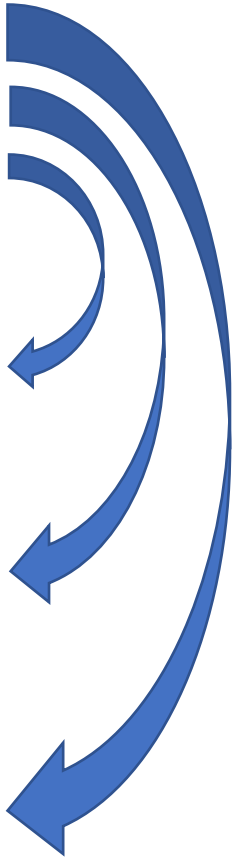
Innovations from Slovakia / AKIS

SOIL – CARBON AND WATER BANK OF THE LANDSCAPES - The concept of valuation and financing of soil and landscape ecosystem services

1. SOIL - INFORMATION AND MONITORING

2. CARBON AND WATER BANK - certification system

3. CLIMATE FUND FOR SOIL SYSTEM-new financial instrument for support of soil climate actions



Agricultural knowledge base NEXUS: soil – water – vegetation – climate – food – energy

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Opening an account in CARBON and WATER bank

Condition for participation: land owner or contracted land user / entry to a higher standard of ecological and climate stability

Account size = plot size / aggregate plot area
Bank account duration = support for soil protection / growth, soil protection against erosion, good water retention capacity = support of general interest
Bank services (support, monitoring, standards):

- land management records and history report
- support for adaptation measures (rain water retention, anti-erosion, green cover)
- land management support – annual area based payment
- certificate of conformity.

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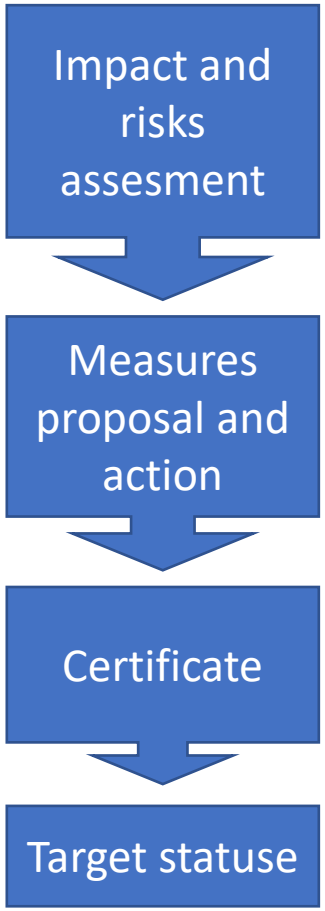
Water retention capacity as decentralised public infrastructure



Water retention capacity of soil and landscape structures:

1. **is currently not subject of systematic monitoring** - necessity
2. plays the key role in managing of water and carbon cycles (both - local and global) and speeding up climate changes and related risks
3. **has decentralised character** - every square metre, every hectare of the land has its exact contribution (size of the plot of the land / total size of available land surface of the continents)
4. **maintenance of good water retention capacity is subject of public interest**
5. from that point of view **it can be understood as decentralised public infrastructure**

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Soil - key environment, place and space for climate action and innovations - I

1. **Water retention capacity** of soil and landscape structures need to be monitored, assessed regularly and managed well. It plays a key role in the territorial distribution of rainwater. Rainwater is an asset of every country, every landowner and land user. Water retention capacity as decentralised public infrastructure
2. **Two thirds of the rainwater on the continents come from evaporation** of the water on continents. It is important to secure and maintain evapotranspiration via plants and vegetation cover of the soil.
3. **The evaporation of water through the process of photosynthesis is not a loss of the water.** CO_2 is a basic component of photosynthesis. Vegetation especially forests have a key role in cooling and managing temperatures. There is a direct link and relation between water retention capacity and climate
4. **Land use assessment** of the impact on the hydrology, biodiversity and climate

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Soil - key environment, place and space for climate action and innovations - II

5. Sensible heat footprint rises with less vegetation cover and decrease of soil water (forming heat islands effect)

6. Basic level of integrated planning - local plans of integrated rainwater management - maximising benefits of rainwater and securing good water retention capacity of soil and landscape structure of cadastral area (forest, agricultural land, urban areas). Managing rainwater and water retention capacities of land plots means managing the water, energy and carbon cycles on a local, regional and global level

7. Need for interlinking those who pay for the CO2 emissions, would like and need to secure its carbon neutrality with those who can guarantee CO2 removals by photosynthesis – wide land users and landowners participation.

Need for integrated approach - EU legislation

EU legislative framework	**Water framework directive**	Soil Health Law	**Solutions**
goals	**Good status of water - quality and quantity**	**Good status of soil - quality and quantity**	**Flood and drought risk reduction / moderation of temperatures, water production and soil productivity**
Type of planning	**Water planning**	Soil planning	**Integrated management and planning of soil fund and water resources****
Integration level	**Local water planning**	**Local soil planning**	**<u>Level of municipality cadastral area*</u>**

..... too many public strategies – lack of real integration – high costs – weak results ....

* **basic planning and integration unit** - includes all parts and lands of the cadastral area: forest, agricultural land, built-up areas, water areas

** principles of integrated water resources and land fund management

Level of planning / action plans / RWM and soil target

- **global framework** - GAP / Global action plan / Increase of water retention capacity 750 km^3
- **continental framework** - CAP / Continental action plan / Around few hundred km^3
- **national framework** - NAP / National action plan / Around few hundred million or few billion m^3 / Example of Slovakia - national target – to increase by **750 million cubic meters till 2035**
- **regional framework** - RAP / Regional action plan / Around 50 up to 100 million m^3/ Example of Kosice self-government region in Slovakia (461 villages and towns) – to increase by **60 million cubic meters**
- **local framework** - LAP / Local action plan / local water and soil planning / Around 100 000 m^3 and more / Plans of integrated rainwater and soil management as base of planning / Example of implementation measures in 488 Slovakia villages and towns – **increased water retention capacity by 10 million cubic meters** with more than 60 000 water retention measures

(reference: After us, the deserts or the deluge?, 2012, Global Action Plan, 2015)

Central role of EU Soil Strategy 2030

Figure 1: links between the EU Soil Strategy and other EU initiatives

Interactions of relevant Horizon Europe Missions:

- **Soil Deal for Europe**
- **Adaptation to Climate Change**
- **Restore our Oceans and Waters**
- **Climate Neutral and Smart Cities**

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Principles of integrated management of water and land resources

1st - of widespread protection of water resources and application of widespread measures of flood protection in basins as a priority

2nd - of respecting the importance of rainwater and the landscape's role in rainwater distribution

3rd - of cooperation and association of owners and co-owners of land and buildings in order to protect and use rainwater and protect the soil against erosion

4th - of evaluating the impact of planned construction, investment and management activities upon water circulation in the landscape

Principles of integrated management of water and land resources

5th - of re-assessment of current landscaping influencing the water balance and water regime in the area when deploying integrated management

6th - of thorough waste water treatment and economic assessment of the most suitable public water supply and sewage system

7th - of economical handling of water resources and recycling water

8th - of the creation and application of a real price for water

9th - of preparation and approval of plans for integrated water resources management in municipalities as a local element of the water planning process

Thank you for your attention

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