Climate-smart sustainable soil management for multiple benefits

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Soils provide ecosystem services

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Food security
Climate change
Water security
Soils
Health
Biodiversity & extinction

Adapted from McBratney et al., 2012

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1) Challenges

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33%
Climate change strongly affects land and soils

**Direct effects**
- Increased temperature
- Drought
- Increased frequency, intensity, amount of heavy precipitation
- Sea level rise

**Indirect effects**
- Irrigation
- Increased crop surface area

Climate change exacerbates the rate and magnitude of several ongoing land degradation processes and introduces new degradation patterns (high confidence). IPCC Special report on Land, 2019

Coastal erosion
Erosion
Floods
Permafrost thawing
Loss of soil organic matter
Salinization

**Indirect effects**
- Irrigation
- Increased crop surface area

IPCC Special report on Land, 2019

Soil management is sustainable if the supporting, provisioning, regulating, and cultural services provided by soil are maintained or enhanced without significantly impairing either the soil functions that enable those services or biodiversity.

**Sustainable soil management**
- Minimize soil erosion
- Enhance soil organic matter content
- Foster soil nutrient balance and cycle
- Preserve and enhance soil biodiversity
- Prevent and minimize soil acidification
- Prevent and mitigate soil salinization and alkalinization
- Prevent and minimize soil contamination
- Improve soil water management
- Prevent and mitigate soil compaction
- Minimize soil sealing

Soil organic matter
Soil organic matter provides ecosystem services

- Good soil structure
- Water infiltration and retention
- Aeration
- Provision of nutrients
- Beneficial organisms
- Soil fertility

The global carbon cycle

- Mean values 2009-2018 (Le Quéré et al., 2018)
- Graph after Obermeier & Baehr, 2010

4) Which management options?

Conservation agriculture
Agroforestry

Practices to increase SOC stocks in agriculture

Climate-smart sustainable soil management with no SOM preservation/ increase?

Different priorities

IPCC special report Climate Change and Land- 2019
Climate-smart sustainably managing soils, in particular preserving and enhancing soil carbon, brings multiple benefits

- **Benefits** ecosystem services delivery, climate change adaptation and mitigation, reducing soil degradation and restoring soils
- preserving/increasing soil C is feasible, but heterogeneous
- achieve locally, spatially differentiated, global impacts
- not a single good practice but adequate combination of practices in a given context
- enabling environment
- **systems** perspective, thinking

Knowledge needed...

- Detailed knowledge of the properties and functions of soils
- Soil biochemical systems
- Framework and tools to assess and monitor soils and ecosystems
- Ecosystem services
- Enabling context for action or impact
- Opportunities and trade-offs

Climate-smart sustainable soil management

Thank you for your attention!