ERASMUS-EDU-2023-CBHE
Project number: 101129032

Duration: 36 months
(01/01/2024 – 31/12/2026)

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LAND MANAGEMENT
ENVIRONMENT &
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MICRO-CREDENTIAL

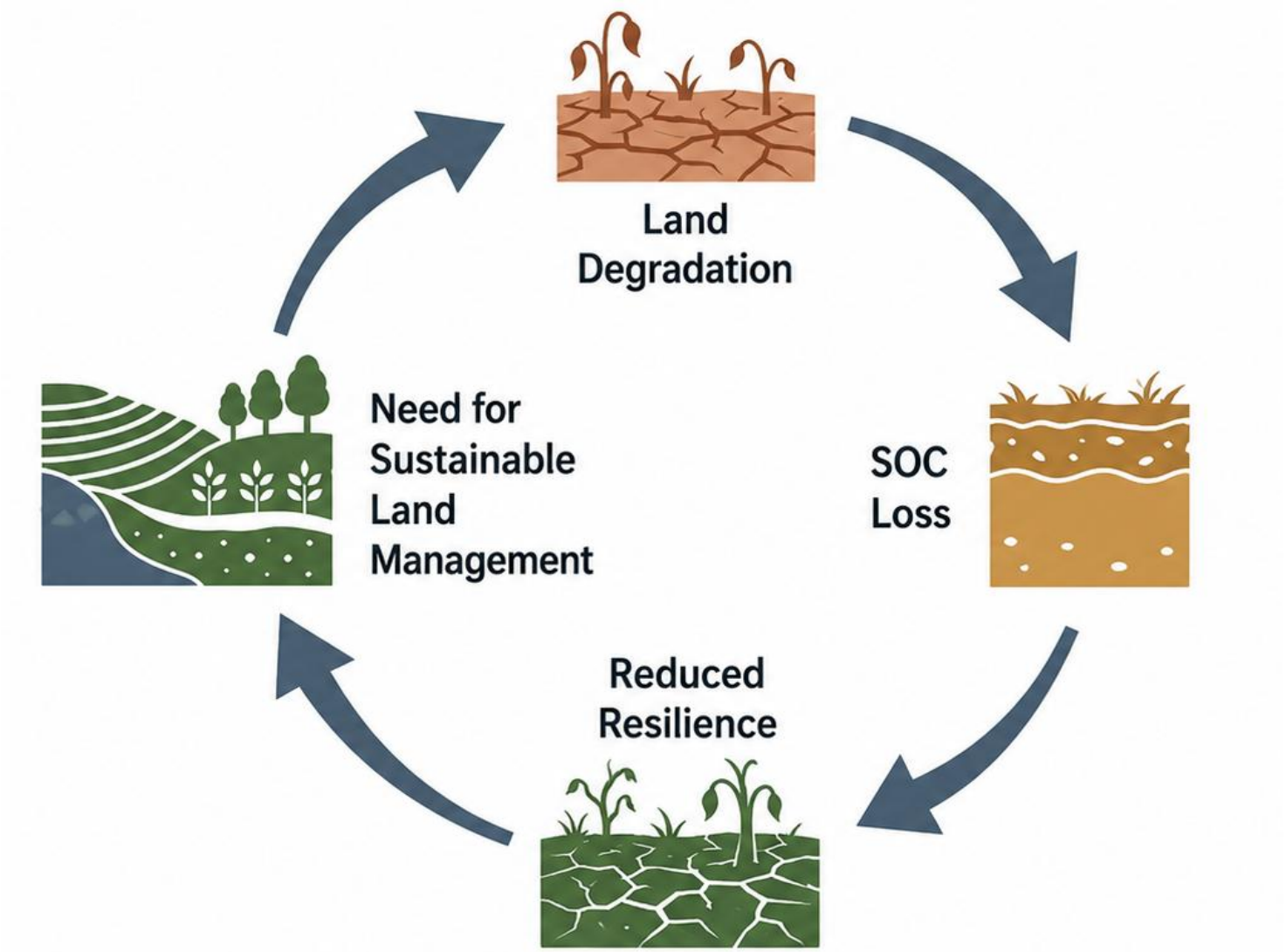
CLIMATE CHANGE FOR SUSTAINABLE LAND MANAGEMENT IN CENTRAL ASIA

3.- The Carbon Cycle, Land Use and SLM

Sustainable Land Management as a Climate Solution

CC-W03-V12

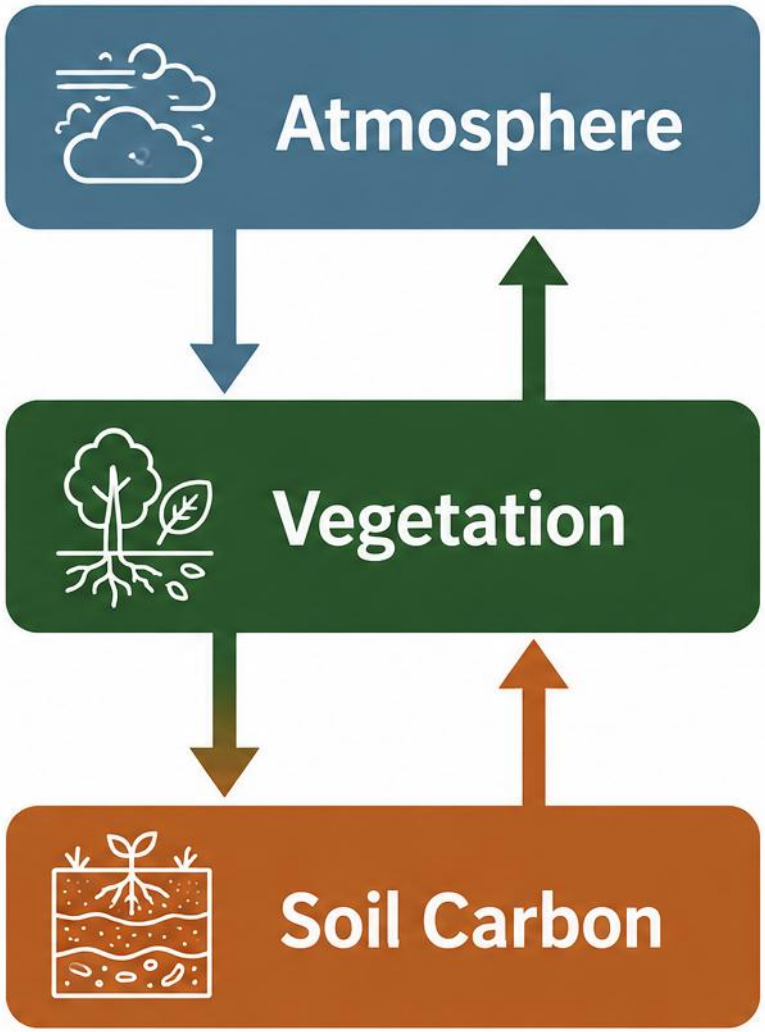
From Carbon Loss to Climate Solutions



Land degradation reduces soil carbon, weakens ecosystem resilience, and creates the need for Sustainable Land Management.

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Why Soils Matter for Climate Mitigation



Largest terrestrial carbon reservoir

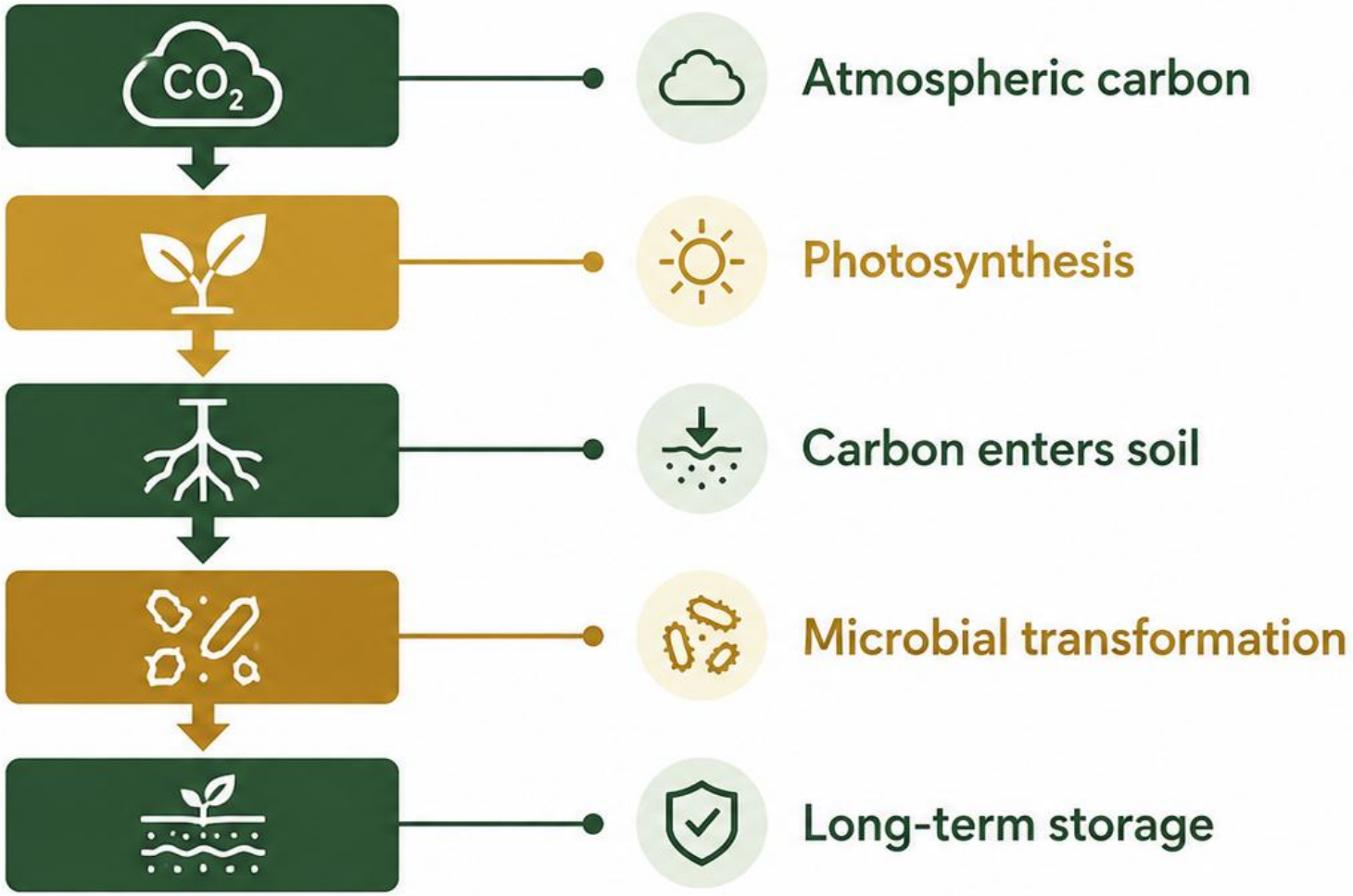
Soils store more carbon than the atmosphere and all terrestrial vegetation combined.

High climate leverage

Because soils contain so much carbon, even small changes in soil carbon can influence climate outcomes.

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What is Soil Carbon Sequestration?

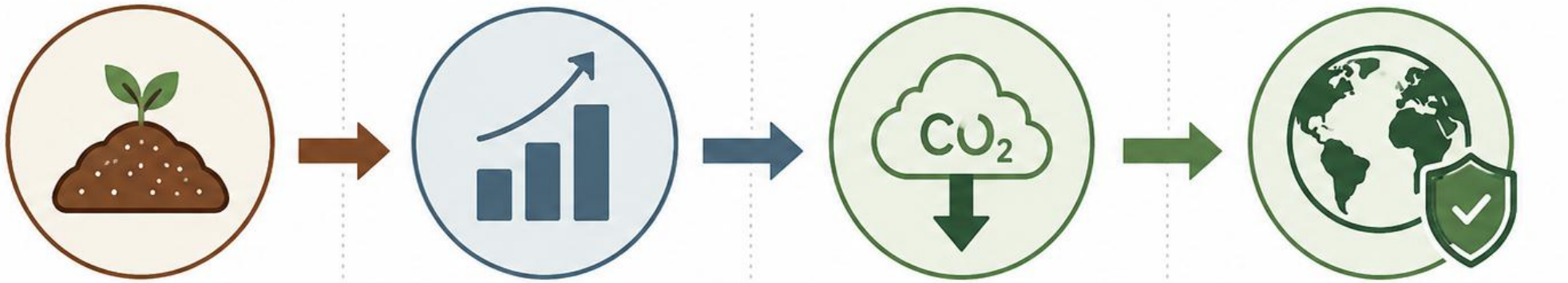


Soils function as carbon sinks when plant-driven carbon gains exceed descomposition and disturbances losses.

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Understanding Carbon Sequestration

Not every increase in soil carbon automatically becomes **climate mitigation.**



1. Carbon Storage

Carbon is present in soil organic matter pools.

2. SOC Increase

Soil organic carbon stocks increase locally.

3. Carbon Sequestration

CO_2 is removed from the atmosphere and stored in stable soil reservoirs.

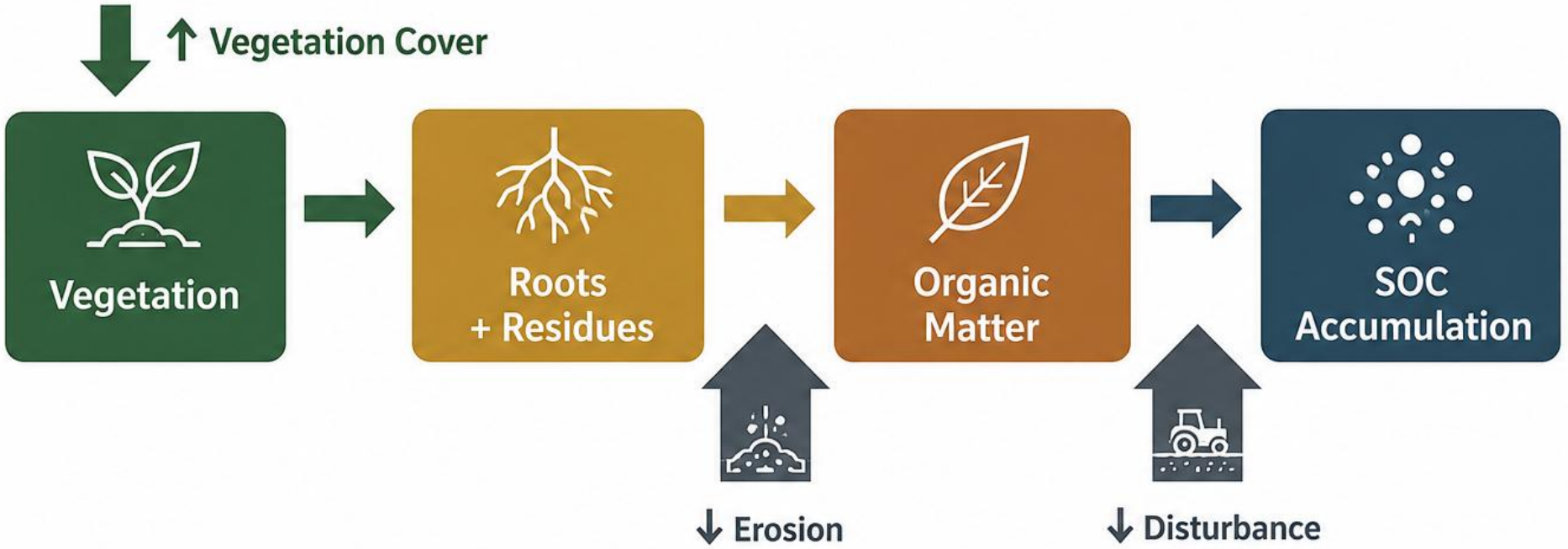
4. Climate Mitigation

The net effect is a measurable, persistent reduction in atmospheric greenhouse gases.

Permanence and stability are essential. Only when stored carbon is stable over time does it contribute to real climate mitigation.

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How Sustainable Land Management Builds Soil Carbon



More Inputs
(Build biomass, roots, and residues)

+

Fewer Losses
(Reduce erosion and disturbance)

=

More Soil Carbon
(SOC accumulates over time)

SLM builds soil carbon by increasing what enters the soil and reducing what leaves it.

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Key SLM Practices for Carbon Storage



1 Agroforestry

Trees increase biomass and deep carbon inputs.



2 Cover Crops

Protect soil and add continuous organic inputs.



3 Residue Retention

Keeps plant residues on the soil and reduces erosion.



4 Reduced Tillage

Minimizes disturbance and carbon losses.

Multiple SLM practices operate through diverse mechanisms; combining practices often provides the greatest carbon benefits.

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Restoring Degraded Soils

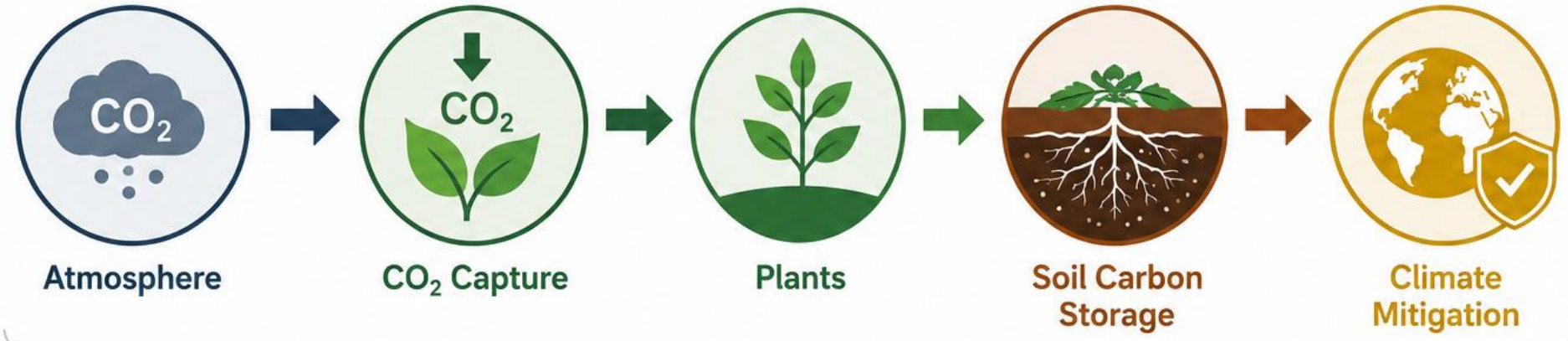


1. Degraded Soil	2. Improved Management	3. SOC Recovery	4. Healthy Soil	5. Improved Ecosystem Functions
Intensive cultivation, overgrazing, and erosion have caused severe, long-term losses of soil organic carbon.	Sustainable land management addresses the drivers of degradation and improves soil conditions.	Scientific evidence shows that consistent SLM practices can gradually restore soil organic carbon.	Soil organic carbon increases, improving soil structure, fertility, and biological activity.	Ecosystems regain key functions, including water regulation, productivity, and resilience to climate stress.

Through long-term SLM, degraded soils can recover carbon stocks and regain important ecosystem functions.

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Climate Benefits of SLM



SLM enhances the natural pathway of carbon from the atmosphere to stable storage in soils.

Broader Benefits Beyond Carbon

Climate Mitigation

Reduces atmospheric CO_2 through long-term soil carbon storage.

Ecosystem Resilience

Stronger ecosystems are more resilient to droughts, floods, and climate stress.

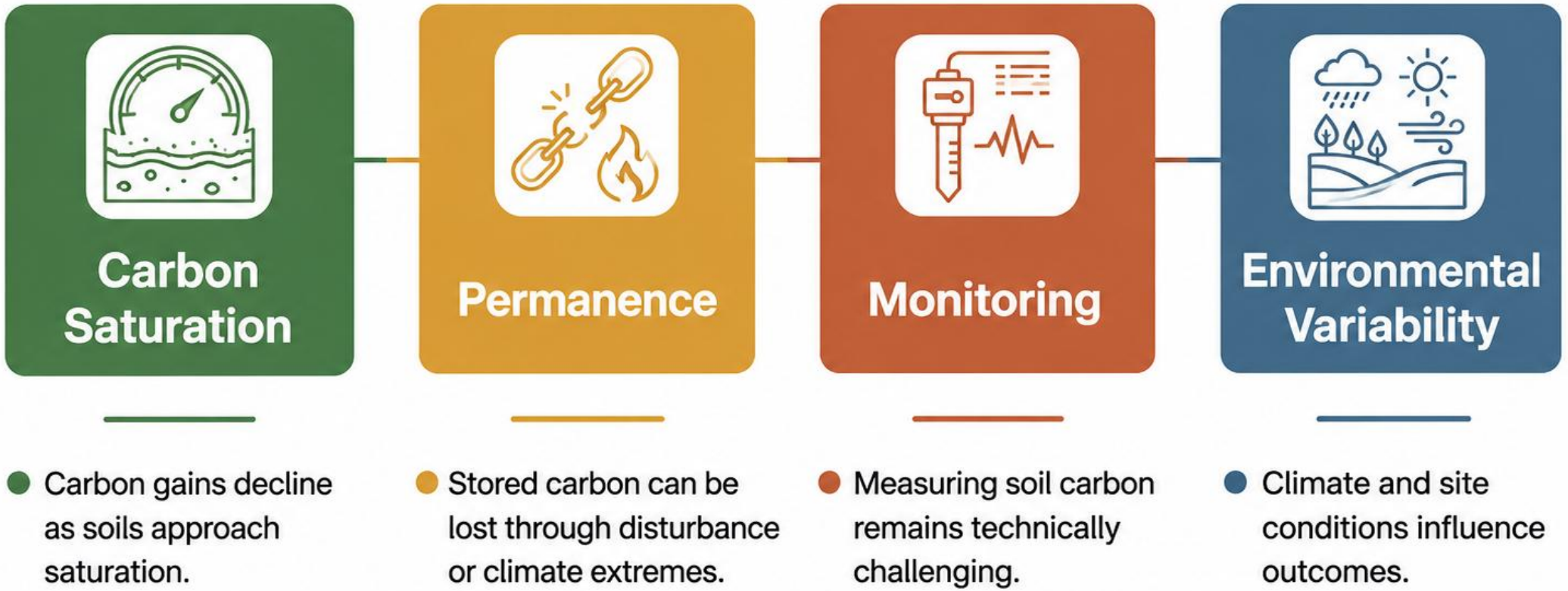
Improved Soil & Water Functions

Enhances soil structure, water retention, and nutrient cycling.

SLM contributes to climate mitigation by acting as a terrestrial carbon sink, while strengthening ecosystem resilience and essential land functions.

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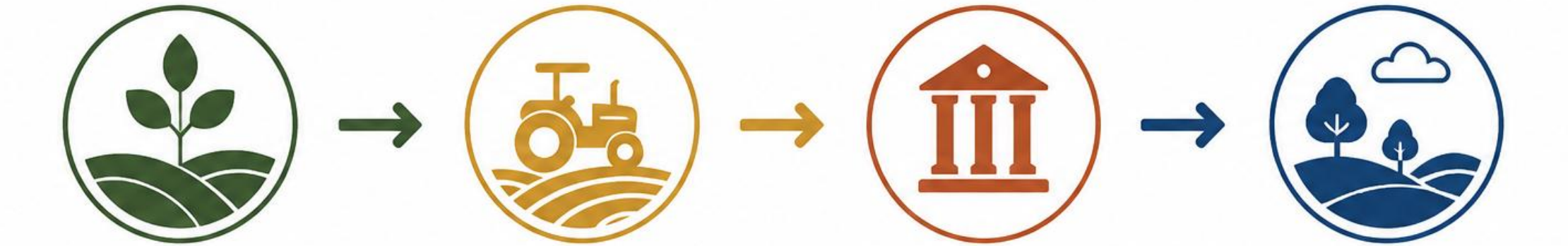
Challenges and Limitations



Soil carbon gains are finite and reversible; SLM must complement, rather than replace, direct emission reductions.

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SLM in Climate Policy and Land Restoration



1. SLM Practices

Effective practices increase soil carbon and improve land health.

2. Field Adoption

Widespread adoption by land users is essential for real and lasting change.

3. Policy Support

Supportive policies, institutions, and incentives create an enabling environment.

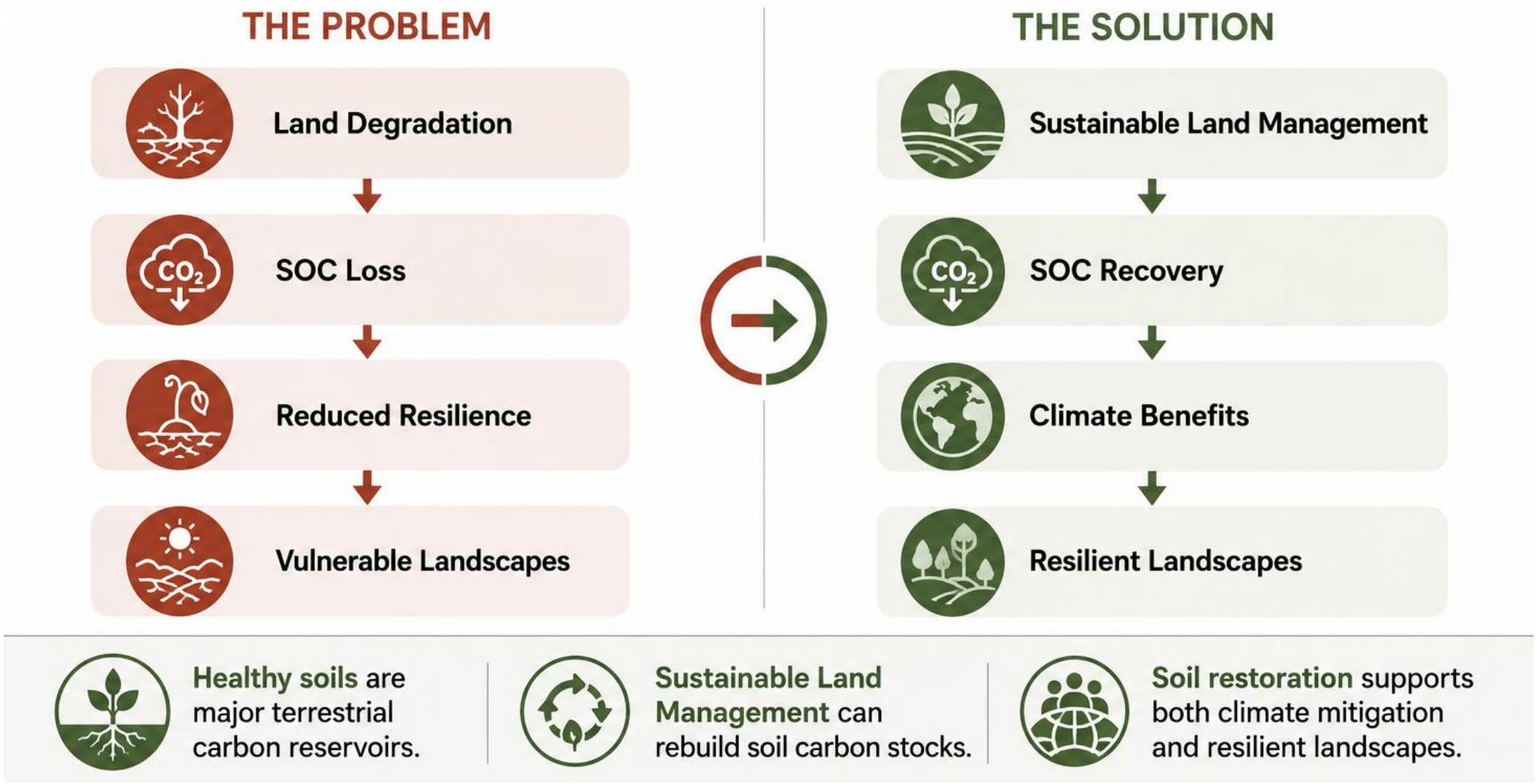
4. Landscape Impact

Together, these factors drive large-scale benefits for climate, people, and ecosystems.

Good practices alone are not enough. Large-scale impact requires adoption, supportive policies, and long-term commitment.

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Key Conclusions



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