Sustainable Soil and Land Management for Climate Smart Agriculture: Preventing and mitigating land degradation

24 June 2020

14:30 to 16:00

Combine land management practices to tackle land degradation and share tools to support the implementation and scaling out of sustainable soil and land management

CIHEAM BARI

Webinar IV

Preventing and mitigating land degradation: Sustainable Soil and Land Management for Climate Smart Agriculture:

Wednesday 24 June 2020

14:30 - 16:00 CEST (Rome time)

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CIHEAM Bari, Italy

Food and Agriculture Organization of the United Nations

agreenium
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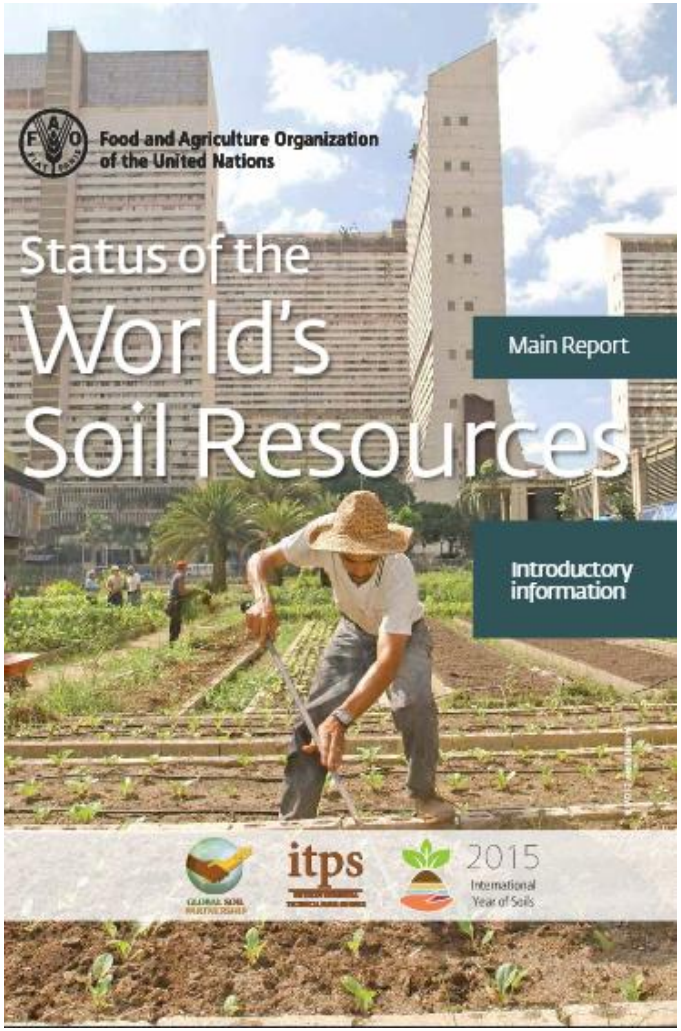
UNITED NATIONS ESCAP
Economic and Social Commission for Asia and the Pacific

Quick look at some global disturbing facts



FAO (2015)

About **33% of global soils are moderately or highly degraded,** *i.e.* due to unsustainable management practices.

On a global scale an **annual loss of 75 billion tons of soil** from arable land is estimated to cost about **USD 400 billion** each year in lost agricultural production.

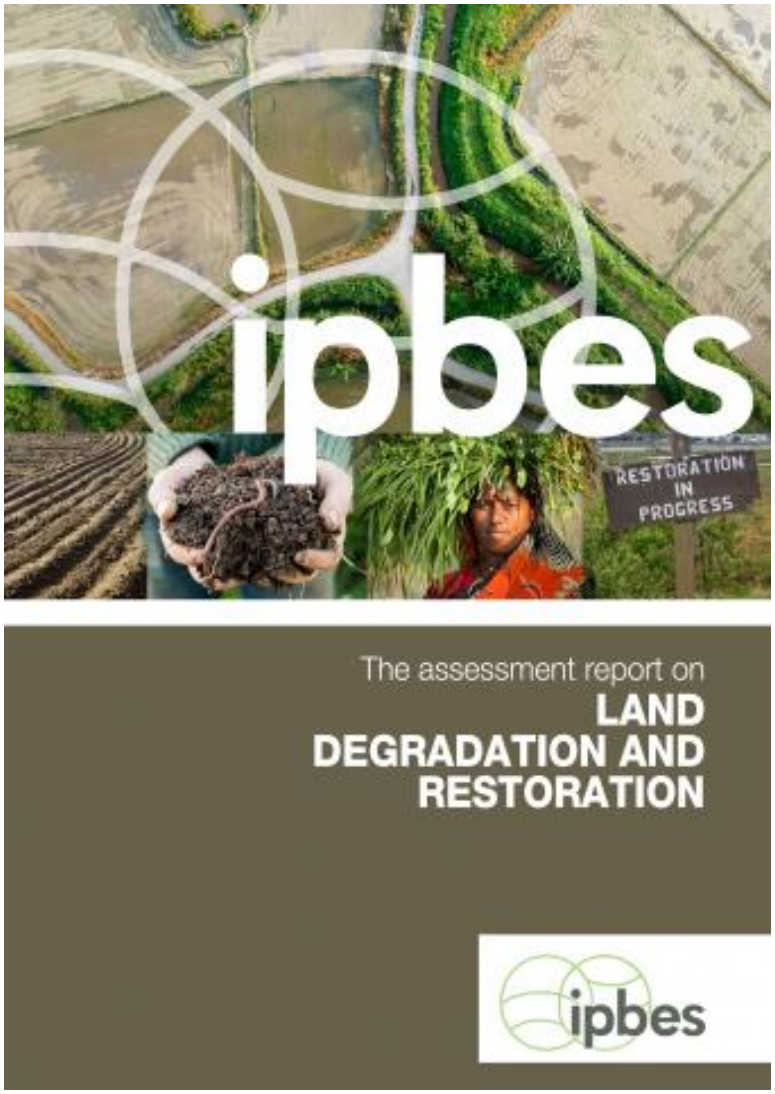
This loss also significantly reduces the soil's ability **to store and cycle carbon, nutrients, and water**

Annual **cereal** production **losses** due to erosion have been estimated at **7.6 million tonnes.**

Erosion: a natural and man-made process

Soil water erosion affects more than 25 per cent of the EU, especially the Mediterranean and Alpine region

Panagos *et al.* 2014

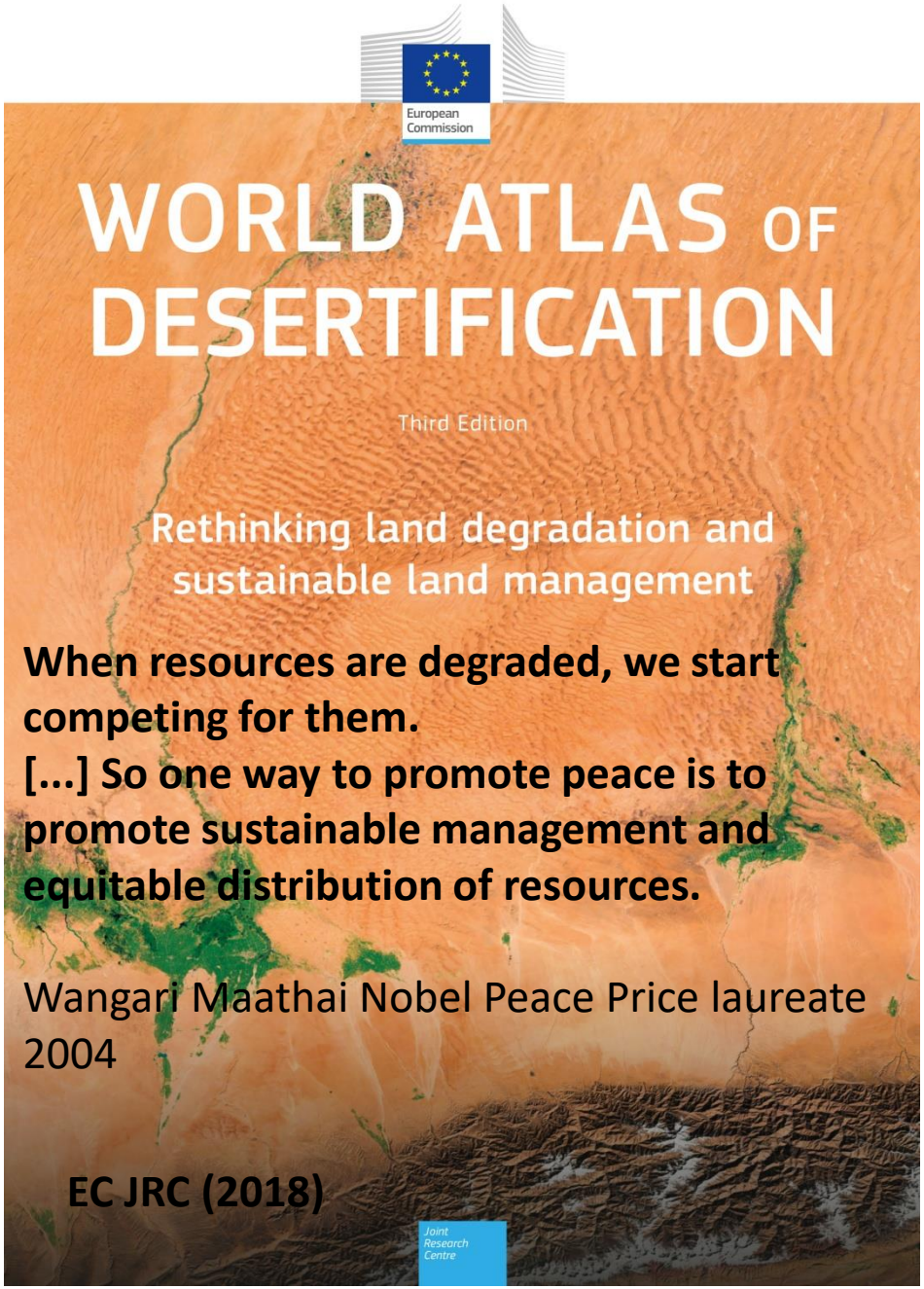


Land degradation negatively impacts **3.2 billion people**, and represents an economic loss in the order of **10% of annual global gross product**.

Land degradation is a pervasive, systemic phenomenon: it occurs **in all parts of the terrestrial world** and can take many forms

Restoring degraded lands makes sound economic sense, resulting in ***increased food and* water security,** increased **employment**, improved **gender equality**, and avoidance of **conflict and migration**

IPBES (2018)



Global patterns of human domination

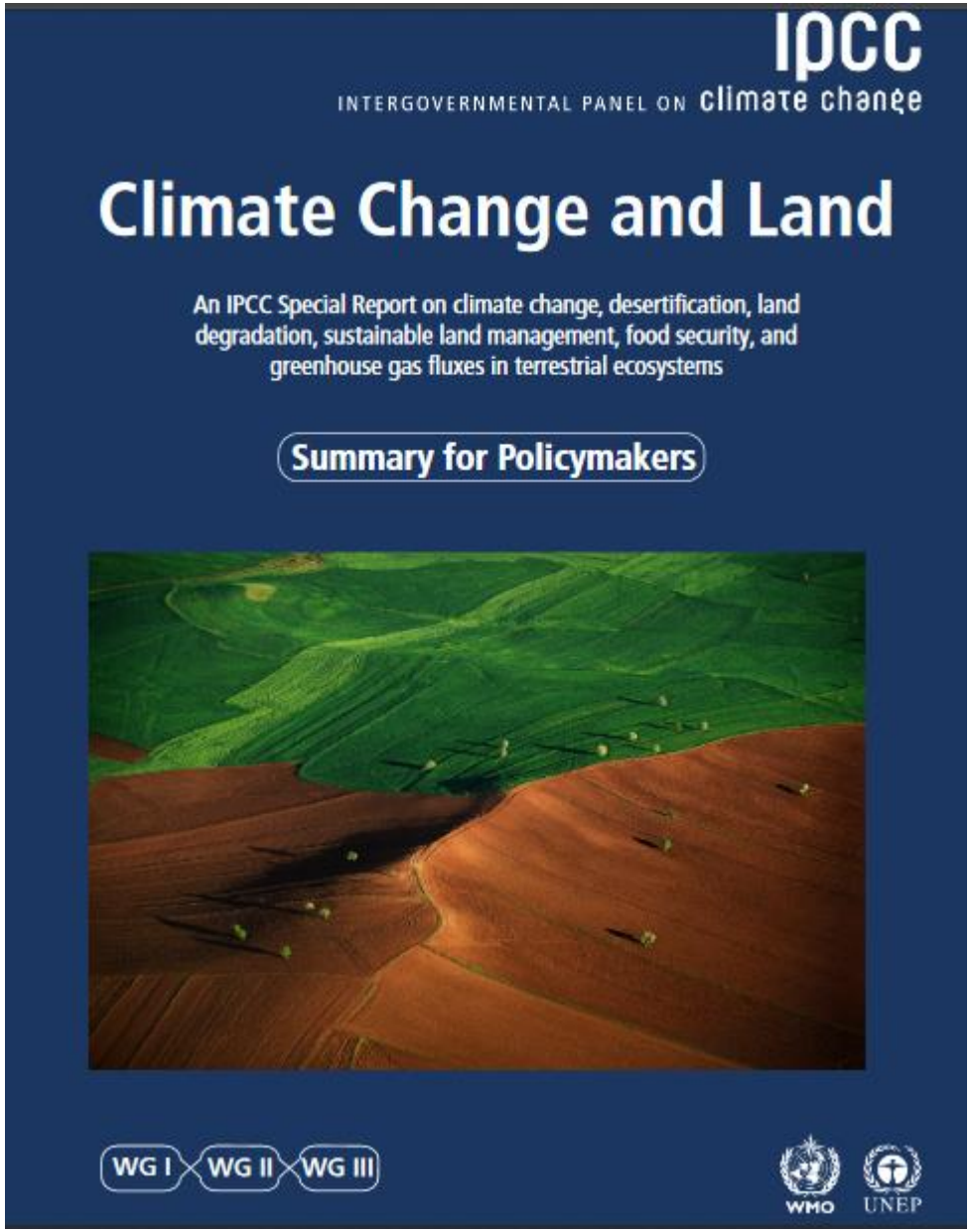
Feeding a global growing population

Limits to sustainability

Convergence of evidence

Solutions

https://wad.jrc.ec.europa.eu/



IPCC (2019)

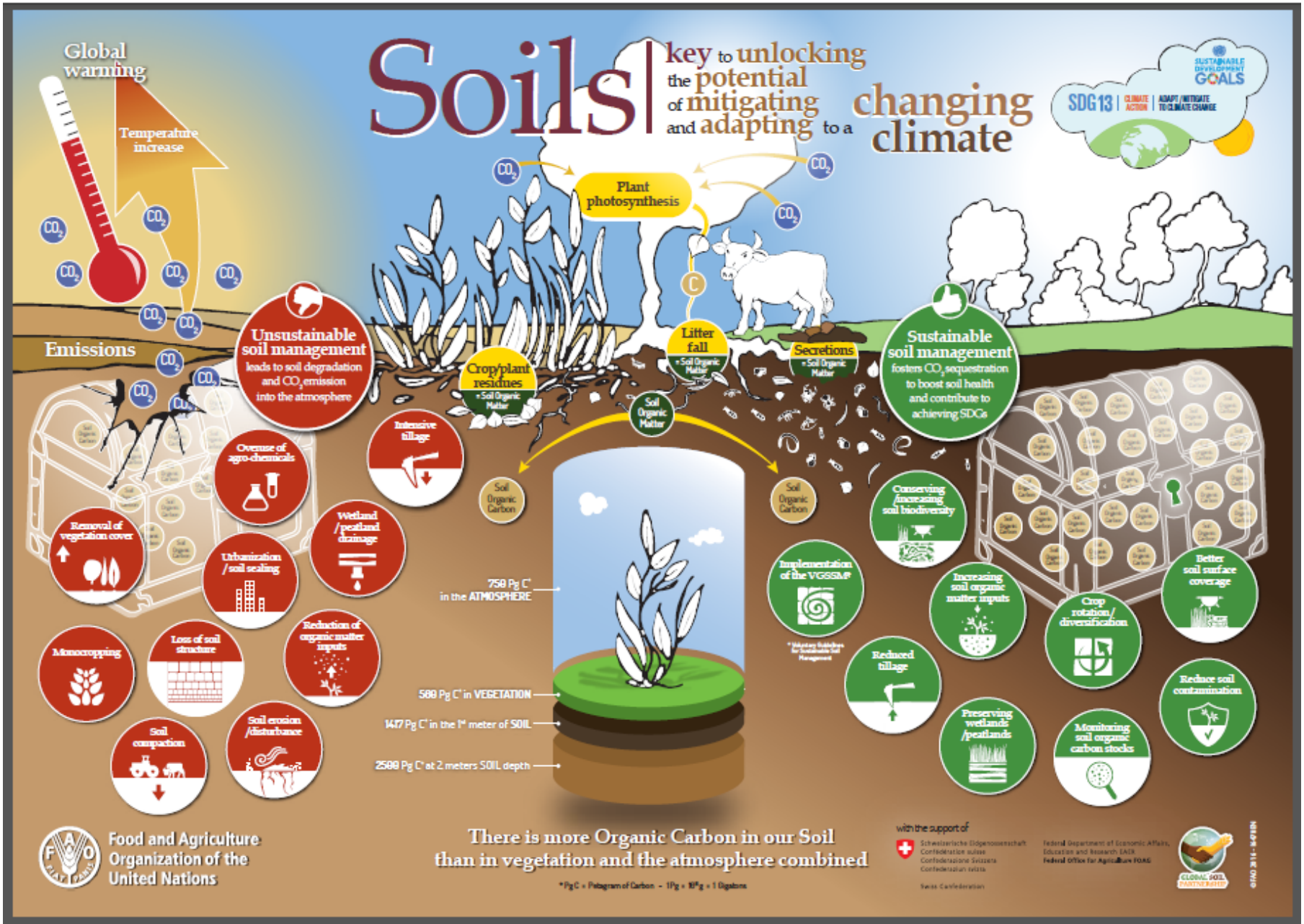
Land degradation affects **people and ecosystems** throughout the planet and is both affected by climate change and contributes to it.

Land-use changes and **unsustainable land management** are direct human causes of land degradation , with agriculture being a dominant sector driving degradation

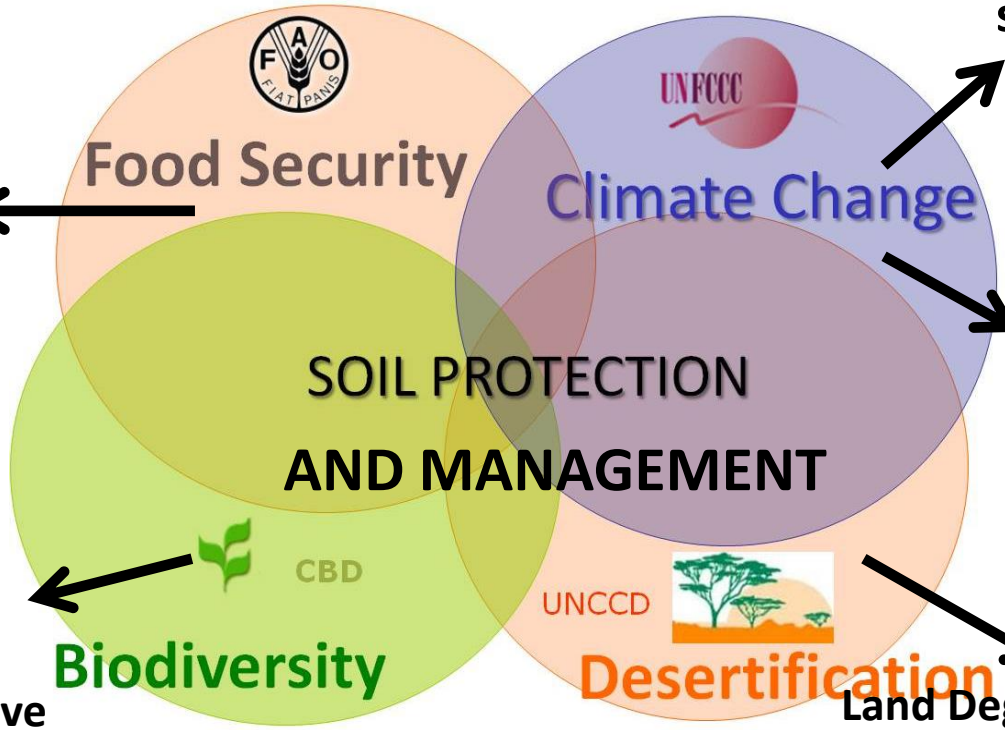
Cropland soils have lost **20–60% of their organic carbon** content prior to cultivation, and soils under conventional agriculture continue to be a source of GHGs

Land degradation and climate change, both individually and in combination, have profound implications for **natural resource-based livelihood systems and societal groups**

Soils: a great ally mitigate to climate change impacts



The crucial role of soil in UN conventions and Int. Organisations including EU



Healthy soils produce healthy and nutritious food

Soils could sequester carbon 5 times more than the atmosphere

Soils could represent up to 25 % of the total global potential for natural climate solutions

Bossio et al., 2020

GLOBAL SOIL BIODIVERSITY INITIATIVE

Bach et al., 2020

Only 1 % of soil microorganisms have been identified

Land Degradation Neutrality

Economics of Land Degradation

EU Green Deal , Soil Health and Food Mission

SUSTAINABLE DEVELOPMENT GOALS

17 GOALS TO TRANSFORM OUR WORLD

GLOBAL SOIL PARTNERSHIP

4 PER 1000

SOILS FOR FOOD SECURITY AND CLIMATE

International Decade of Soils 2015-2024

WOCAT

World Overview of Conservation Approaches and Technologies

where the land is greener

case studies and analysis of soil and water conservation initiatives worldwide

Sustainable Land Management (SLM) could

- **protect watersheds,**
- **conserve ecosystems,**
- **sustain biodiversity,**
- **improve production, and**
- **generate social and economic benefits**

The Global SLM Database contains over 1500 SLM practices from all over the world.

https://www.wocat.net/en/global-slm-database/

WOCAT
World Overview of Conservation Approaches and Technologies

Put people at the center of actions: A few examples of SLM

Yacouba Sawadogo (from Burkina Faso), the man who stopped erosion and desertification. Right Livelihood Award Laureate 2018

https://www.youtube.com/watch?v=B_bgGAMRkso

What Yacouba did next

Crop yields in East Africa have increased by at least by 25% and SOM by 33 % compared with conventional farms in the area.

Source: Saiz et al., 2016

Terraced agro-forestry system in Konso, Ethiopia demonstrate dual benefits of soil conservation and agriculture

Schematic design of Fanya-juu terraces in Kenya

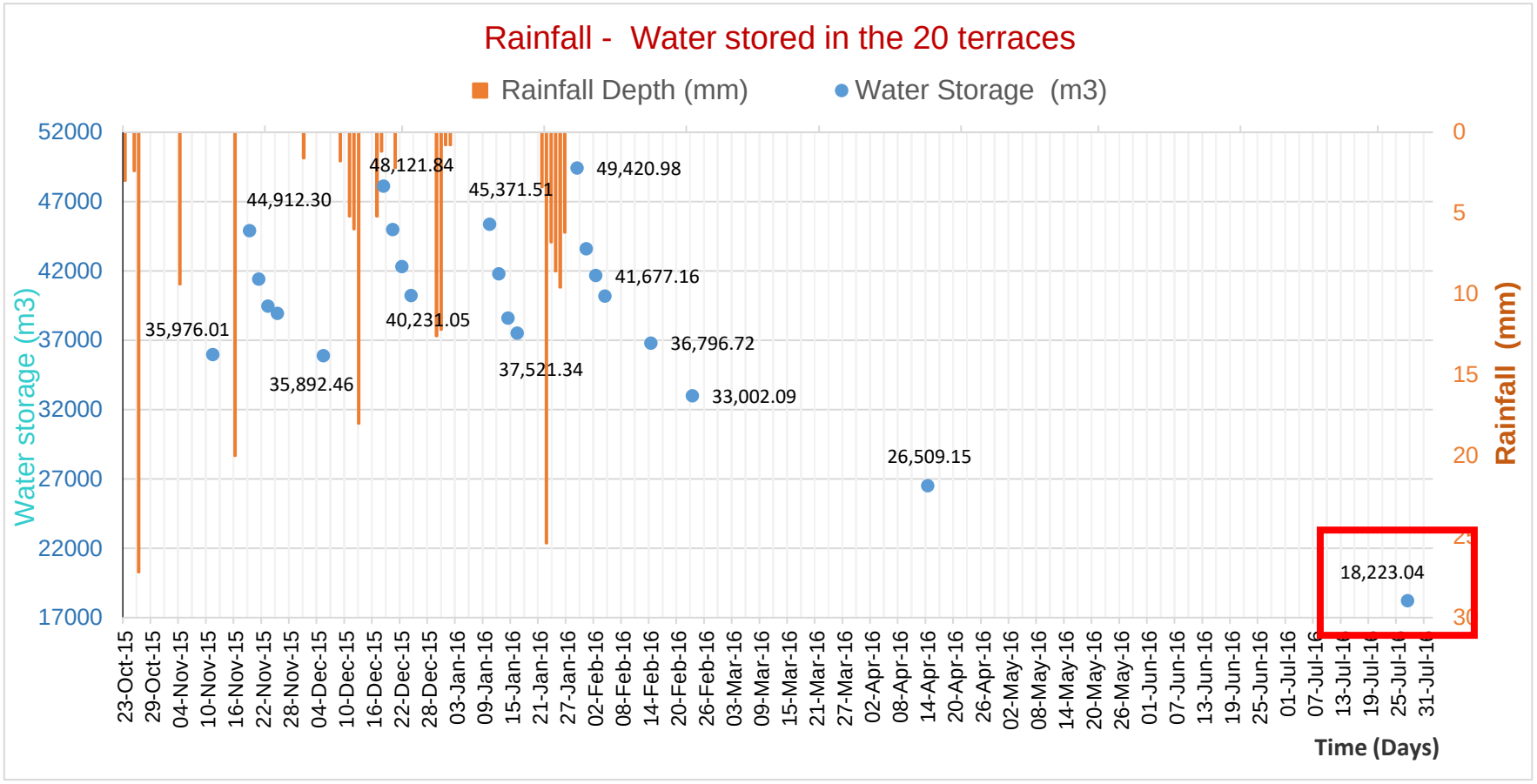
Matrouh Region, Western Desert of Egypt

Gully erosion and abandonment Wadi Kharrouba in 2013

March 2017: 13 ha of reclaimed land were handed over to local community to be planted with olives, figs and vegetables

In 2019 IFAD and Egypt earmarked to invest 81 million USD in the Matrouh Governorate to enhance food and nutrition security including rehabilitation of 7,980 hectares in eroded wadis

In 2016 Wadi Kharrouba harvested almost 50,000 m3 of water of which about 18,000 m3 were still stored in the soil until the end of July



Coppola et al., 2018 *Ecohydrology*

If not for land reclamation this amount of water would have been lost!

Tens of semicircles are built and planted with local native plants used for grazing and income generating

Opuntia ficus-indica

Medicago arborea

Atriplex litoralis spp

Moringa oleifera

Climate-Smart Agriculture

Helps farmers build resilience to adapt to climate change

Sustainably increases agricultural production and incomes

Reduces greenhouse gases, where possible

All three pillars are addressed

Carbon sequestration

GHG reduction

Productivity

Last step: ensure sustainability

Land and water management

Crop management

Agro-food value chain

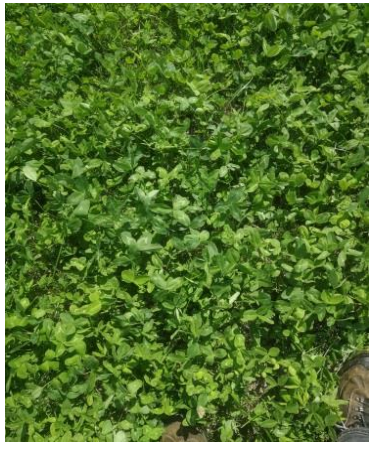
Marketing of local products

Empowering women

Respect for local traditions

Mr. Coimbra's farm located at Quinta da Cholda, Santarém in Portugal has been growing no till maize for 20 consecutive years in 200 ha and has increased SOM from 0.5 to 3 %

Mr Fergal Byrne in Ireland converted his sheep and cattle farm from conventional to organic farming improving soil fertility and crop yields . He combines red clover with barley, peas and oats.



The Cinque Terre National Park in Italy

The dry wall rocky terraces of the park reach 12,000 km

The example of Mr. Dino Masala owner of the agriculture farm "A Trincea " in Airole where he built 80,000 m3 of dry wall terraces

https://www.youtube.com/watch?v=fOM2poAP7rg

From the Soil Health Institute in the USA

There are many more similar examples

11-way cover crop mix planted after wheat

Interseeded cover crop mix

FEBRUARY 2020

Soil Health Case Study

John and Jim Macauley, Macauley Farms LLC, NY

Farm at a Glance

- COUNTY: Livingston, NY
- WATERSHED: Genesee River
- CROPS: Grain corn, soybean, & wheat
- FARM SIZE: 1,106 acres
- [illegible]: Clay [illegible] gravelly [illegible] rolling [illegible]
- SOIL HEALTH PRACTICES: No-till, cover crops, & nutrient management

Introduction

John Macauley, his father Jim, and his brother Jeff operate their family's beef and crop farm in northwestern New York. Due to macroeconomic conditions in 2017, the Macauleys converted their dairy to beef and currently manage 80 cattle. The family owns all 1,106 acres of cropland they operate—200 are on river bottom, 339 are for hay and pasture, while the remaining 567 on rolling hills above the Genesee River are the focus of this study. John practices no-till and nutrient management on all 567 acres through a four-year rotation of one-year grain corn, two years of soybeans, and one year of wheat. He follows the wheat with cover crops, matching the acres, which varies season to season.

John found conventionally tilling his crops took too much time. He also wanted to save on equipment costs, reduce erosion, and improve soil tilth. In 2009, he received financial and technical assistance from his local USDA Natural Resources Conservation Service (NRCS) office through an Environmental Quality Incentives Program (EQIP) contract to begin no-tilling wheat. In the first year, the Macauleys struggled to get the grain drill set at the right depth. They experimented by adding weights but eventually decided to buy a bigger drill. By 2012, they expanded to no-till corn and now use no-till for all crops on the 567 acres.

In 2012, the Macauleys received another EQIP contract to add cover crops after wheat, hoping [illegible] reduce compaction, improve weed control [illegible] wheat and [illegible] and improve water infiltration [illegible] following wheat harvest [illegible] more time [illegible] cover crop to establish before winter. John currently plants a 12-way mix before corn and a seven-way mix before soybeans. In general, the mixes include oats, cereal rye, radishes, winter peas, and hairy vetch. Each year, John designs the cover crop seed mix [illegible] nitrogen [illegible] of his cover [illegible] mixes himself.

In 2014, John began planting his cash crop into the living cover crop and terminating the cover after planting. This practice, known as "planting green," allows the cover crop to grow longer, which means more biomass production, greater suppression of weeds and pathogens, and drier fields allowing earlier planting.

Prior to 2012, the Macauleys were putting all their nutrients, both organic and inorganic, on their fields at planting. John is happy with his current mid-season, split application of N on 254 acres of corn and wheat to complement the no-till program. Eventually, John hopes to lower his reliance on inorganic nutrients with the right cover crop mix.

Jeff, Jim, and John Macauley

Soil Health, Economic, Water Quality, and Climate Benefits

Partial budgeting was used to analyze the marginal benefits and costs of adopting no-till, cover crops, and nutrient management on the

15" no-till drill

USDA United States Department of Agriculture Natural Resources Conservation Service

American Farmland Trust

Converted strip-till tool hooked to low-compaction tractor

FEBRUARY 2020

Soil Health Case Study

Dan Lane, Homewood Farms, OH

Farm at a Glance

- COUNTY: Delaware, OH
- WATERSHED: Upper Scioto River
- CROPS: Corn & soybeans
- FARM SIZE: 1,830 acres
- SOILS: Silt & clay loam soils on flat to slightly rolling fields
- SOIL HEALTH PRACTICES: Strip-till, nutrient management, & cover crops

Introduction

Dan Lane's Homewood Farms lies in the Upper Scioto watershed in central Ohio. Dan and his wife, Jennifer, have been farming for 30 years and own 60% of the 1,830 acres of corn and soybeans they grow. The terrain is flat to slightly rolling with silt and clay loam soils. Dan started farming with his father, John, in 1990 and took over in 2000.

In [illegible] Lanes [illegible] used two [illegible] cultivator passes [illegible] corn [illegible] soybeans. The Lanes applied their phosphorus (P) and potassium (K) with the planter ahead of corn and then side-dressed with anhydrous ammonia. Then, as now, the Lanes do not apply fertilizer to [illegible]

To [illegible] protect his soils, Dan began strip-tilling and banding dry fertilizer on all his corn in 2003. By injecting fertilizer five to six inches deep, banding with strip-till allows Dan to apply fertilizer where and when it's needed. He also began soil testing. Dan believes banding dry fertilizers is the most efficient way to maintain fertility and profitability.

Dan and Jennifer Lane

In 2014, Dan transitioned to reduced tillage on all acres ahead of soybeans by using a one-pass operation with a high-speed vertical tillage tool before planting beans in the spring. That same fall, Dan tried planting cover crops after his corn, broadcasting cereal rye and incorporating it with vertical tillage. Later, when Dan began planting soybeans with a twin row planter, he used the same planter to plant a mixture of barley and hairy vetch cover in the fall after the soybeans, followed with a strip-till pass. Dan has achieved a synergy between strip-tilling and cover cropping because he can plant corn in the spring between the rows of cover crops in a consistent seedbed.

Soil Health, Economic, Water Quality, and Climate Benefits

Partial budgeting analysis was used to estimate the marginal benefits and costs of adopting strip-till, nutrient management, and cover crops on the Lane Farm. The study was limited to only those income and cost variables affected by the adoption of these practices. The table on page 2 presents a summary of these economic effects revealing that, due to the three soil health practices, Dan's net income increased by $56 per acre per year or by $102,366 annually on the 1,830-acre study area, achieving a 143% return on investment.

Dan believes the most significant benefit from using all three soil health practices has been a 40-bushel per acre increase in corn yields since 2008, which increased income on the corn acres by $142 per acre per year.

Using a strip-tiller he converted from an older planter bar, Dan's strip-till system saves him three passes over the field, or about $24 per acre each year, in machinery and labor costs compared to conventional tillage. Strip till also provides an optimal environment for corn because the soil warms up sooner and the seedbed offers consistent seed depth with enough nutrients to grow quickly and early. The cost savings from avoided purchases and maintenance of tillage equipment allowed him to increase his planter size, which also helps achieve earlier planting.

Dan believes that multiple banded nutrient applications (during the strip-till pass in the

Refilling converted strip-till tool with fertilizer in the field

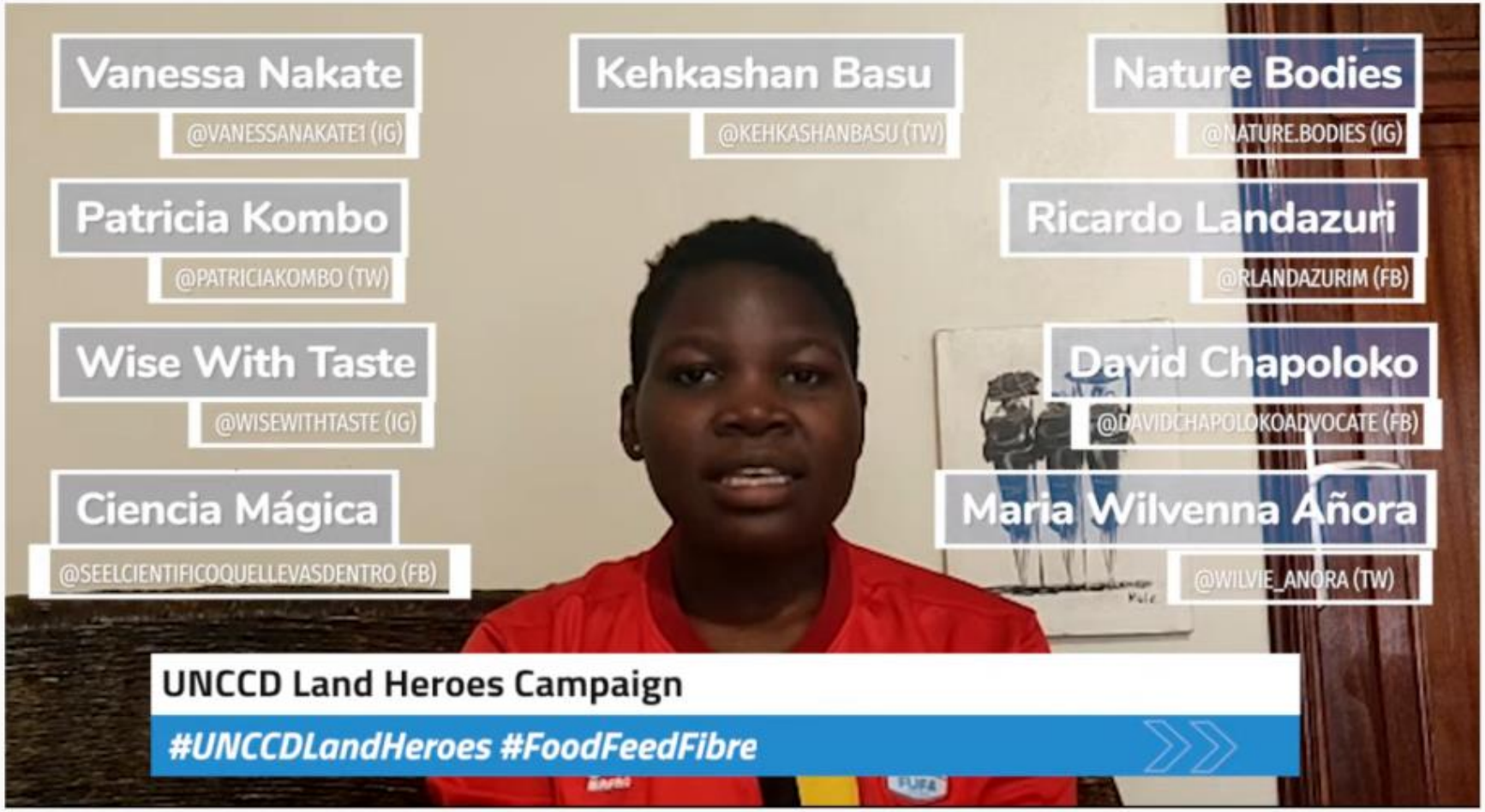
USDA United States Department of Agriculture Natural Resources Conservation Service

American Farmland Trust

A good example from Loess Plateau in China

This family is self sufficient in food and much of the energy needs deriving from solar and biogas

UNCCD Land Heroes



Youth In Action - Desertification and Drought Day 2020

How all these examples relate to climate smart agriculture (CSA)

FAO: “CSA aims to tackle three main objectives:

- sustainably **increasing agricultural productivity** and incomes;

- adapting and **building resilience** to climate change, and

- reducing and/or **removing greenhouse** gas emissions, where possible”.

How to do this: endorse a multi stakeholder approach

Connect all stakeholders including UN Organizations, International development agencies, EU institutions, NGOs, civil societies, private sector and academic institutions on drafting and implementing projects related to climate smart agriculture.

Bringing together 260 members from a variety of sectors

GACSA

GLOBAL ALLIANCE FOR
CLIMATE-SMART AGRICULTURE

Food and Agriculture Organization of the United Nations

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What would you like to learn about?

One stop shop on SLM and land restoration

Sustainable land management and land restoration

Sustainable land management and land restoration

This course focuses on Sustainable Land Management (SLM) practices, and their place within the global development agenda, specifically in order to achieve target 15.3 of the Sustainable Development Goals (SDGs), which aims to achieve a land degradation-neutral world. The course assists policy makers, practitioners and land users in the selection, planning, implementation and monitoring of SLM interventions, and related enabling environment.

Duration: 2 hours Publication Date: March 2019

Released in: MARCH 2019

2 h of learning

Access online version

Download course (77.6Mb)

Five interconnected lessons

System Requirements

The ***online version*** of this course runs on the latest versions of Chrome and Safari. In order to access this course on Internet Explorer or Firefox, you must install and enable Adobe Flash player.

The ***downloadable version*** **only** runs on Windows PC's and no additional software is needed.

https://elearning.fao.org/course/view.php?id=454

How to scale out SLMs in support of climate smart agriculture (CSA)

Knowledge sharing

WOCAT database

Farmer to farmer, Researcher to farmer

Long term experimental data

Doing by learning, cost of inaction

Reap the benefits (including environmental)

Extension service

Socio-economic context

Political support

Prevention than cure

Capacity, institutions, Training and education

FAO World Soil Charter

Funding opportunities

Development Smart Innovation through Research in Agriculture

DeSIRA INITIATIVE

EC DG DEVCO, AGRI, RTD

"*seeks to enhance an inclusive, sustainable and climate-relevant transformation of rural areas and of agri-food systems, by linking better agricultural innovation with science and research for more developmental impact*"

GREEN CLIMATE FUND

Raising ambition. Empowering action.

Land Degradation Neutrality Fund

GEF Land Degradation Focal Area (2018-2030)

USAID, GIZ, AICS, JICA, Private sector, etc

FAO Voluntary Guidelines for Sustainable Soil Management

Can the soil maintain its ecosystem services and functions? YES but only through SLM

It's all about management!!!

WOCAT

Conservation agriculture

Climate smart agriculture

Urea deep placement

Regenerative agriculture

EverGreen agriculture

Reduced or No tillage

Conservation tillage

Agro-ecology

Organic Farming

Carbon Farming

"Bhoochetana initiative"
or land rejuvination

CRP

PES

Zero Budget Natural Farming (ZBNF)

Integrated Financing Strategies for SLM

Integrated soil fertility management

Land Degradation Neutrality

Globally Important Agricultural Heritage Systems

Precision agriculture

Thank you

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