FAO'S work on climate change *Soils, land and water*

Food and Agriculture Organization of the United Nations

SOILS, LAND AND WATER

for climate change adaptation and mitigation

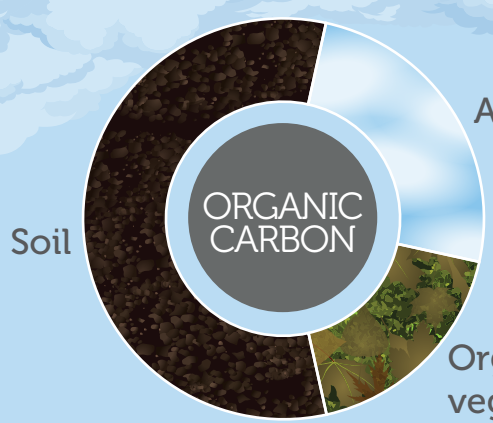
Soils constitute the largest store of terrestrial carbon. When managed using Sustainable Soil Management (SSM) techniques, soils can play an important role in climate change adaptation and mitigation and could enhance the provision of ecosystem services by storing carbon (carbon sequestration) and decreasing greenhouse gas emissions in the atmosphere.

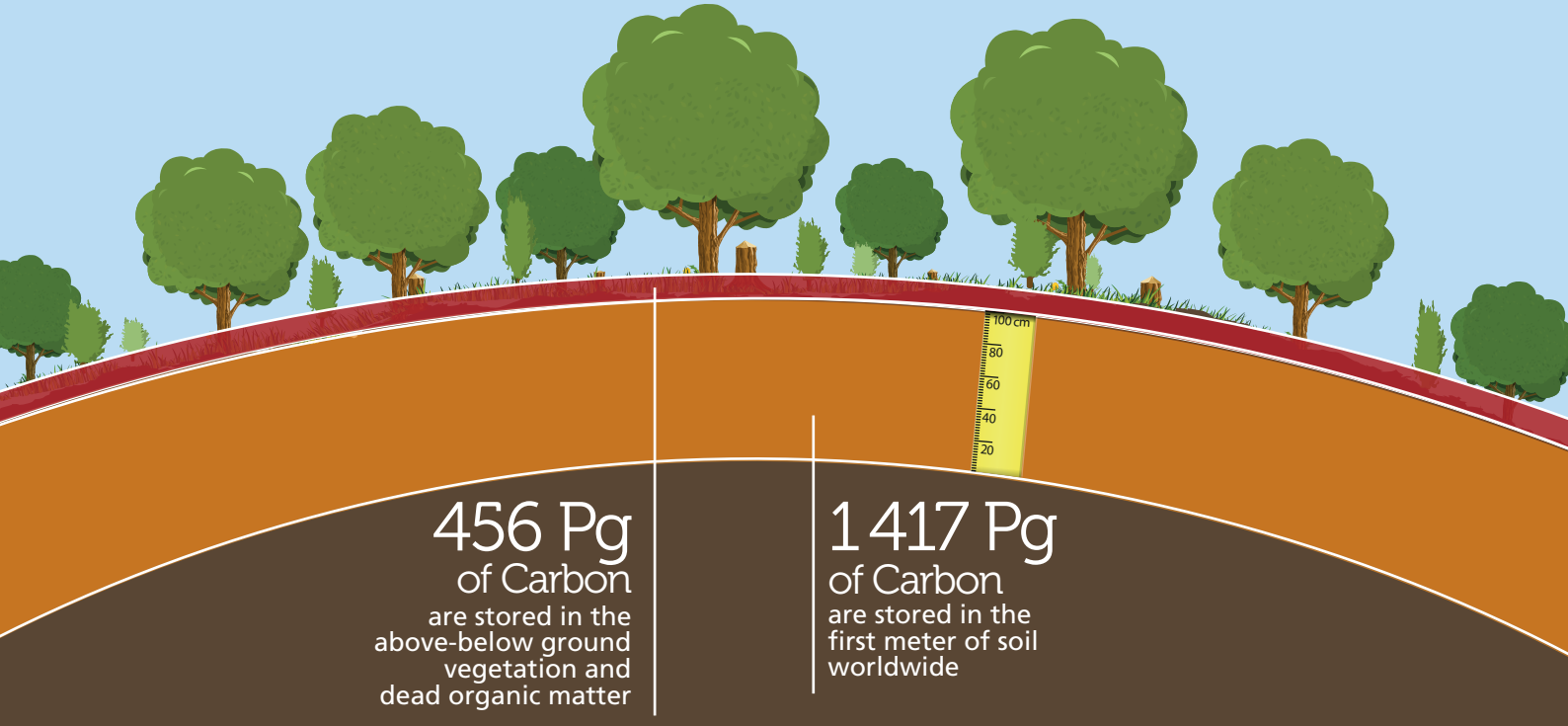
Furthermore, promising **Sustainable Land Management (SLM)** options are available to improve productivity and contribute to reducing greenhouse gas emissions and increasing carbon sequestration. The identification of potential areas for successful implementation and scaling-out of SLM, supported by proper policies and financial mechanisms, is needed to foster wider uptake and adoption of SLM.

Water is the key to life on our planet, yet we have access to a limited amount of our global freshwater resources. Climate change affects freshwater resources negatively, in terms of both quantity and quality. More frequent and severe droughts are having an impact on agricultural production, while rising temperatures translate into increased crop water demand. So we must take action to harvest and reuse our freshwater resources, and employ more efficient ways to use water to provide food for an ever-increasing global population.

Soils and the carbon cycle

There is more organic carbon in our soil than there is in our atmosphere and our organic vegetation combined



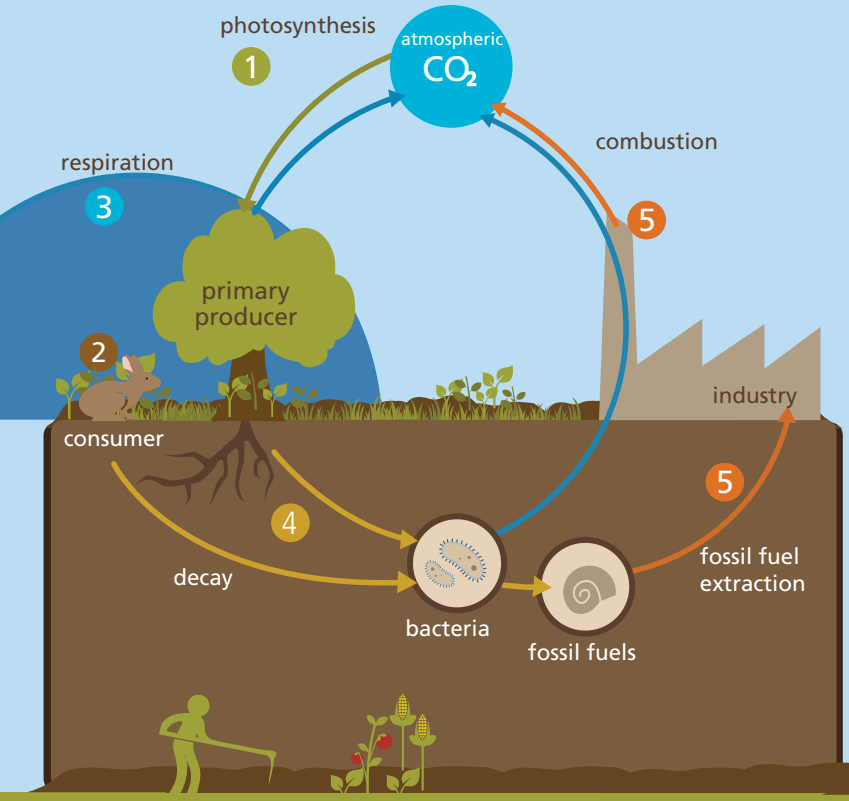


456 Pg
of Carbon
are stored in the above-below ground vegetation and dead organic matter

1 417 Pg
of Carbon
are stored in the first meter of soil worldwide

Soils and the carbon cycle

The carbon cycle is the exchange of carbon between the atmosphere, ocean, terrestrial biosphere and geological deposits



1. Plants use CO_2 from the atmosphere, water from the soil and sunlight to make their own food and grow in a process called photosynthesis. The carbon they absorb from the air becomes part of the plant.

2. Animals that feed on the plants pass the carbon compounds along the food chain.

3. Most of the carbon the animals consume is converted into CO_2 as they breathe (respiration), and is released back into the atmosphere.

4. When the animals and plants die, the dead organisms are eaten by decomposers in the soil (bacteria and fungi) and the carbon in their bodies is again returned to the atmosphere as CO_2.

5. In some cases, the dead plants and animals are buried and turn into fossil fuels, such as coal and oil, over millions of years. Humans burn fossil fuels to create energy, which sends most of the carbon back into the atmosphere in the form of CO_2.

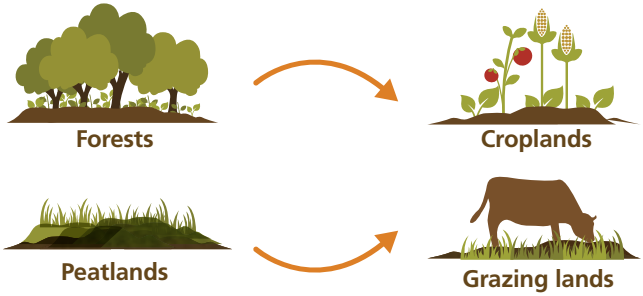
Sustainably managed soils

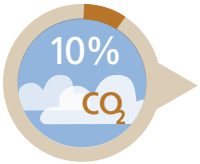
Poorly managed soils

If soils are managed poorly or cultivated through unsustainable agricultural practices, soil carbon can be released into the atmosphere in the form of carbon dioxide, which can contribute to climate change

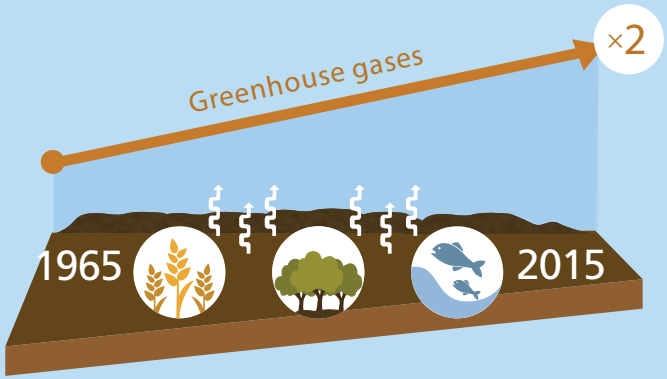
Climate change represents a serious threat to global food security.

The steady conversion of grassland and forestland to cropland and grazing lands has resulted in historic losses of soil carbon worldwide.

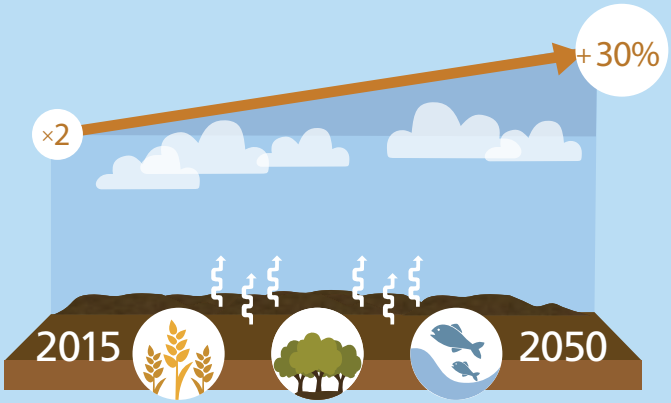




Land-use conversions and drainage of organic soils for cultivation are responsible for about 10% of all greenhouse gas emissions.



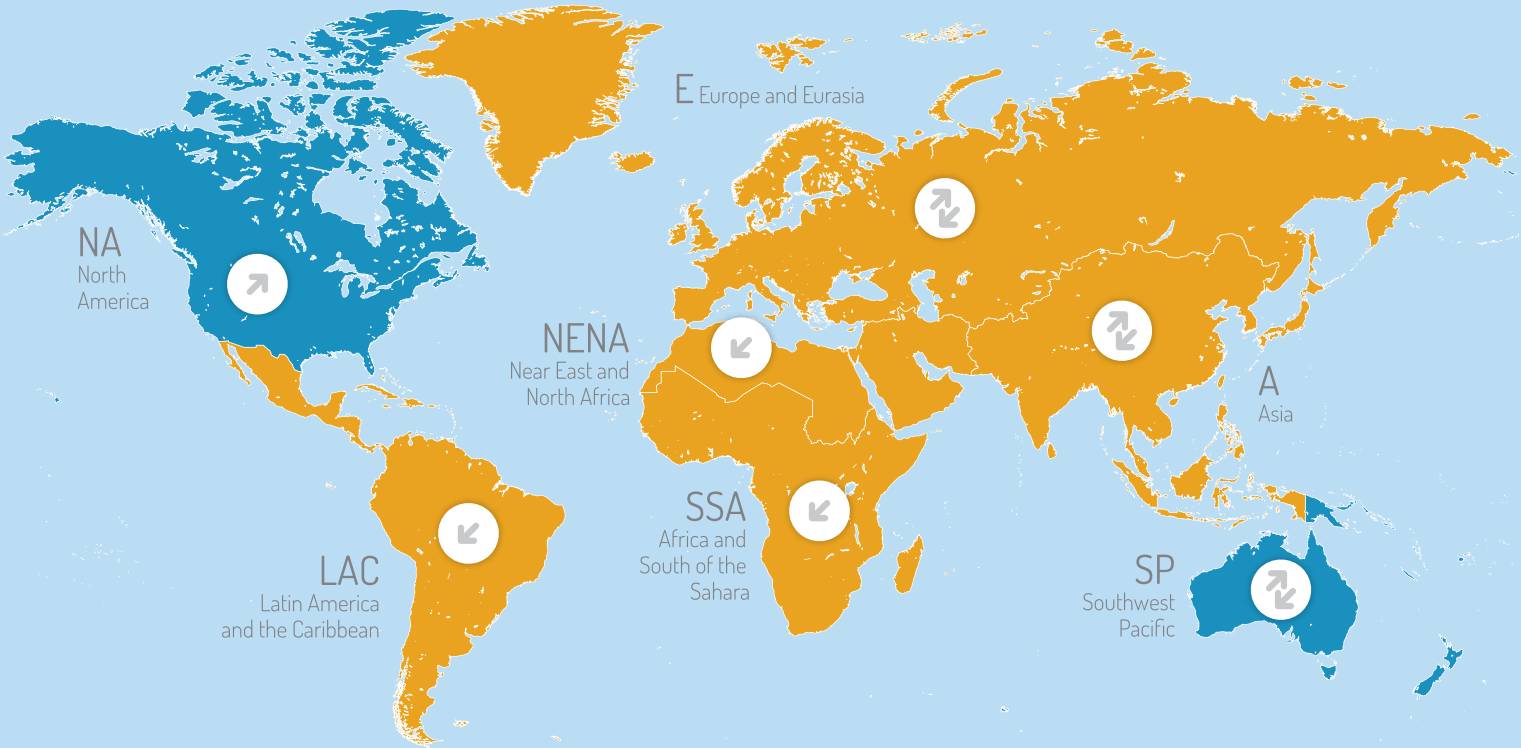
Greenhouse gas emissions from agriculture, forestry and fisheries have nearly doubled over the past 50 years.



Without greater efforts to reduce them, they could increase by an additional 30% by 2050.

Soils Organic Carbon (SOC) loss

Soil organic carbon (SOC) loss occurs when organic carbon stored in the soil is converted into carbon dioxide (CO_2) or methane (CH_4), both of which are greenhouse gases that are subsequently lost from the soil, or through physical loss of carbon by erosion



FAO's work on soils

The Global Soil Partnership (GSP) and its Intergovernmental Technical Panel on Soils (ITPS) is compiling a Global Soil Organic Carbon map based on national soil organic carbon maps. This map will be part of the Global Soil Information System and will aid with the reporting process on the Sustainable Development Goals.

Voluntary Guidelines for Sustainable Soil Management have been developed to support climate change adaptation and mitigation in agriculture through the maintenance and increase of soil organic matter.

Degraded soils are being restored to return to providing of ecosystem services including climate change adaptation, mitigation and food production.

Sustainable Land Management (SLM)

SLM refers to practices that aim to integrate the management of land, water, biodiversity, and other environmental resources to meet human needs while ensuring the long-term sustainability of ecosystem services and livelihoods.

SLM practices can increase carbon sequestration and increase crop yield by as much as

58%

SLM Tools and practices

Knowing the status and condition of soil and land resources is fundamental for making decisions about **sustainable soil/land management practices** that contribute to **climate-smart land use systems**.

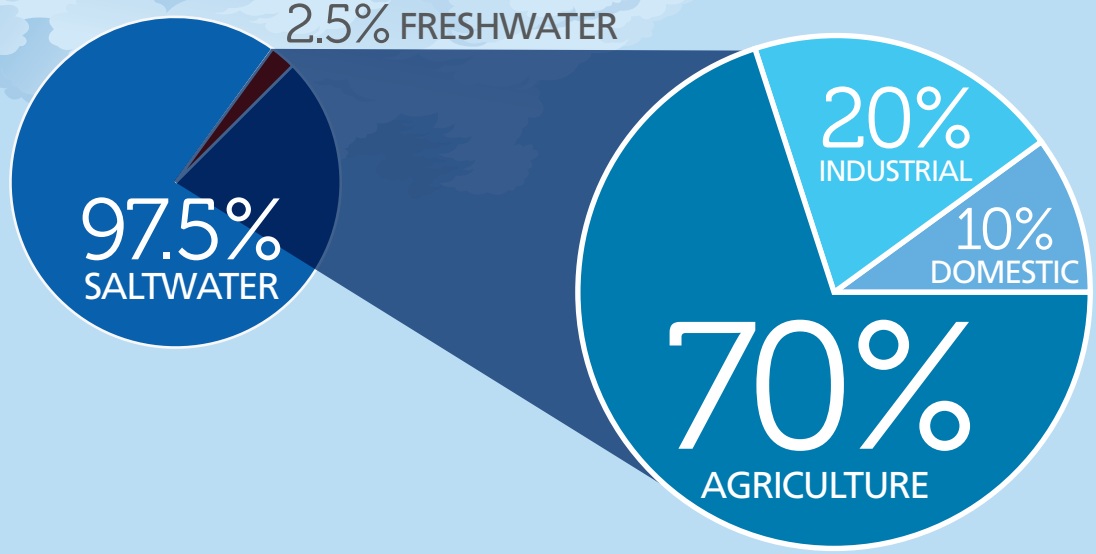
Proper selection of SLM options for specific conditions provide an opportunity to **enhance adaptation** and **mitigation** of climate change and the establishment of a **resilient ago-ecosystems**.

The Ex-Ante Carbon-balance Tool (EX-ACT) is an appraisal system developed by FAO to provide estimates of the impact of land use changes and sustainable land management programs on greenhouse gas emissions and carbon sequestration. The tool helps project designers estimate and prioritize activities with high benefits in economic and climate change mitigation terms.

EX-ACT was used for the FAO Transboundary Agro-ecosystem Management Project for the Kagera River Basin (Kagera TAMP) in Burundi, Rwanda, Tanzania and Uganda. The Kagera TAMP project led to the scale-up of sustainable land management practices such as agroforestry systems, sustainable management of annual cropland, erosion prevention on hillsides, and the increased use of soil and water conservation structures.

Water, agriculture & climate change

We have access to very little of the available water on our planet. And 70 percent of our water withdrawals are used up by agriculture, yet competition with other sectors for water is increasing.



In addition to the increasing demand for water due to population increase and changing diets, we must also consider the issue of water scarcity, the lack of sufficient available water resources to meet water needs, which is becoming one of the leading challenges of the twenty-first century.

By 2025

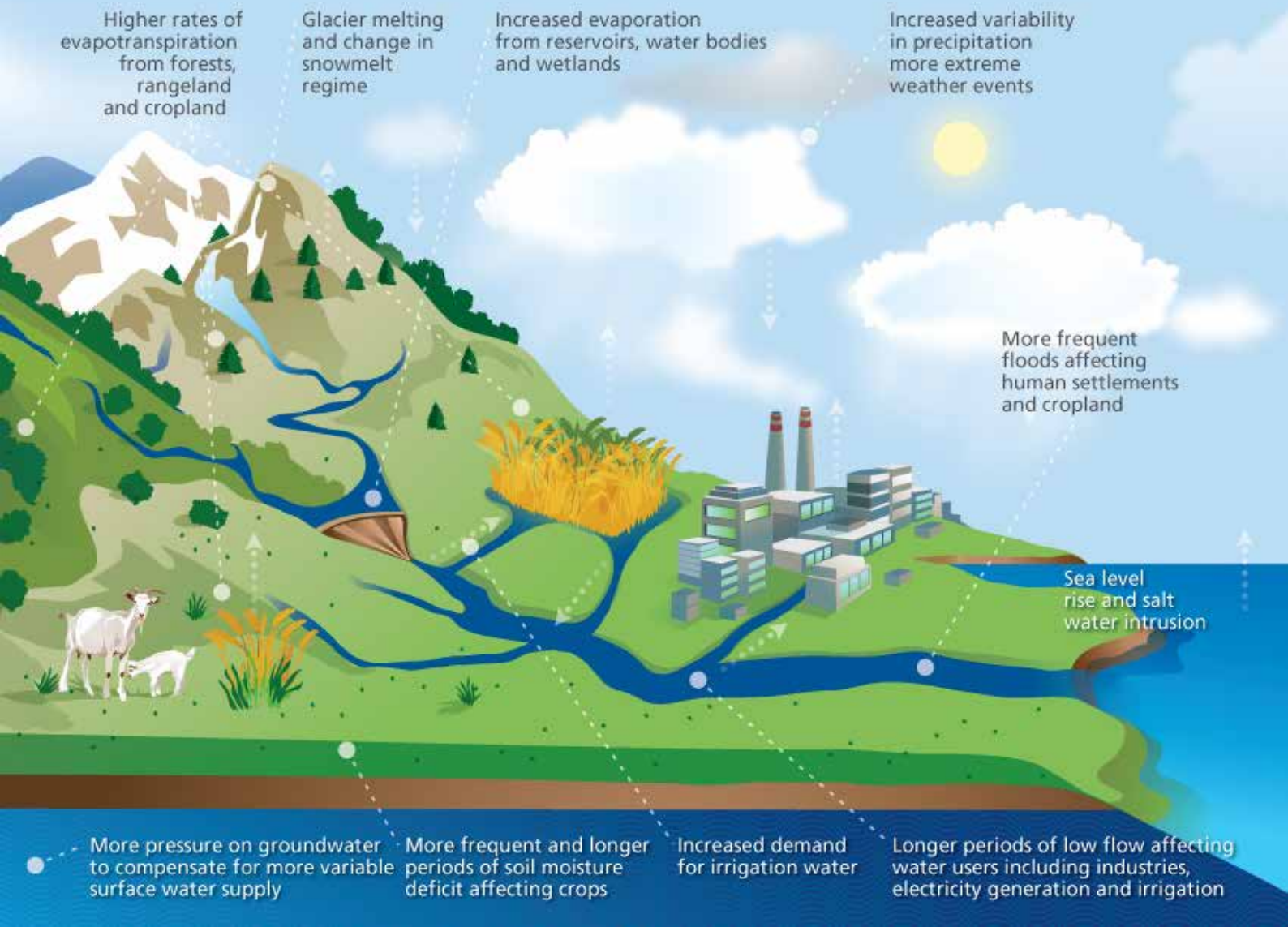
1.8 Billion

people will be living in countries or regions with absolute water scarcity

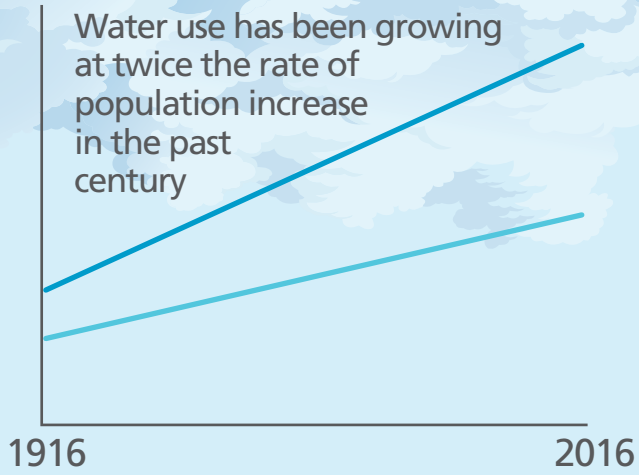
and **two-thirds of the world population**

could be living under water stressed conditions

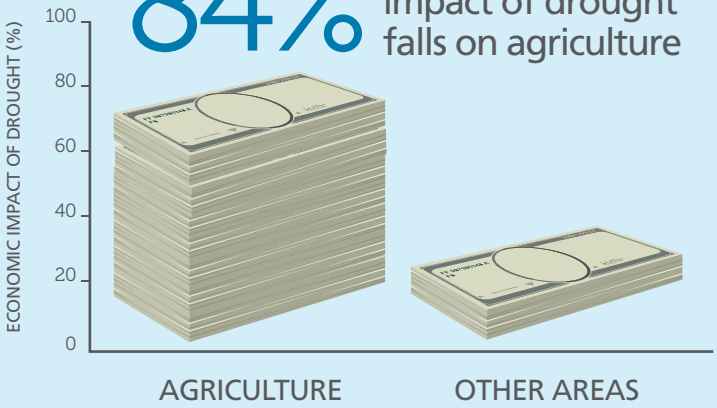
Water scarcity is expected to intensify as a result of climate change



Water scarcity & climate change: Some of the key facts



As much as **84%** of the economic impact of drought falls on agriculture



By 2025, water withdrawls will increase by

18%

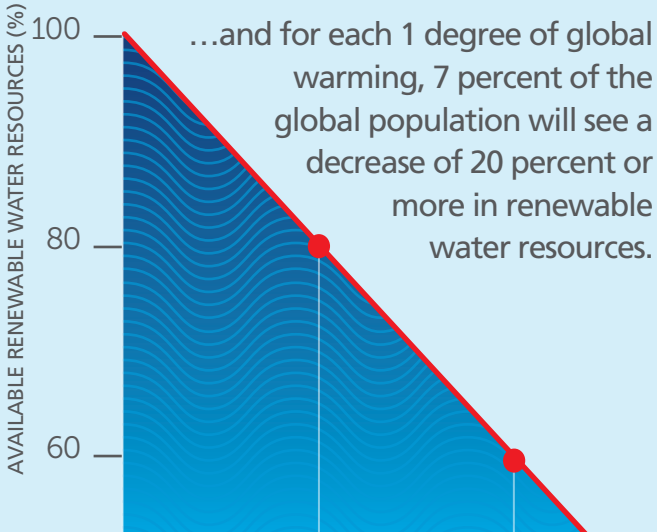
IN DEVELOPED COUNTRIES

and up to

50%

IN DEVELOPING COUNTRIES

Climate change is predicted to bring about increased temperatures across the world in the range of 1.6°c to as much as 6°c by 2050…



…and for each 1 degree of global warming, 7 percent of the global population will see a decrease of 20 percent or more in renewable water resources.

Water scarcity is a globally recognized issue

Of **188** UNFCC Countries who submitted Intended Nationally Detemined Contributions (INDCs):

88% of them contain sections on agriculture

...and of those **70%** contain an adaptation section

...and from those a further **79%** list water scarcity and water quality as important

FAO is working to combat the effects of climate change on water scarcity

Climate adaptation measures in agriculture that build on existing good management practices can increase water security and thus contribute directly to sustainable development.

Innovative technologies derived from applied research, combined with appropriate policies and strategies, are necessary for both adaptation to and the mitigation of climate change.

Precision irrigation techniques

Software models that improve crop yield

Water harvesting techniques

Wastewater management

FAO's global framework for action

FAO's work to combat the effects of climate change on our water resources has resulted in the establishment of **'Coping with water scarcity in agriculture: a global framework for action in a changing climate'**

Among the key goals of the framework are:

Evolving risk management strategies for national food security policies under water constraints and economic transitions

Implementing sound and innovative water accounting and auditing to support decision-making and management

Focused investments in water infrastructure; and the development of institutional and human capacities

Increased crop yield

Better livestock practices

Enhanced water-use efficiency

www.fao.org/climate-change

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