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# Working materials Educative sessions

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# The Climate Change: The Key Terms

# Glossary

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This brief glossary of climate change oriented key terms and concepts was aggregated and collected from various topical glossaries to include the key climate change oriented terms only. As such the glossary shall serve as an indispensable companion, when reading the guidelines, further designing and developing the climate change scoped project proposals under the current Visegrad project and beyond.

Correct, proper understanding and description remain the key, while the key terms in “climate change dictionary and its impact on agriculture” have their distinctive designation and precise meaning. Climate does not equal weather and climate change adaptation does not stand for climate change mitigation.

**Adaptation:** the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects

**Adaptive Capacity:** the ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences.

**Adverse Side Effects:** the negative effects that a policy or measure aimed at one objective might have on other objectives, irrespective of the net effect on overall social welfare. Adverse side effects are often subject to uncertainty and depend on local circumstances and implementation practices, among other factors. See also Co-benefits and Risk.

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**Afforestation:** Planting of new forests on lands that historically have not contained forests. See: IPCC Special Report on Land Use, Land-Use Change, and Forestry; Definitions and Methodological Options to Inventory. Emissions from Direct Human-induced Degradation of Forests and Devegetation of Other Vegetation Types. Agriculture, Forestry and Other Land Use (AFOLU): emissions and removals of greenhouse gases (resulting from direct human-induced land use, land-use change, and forestry activities, which may include or exclude agricultural emissions).

AFOLU plays a central role for food security and sustainable development. The main mitigation options within AFOLU involve one or more of three strategies: 1) prevention—of emissions to the atmosphere by conserving existing carbon pools in soils or vegetation or by reducing emissions of methane and nitrous oxide; 2) sequestration increasing the size of existing carbon pools and thereby extracting carbon dioxide (CO<sub>2</sub>) from the atmosphere; and 3) substitution—substituting biological products for fossil fuels or energy-intensive products, thereby reducing CO<sub>2</sub> emissions. Demand-side measures (e.g., reducing losses and wastes of food, changes in human diet, or changes in wood consumption) may also play a role.

**Anomaly:** a change or departure from a reference value or long-term average. Temperature anomaly is the difference between the long-term average temperature (i.e. reference value) and the temperature that is occurring. The long-term average temperature is one that would be expected; the anomaly is the difference between what you would expect and what is happening. A positive temperature anomaly indicates that the observed temperature was warmer than the reference value, while a negative temperature anomaly indicates that the observed temperature was cooler than the reference value. A climate anomaly is the difference of a future climate compared to the present climate.

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**Baseline:** baseline (or reference) is the state against which change is measured. A baseline period is the period relative to which anomalies are computed. In the context of transformation pathways, the term baseline scenarios refer to scenarios that assume that no mitigation policies or measures will be implemented beyond those that are already in force and/or are legislated or planned to be adopted. Baseline scenarios are not intended to be predictions of the future, but rather counterfactual constructions that can serve to highlight the level of emissions that would occur without further policy effort. Baseline scenarios can be compared to mitigation scenarios that are constructed to meet different goals for greenhouse gas (GHG) emissions, atmospheric concentrations or temperature changes. The term baseline scenario is used interchangeably with reference scenario and no policy scenario. In much of the literature the term is also synonymous with the term business-as-usual (BAU) scenario.

**Biodiversity:** Variety of plant and animal life in the world or in a habitat or ecosystem.

**Climate:** the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classic period for averaging these variables is 30 years, as defined by the World Meteorological Organization. The relevant quantities are most often surface variables such as temperature, precipitation and wind. Climate in a wider sense is the state, including a statistical description, of the climate system. Climate change refers to a change in the state of the climate that can be identified (i.e., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcing such as modulations of the solar cycles, volcanic eruptions and persistent anthropogenic changes in the composition of the atmosphere or in land use.

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**Climate Change:** A change in the state of the climate that can be identified (for example, using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as a result of human activity.

**Climate Change Induced Migration:** In this report, climate change-induced migration is migration that can be attributed largely to the slow-onset impacts of climate change on livelihoods owing to shifts in water availability and crop productivity, or to factors such as sea level rise or storm surge.

**Climate Model:** A numerical representation of the climate system based on the physical, chemical and biological properties of its components, their interactions and feedback processes and accounting for some of its known properties. The climate system can be represented by models of varying complexity; that is, for any one component or combination of components a spectrum or hierarchy of models can be identified, differing in such aspects as the number of spatial dimensions, the extent to which physical, chemical or biological processes are explicitly represented, or the level at which empirical parametrizations are involved.

Coupled Atmosphere–Ocean General Circulation Models (AOGCMs) provide a representation of the climate system that is near or at the most comprehensive end of the spectrum currently available. Climate models are typically applied as a research tool to study and simulate the climate and for operational purposes, including monthly, seasonal and interannual climate predictions.

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**Climate Prediction:** is a probabilistic statement about future climate conditions on timescales ranging from seasons to decades. It is based on conditions that are known at present and assumptions about the physical processes that will determine future changes. When a projection is branded "most likely" it becomes a prediction and outputs of which can enable some level of confidence to be attached to projections

**Climate Projection:** the simulated response of the climate system to a scenario of future emission or concentration of greenhouse gases (GHGs) and aerosols, generally derived using climate models. Projections provide a potential future evolution of a quantity or set of quantities, often computed with the aid of a model.

Climate projections are distinguished from climate predictions by their dependence on the emission/concentration/radiative forcing scenario used, which is in turn based on assumptions concerning, for example, future socio-economic and technological developments that may or may not be realized. Unlike predictions, projections are conditional on assumptions concerning, for example, future socio-economic and technological developments that may or may not be realized.

**Climate-Resilient Pathways:** the iterative processes for managing change within complex systems in order to reduce disruptions and enhance opportunities associated with climate change.

**Climate Risk:** Potential for consequences from climate variability and change where something of value is at stake and the outcome is uncertain. Often represented as the probability that a hazardous event or trend occurs multiplied by the expected impact. Risk results from the interaction of vulnerability, exposure, and hazard.

**Coastal Erosion:** Erosion of coastal landforms that results from wave action, exacerbated by storm surge and sea level rise.

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**Coastal Zone:** In this report, the coastal zone is land area within 10 kilometers of the coastline.

**Climate System:** the highly complex system consisting of five major components: the atmosphere, the hydrosphere, the cryosphere, the lithosphere and the biosphere and the interactions between them. The climate system evolves in time under the influence of its own internal dynamics and because of external forcing such as volcanic eruptions, solar variations and anthropogenic forcing such as the changing composition of the atmosphere and land-use change.

**Climate Variability:** variations in the mean state and other statistics (i.e., standard deviations, occurrence of extremes, etc.) of the climate across all spatial and temporal scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability).

**Coupled Model Intercomparison Project Phase 5 (CMIP5):** The CMIP is a standard experimental framework for studying the output of coupled atmosphere-ocean general circulation models. This facilitates assessment of the strengths and weaknesses of climate models which can enhance and focus the development of future models. For example, if the models indicate a wide range of values either regionally or globally, then scientists may be able to determine the cause(s) of this uncertainty. CMIP5 is the most current and extensive of the CMIPs. It is defined by experiment suites divided into three categories: 1) Decadal Hindcasts and Predictions simulations; 2) "long-term" simulations; and 3) "atmosphere-only" (prescribed SST) simulations for especially computationally-demanding models. CMIP5 builds the database for the global climate change projections presented in the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC). See World Climate Research Programme, CMIP5. Co-benefits: The positive effects that a policy or measure aimed at one objective might have on other objectives, irrespective of the net effect on overall social welfare. Co-benefits are often subject to

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uncertainty and depend on local circumstances and implementation practices, among other factors. Also referred to as ancillary benefits. Confidence: The validity of a finding based on the type, amount, quality and consistency of evidence (e.g., mechanistic understanding, theory, data, models, expert judgment) and on the degree of agreement.

**Cost-effectiveness:** A policy is more cost-effective if it achieves a given policy goal at lower cost. Integrated models approximate cost-effective solutions, unless they are specifically constrained to behave otherwise. Cost-effective mitigation scenarios are those based on a stylized implementation approach in which a single price on carbon dioxide and other greenhouse gases is applied across the globe in every sector of every country and that rises over time in a way that achieves lowest global discounted costs.

**Decarbonization:** The process by which countries or other entities aim to achieve a low-carbon economy, or by which individuals aim to reduce their consumption of carbon.

**Deforestation:** Conversion of forest to non-forest. See IPCC Special Report on Land Use, Land-Use Change, and Forestry; Definitions and Methodological Options to Inventory Emissions from Direct Human-induced

**Disaster:** Severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery. See UNISDR Global Assessment Report on Disaster Risk Reduction 2015.

**Displacement:** Forced removal of people or people obliged to flee from their places of habitual residence.

**Drought:** A period of abnormally dry weather long enough to cause a serious hydrological imbalance. Drought is a relative term; therefore,

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any discussion in terms of precipitation deficit must refer to the particular precipitation-related activity that is under discussion. For example, shortage of precipitation during the growing season impinges on crop production or ecosystem function in general (due to soil moisture drought, also termed agricultural drought) and during the runoff and percolation season primarily affects water supplies (hydrological drought). Storage changes in soil moisture and groundwater are also affected by increases in actual evapotranspiration in addition to reductions in precipitation. A period with an abnormal precipitation deficit is defined as a meteorological drought. A megadrought is a very lengthy and pervasive drought, lasting much longer than normal, usually a decade or more.

**Early warning system:** The set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organizations threatened by a hazard to prepare to act promptly and appropriately to reduce the possibility of harm or loss.

**Earth System Model (ESM):** A coupled atmosphere–ocean general circulation model in which a representation of the carbon cycle is included, allowing for interactive calculation of atmospheric CO<sub>2</sub> or compatible emissions. Additional components (i.e., atmospheric chemistry, ice sheets, dynamic vegetation, nitrogen cycle, but also urban or crop models) may be included.

**Ecosystem:** An ecosystem is a functional unit consisting of living organisms, their non-living environment and the interactions within and between them. The components included in a given ecosystem and its spatial boundaries depend on the purpose for which the ecosystem is defined. Ecosystem boundaries can change over time. Ecosystems are nested within other ecosystems and their scale can range from very small to the entire biosphere. In the current era, most ecosystems either contain people as key organisms, or are influenced by the effects of human activities in their environment.

**Emission scenario:** A plausible representation of the future development of emissions of substances that are potentially radiatively

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active (i.e., greenhouse gases, aerosols) based on a coherent and internally consistent set of assumptions about driving forces (such as demographic and socio-economic development, technological change, energy and land use) and their key relationships. Concentration scenarios, derived from emission scenarios, are used as input to a climate model to compute climate projections. In IPCC (1992) a set of emission scenarios was presented which were used as a basis for the climate projections in IPCC (1996). These emission scenarios are referred to as the IS92 scenarios. In the IPCC Special Report on Emissions Scenarios (IPCC, 2000a) emission scenarios, the so-called SRES scenarios, were published, some of which were used, among others, as a basis for the climate projections presented in Chapters 9 to 11 of IPCC WGI TAR (IPCC, 2001a) and Chapters 10 and 11 of IPCC WGI AR4 (IPCC, 2007) as well as in the IPCC WGI AR5 (IPCC, 2013b). New emission scenarios for climate change, the four Representative Concentration Pathways, were developed for, but independently of, the current IPCC assessment, AR5.

**Ensemble:** A collection of model simulations characterizing a climate prediction or projection. Differences in initial conditions and model formulation result in different evolutions of the modelled system and may give information on uncertainty associated with model error and error in initial conditions in the case of climate forecasts and on uncertainty associated with model error and with internally generated climate variability in the case of climate projections.

**Evapotranspiration:** the process of transferring moisture from the earth into the atmosphere. Evaporation occurs when water vapor leaves the soil or a plant's surface. Transpiration involves the passage of water through a plant, from its roots through its vascular system. The sum of evaporation and transpiration is evapotranspiration.

**Exposure:** The presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected.

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**External forcing:** External forcing refers to a forcing agent outside the climate system causing a change in the climate system. Volcanic eruptions, solar variations and anthropogenic changes in the composition of the atmosphere and land-use change are external forcings. Orbital forcing is also an external forcing as the insolation changes with orbital parameters eccentricity, tilt and precession of the equinox

**Extreme heat event:** Three or more days of above-average temperatures, generally defined as passing a certain threshold (for example, above the 85th percentile for average daily temperature in a year). **Extreme weather event:** An extreme weather event is an event that is rare at a particular place and time of year. Definitions of rare vary, but an extreme weather event would normally be as rare as or rarer than the 10th or 90th percentile of a probability density function estimated from observations. By definition, the characteristics of what is called extreme weather may vary from place to place in an absolute sense. When a pattern of extreme weather persists for some time, such as a season, it may be classed as an extreme climate event, especially if it yields an average or total that is itself extreme (i.e., drought or heavy rainfall over a season).

**Flood:** The overflowing of the normal confines of a stream or other body of water, or the accumulation of water over areas not normally submerged. Floods include river (fluvial) floods, flash floods, urban floods, pluvial floods, sewer floods, coastal floods and glacial lake outburst floods.

**Food security:** A state that prevails when people have secure access to sufficient amounts of safe and nutritious food for normal growth, development and an active and healthy life.

**Forest:** A vegetation type dominated by trees. Many definitions of the term forest are in use throughout the world, reflecting wide differences in bio-geophysical conditions, social structure and economics

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**Hazard:** The potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems and environmental resources. Here, hazard usually refers to climate related physical events or trends or their physical impacts.

**Heat wave:** While there is no universally accepted definition, heat waves are understood to be periods of unusually hot and dry or hot and humid weather that have a subtle onset and cessation, a duration of at least two–three days, usually with a discernible impact on human and natural systems. Because there is no absolute universal value, such as a given temperature that defines what is extreme heat, heatwaves are relative to a location’s climate: the same meteorological conditions can constitute a heatwave in one place but not in another.

**Hydrological cycle:** The cycle in which water evaporates from the oceans and the land surface, is carried over the Earth in atmospheric circulation as water vapor, condenses to form clouds, precipitates over ocean and land as rain or snow, which on land can be intercepted by trees and vegetation, provides runoff on the land surface, infiltrates into soils, recharges groundwater, discharges into streams and ultimately flows out into the oceans, from which it will eventually evaporate again. The various systems involved in the hydrological cycle are usually referred to as hydrological systems.

**Impacts:** Effects on natural and human systems from extreme weather and climate events and of climate change. Impacts generally refer to effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services and infrastructure due to the interaction of climate changes or hazardous climate events occurring within a specific time period and the vulnerability of an exposed society or system. Impacts are also, referred to as consequences and outcomes. The impacts of climate change on geophysical systems, including floods, droughts and sea level rise, are a subset of impacts called physical impacts.

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**Land Use and Land-Use Change:** Land use refers to the total of arrangements, activities and inputs undertaken in a certain land cover type (a set of human actions). The term land use is also used in the sense of the social and economic purposes for which land is managed (i.e., grazing, timber extraction and conservation). In urban settlements it is related to land uses within cities and their hinterlands. Urban land use has implications on city management, structure and form and thus on energy demand, greenhouse gas emissions and mobility, among other aspects.

**Likelihood:** The chance of a specific outcome occurring, where this might be estimated probabilistically.

**Meridional Overturning Circulation (MOC):** Meridional (north–south) overturning circulation in the ocean quantified by zonal (east–west) sums of mass transports in depth or density layers. In the North Atlantic, away from the subpolar regions, the MOC (which is in principle an observable quantity) is often identified with the thermohaline circulation, which is a conceptual and incomplete interpretation. It must be borne in mind that the MOC is also driven by wind and can also include shallower overturning cells such as occur in the upper ocean in the tropics and subtropics, in which warm (light) waters moving poleward are transformed to slightly denser waters and subducted equatorward at deeper levels.

**Migration:** Movement that requires a change in the place of usual residence and that is longer term. In demographic research and official statistics, it involves crossing a recognized political/administrative border.

**Mitigation:** A human intervention to reduce the sources or enhance the sinks of greenhouse gases. Human interventions can also reduce the sources of other substances which may contribute directly or indirectly to limiting climate change, including, for example, the reduction of particulate matter emissions that can directly alter the radiation balance (e.g., black carbon) or measures that control

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emissions of carbon monoxide, nitrogen oxides, Volatile Organic Compounds and other pollutants that can alter the concentration of tropospheric ozone which has an indirect effect on the climate.

**Mitigation scenario:** A plausible description of the future that describes how the (studied) system responds to the implementation of mitigation policies and measures.

**Precipitation:** Water released from clouds in the form of rain, freezing rain, sleet, snow, or hail. It is the primary connection in the water cycle that provides for the delivery of atmospheric water to the Earth.

**Radiative forcing:** Measurement of capacity of a gas or other forcing agent to affect the energy balance, thereby contributing to climate change.

**Rainfed agriculture:** Agricultural practice relying almost entirely on rainfall as its source of water.

**Rapid-onset event:** Event such as cyclones and floods which take place in days or weeks (in contrast to slow onset climate changes that occur over long periods of time).

**Representative Concentration Pathways (RCPs):** Scenarios that include time series of emissions and concentrations of the full suite of greenhouse gases and aerosols and chemically active gases, as well as land use/land cover. Representative signifies that each RCP provides only one of many possible scenarios that would lead to the specific radiative forcing characteristics. Pathway emphasizes that not only the long-term concentration levels are of interest, but also the trajectory taken over time to reach that outcome. RCPs usually refer to the portion of the concentration pathway extending up to 2100, for which Integrated Assessment.

Models produced corresponding emission scenarios. New emission scenarios for climate change, the four Representative Concentration Pathways, were developed for, but independently of, the current IPCC

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assessment, AR5. See RCP Database. Four RCPs produced from Integrated Assessment Models were selected from the published literature and used in the current IPCC Assessment as a basis for the climate predictions.

**Resilience:** the capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure, while also maintaining the capacity for adaptation, learning and transformation.

**Risk:** potential for consequences where something of value is at stake and where the outcome is uncertain, recognizing the diversity of values. Risk is often represented as probability or likelihood of occurrence of hazardous events or trends multiplied by the impacts if these events or trends occur. In this report, the term risk is often used to refer to the potential, when the outcome is uncertain, for adverse consequences on lives, livelihoods, health, ecosystems and species, economic, social and cultural assets, services (including environmental services) and infrastructure.

**Sea Level Rise:** Increases in the height of the sea with respect to a specific point on land. Eustatic sea level rise is an increase in global average sea level brought about by an increase in the volume of the ocean as a result of the melting of land-based glaciers and ice sheets. Steric sea level rise is an increase in the height of the sea induced by changes in water density as a result of the heating of the ocean.

Density changes induced by temperature changes only are called thermosteric; density changes induced by salinity changes are called halosteric.

**Sequestration:** the uptake (i.e., the addition of a substance of concern to a reservoir) of carbon containing substances, in particular carbon dioxide (CO<sub>2</sub>), in terrestrial or marine reservoirs. Biological sequestration includes direct removal of CO<sub>2</sub> from the atmosphere

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through land-use change (LUC), afforestation, reforestation, revegetation, carbon storage in landfills and practices that enhance soil carbon in agriculture (cropland management, grazing land management). In parts of the literature, but not in this report, (carbon) sequestration is used to refer to Carbon Dioxide Capture and Storage (CCS).

**Slow-onset climate change:** Changes in climate parameters—such as temperature, precipitation, and associated impacts, such as water availability and crop production declines—that occur over long periods of time (in contrast to rapid-onset climate hazards, such as cyclones and floods, which take place in days or weeks).

**Storm surge:** the temporary increase, at a particular locality, in the height of the sea due to extreme meteorological conditions (low atmospheric pressure and/or strong winds). The storm surge is defined as being the excess above the level expected from the tidal variation alone at that time and place

**Stressor:** Event or trend that has important effect on the system exposed and can increase vulnerability to climate-related risk.

**Sustainable livelihood:** Livelihood that endures over time and is resilient to the impacts of various types of shocks including climatic and economic.

**System dynamics model:** A model which decomposes a complex social or behavioral system into its constituent components and then integrates them into a whole that can be easily visualized and simulated.

**Temperature:** is the expected temperature in degrees, valid for the indicated hour. Global temperature is an average of air temperature recordings from weather stations on land and sea as well as some satellite measurements. Extreme temperature events (i.e. maximum, minimum) may have short-term durations of a few days with temperature increases of over 5°C above the normal temperatures.

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**Tipping Element:** Subsystems of the Earth system that are at least subcontinental in scale and can be switched—under certain circumstances— into a qualitatively different state by small perturbations.

**Tipping Point:** a level of change in system properties beyond which a system reorganizes, often abruptly, and does not return to the initial state even if the drivers of the change are abated. For the climate system, it refers to a critical threshold when global or regional climate changes from one stable state to another stable state.

The tipping point event may be irreversible.

**Transformation Pathway:** the trajectory taken over time to meet different goals for greenhouse gas emissions, atmospheric concentrations, or global mean surface temperature change that implies a set of economic, technological and behavioural changes. This can encompass changes in the way energy and infrastructure are used and produced, natural resources are managed, and institutions are set up and, in the pace, and direction of technological change.

**Uncertainty:** a state of incomplete knowledge that can result from a lack of information or from disagreement about what is known or even knowable. It may have many types of sources, from imprecision in the data to ambiguously defined concepts or terminology, or uncertain projections of human behavior. Uncertainty can therefore be represented by quantitative measures (i.e., a probability density function) or by qualitative statements (i.e., reflecting the judgment of a team of experts);

**Vulnerability:** the propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt.

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[https://www.iucn.org/sites/dev/files/import/downloads/terminologies\\_used\\_in\\_climate\\_change\\_2011.pdf](https://www.iucn.org/sites/dev/files/import/downloads/terminologies_used_in_climate_change_2011.pdf)

[https://climateknowledgeportal.worldbank.org/themes/custom/wb\\_cckp/resources/data/CCKP\\_Glossary\\_Oct\\_2018.pdf](https://climateknowledgeportal.worldbank.org/themes/custom/wb_cckp/resources/data/CCKP_Glossary_Oct_2018.pdf)

[https://unfccc.int/sites/default/files/training\\_workshop\\_on\\_implementing\\_napa\\_training\\_materials\\_eng.pdf](https://unfccc.int/sites/default/files/training_workshop_on_implementing_napa_training_materials_eng.pdf)

<https://www.oecd.org/environment/cc/36736773.pdf>

<https://serc.carleton.edu/eslabs/weather/glossary.html>

<https://www.pwc.com/gx/en/energy-utilities-mining/pdf/eumcommoditiestradingriskmanagementglossary.pdf>

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# Micro scale on-farm climate adjustment solutions

Lessons learnt from the members of The Young Agrarians' Society of the Czech Republic

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# Micro scale investments for climate resilience

- Max 2500 euro per project
- Without building permit
- Distinguish change
- Usually impact for diversity, nature etc.

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# 1. Bio - belts



- Low cost investment (seed material costs about 100 – 200 euro)
- Visible changes in months – Short time changes
- Promotion of company Subsidies from EU Anti erosion



- Losing of land for farming for few years
- Problems with administration of project for subsidies
- The fields are very attractive for especially wild boars

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## 2. Agroforestry



- Low cost investment (tree costs about 4-16 euro)
- Possible to add agroforestry to SAPS  
Anti-water erosion, anti-wind erosion



- Losing of production from field (Shadow and lack of water)
- Long term changes

## 3. Wetlands

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- Low input, helps diversity, project is possible realize and see results in months



- Problem with administration of projects if there are subsidies
- Management of moving of lawn is harder (only small machines)

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# 4. Blind stream Branch



- Low input if blind branch is not cultivated
- Easy way how to revitalize



- Ownership of blind stream branch is complicated

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# Smart and cost-effective on-farm adaptations: Climate Change adjusted Innovations

Practical examples  
and solutions for small  
scale farming

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# Alley cropping method

- Multipurpose trees (usually leguminous) are established in rows 4-6 meters apart with crops cultivated in the "alleys" between the tree rows. Trees are pruned at the end of the first year and subsequently managed through periodic pruning of the regrowth so that interplanted food crops get enough light
- Crop production during the years before nut trees come into bearing or hardwood timber is harvested creates cash flow and diversifies farm income, thereby improving the return on long-term investments in trees
- By planting rows of nut or timber trees on land where annual crop production is low due to erosion or other limitations, marginal croplands may be converted to higher value woodlands
- Rows of trees reduce wind speed, thereby controlling wind erosion. They also create sheltered microclimates that improves the yield and quality of crops growing in the alleys
- Alley cropping increases the biodiversity of cropland which creates new habitat for wildlife

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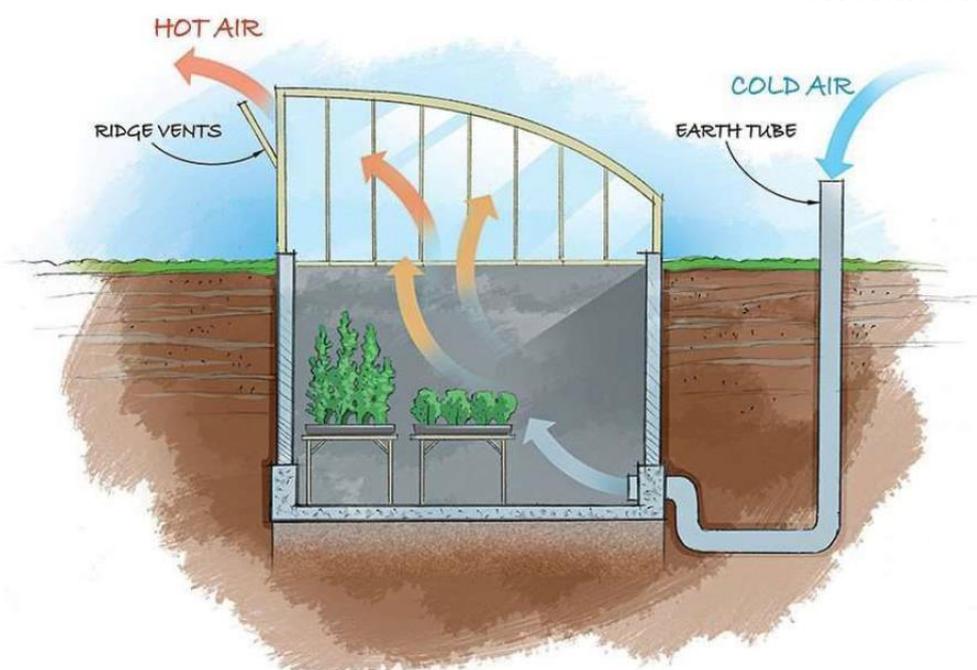
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A wallipini (or underground) green house is a greenhouse that is dug into the ground, typically well below the frost line, which uses a combination of heat from the sun and naturally occurring geothermal heat to keep plant life warm

- Uses geothermal heat to keep plants warm in winter
- Geothermal cooling in the summer to keep plants from over heating
- Can be constructed cheaply
- Can be more visually appealing than an above ground build
- May require less maintenance than other options, with only a roof to repair
- Soil better maintains moisture
- Less weeds
- Can double as a structure to keep livestock warm
- Keeps protected from pests and chemicals



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# Thermosolar hive



Thermosolar Hive is the way to ecological beekeeping with the possibility of organic honey production

- Varroa destructor
- Increasing honey yields (yields are usually higher by 25 to 75%)
- Reduction of consumption of winter bee stocks
- Suppression of the occurrence of parasites of the genus Nosema
- Increase of thermal comfort of the bee colony

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# Bumble Bees for pollination



Bumblebees are useful for pollinating tomatoes, eggplants, strawberries, peppers, and other plants grown under shelter & orchards

- Modern beehive design ensuring optimal working and development conditions
- Technical solutions thanks to which pollination bumblebees can be protected against harmful external factors
- A supply of nutrients for bumblebees and larvae to work effectively
- They significantly affect the quality and quantity of crops
- They are more effective pollinating insects than the honeybee or manual pollination
- 1 bumblebee can pollinate over 3,000 vegetable flowers in approximately 8 hours of work
- Pollination bumblebees are a natural and effective support for the pollination process that determines the yield and economic profitability of production.

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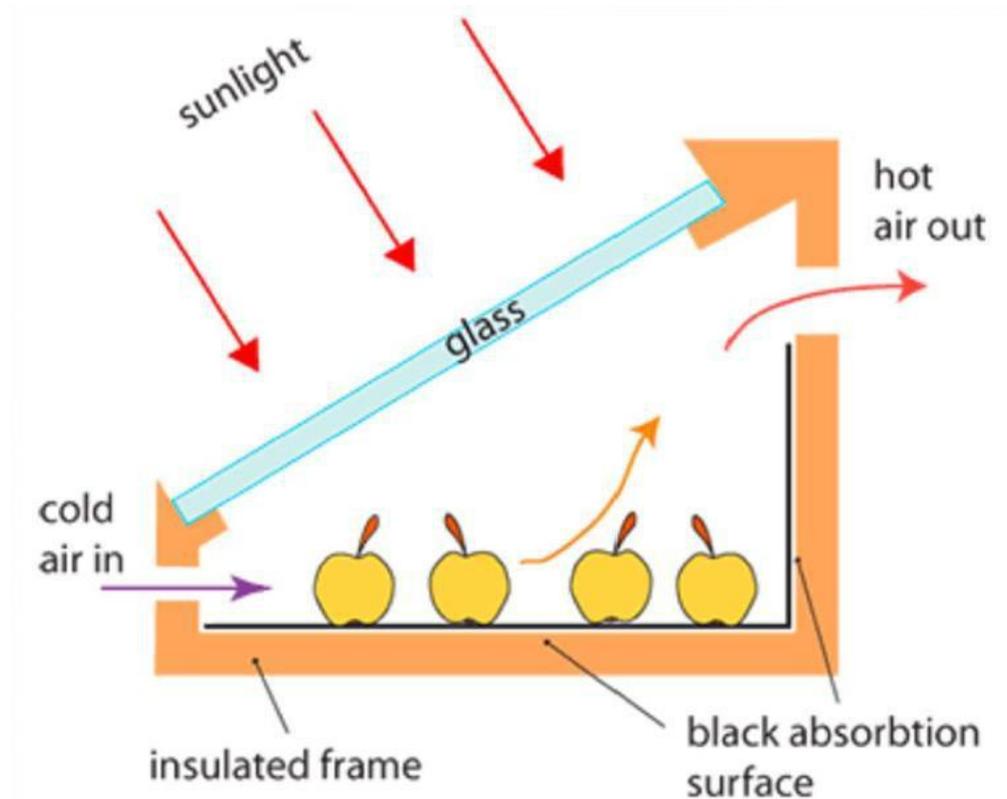
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# Solar dryers

The basic function of a solar dryer is to heat air to a constant temperature with solar energy, which facilitates extraction of humidity from crops inside a drying chamber. This method is preferable for drying foods which lose nutritional value when exposed to direct sunlight



- The products being dried in the dryer are protected from rains and insects and the dried products are of high quality
- The solar air heater has an average daily efficiency of 35% and it performs well both as a solar collector and a roof of a farmhouse

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# Smart rainwater catchment & retention & release



- Stand alone structure: mere example as per reference
- Adjusted to greenhouses/ any large surface
- Easy to scale-up & expand & alter

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# DIY: smart water management: buy online & assemble & adjust



- Easy/Programmable/Mechanic & Wi-Fi Hose Automatic Watering & Irrigation Timer
- Integrated with stand/alone off grid/wi-fi soil moisture sensors
- Easy plug-in wi-fi releaser/ if not provided & connected to localized agri-weather forecast data stream
- Bio-nutrient release switch on/off

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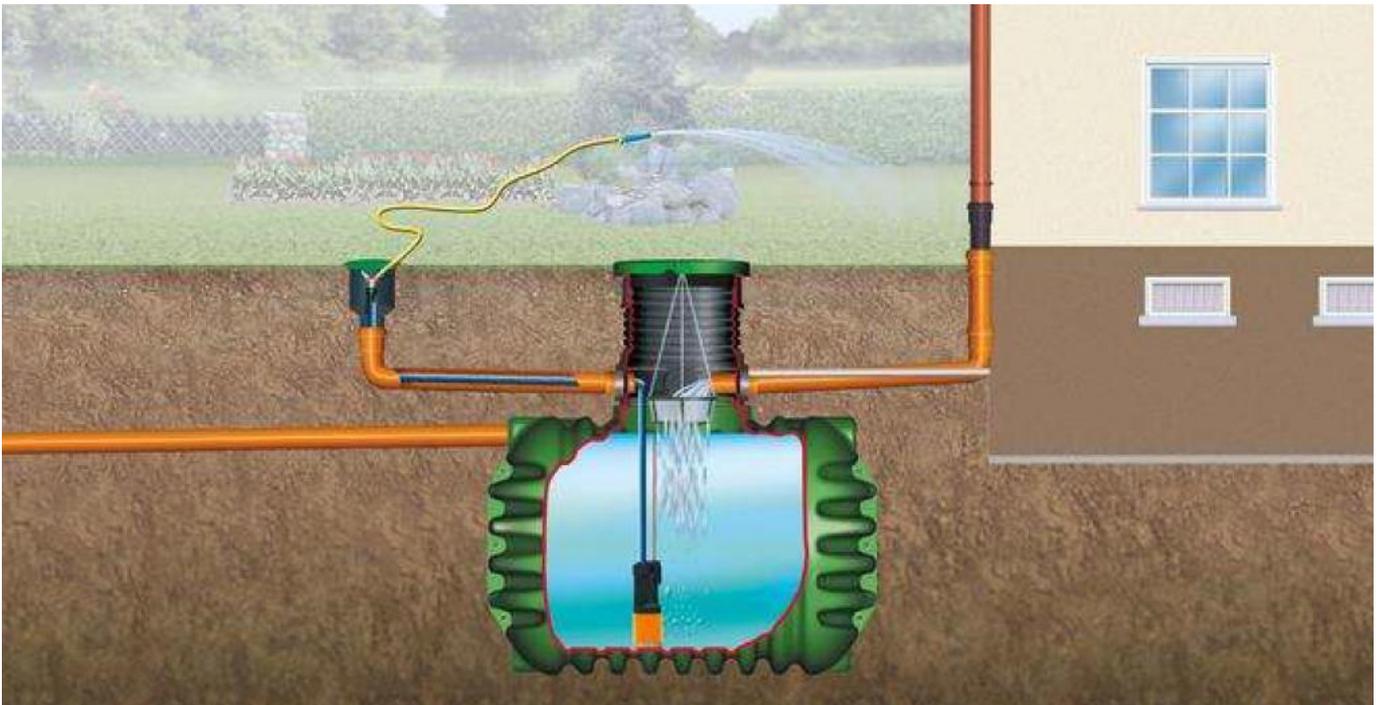
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# Water storage reservoir

Very small reservoirs (ponds) can be constructed in economical and cost-efficient way by individual farmers



- Alternative source of water for irrigation of fields and gardens
- Contribute to the improvement of the structure of water resources
- Increase the biodiversity of the areas used by man

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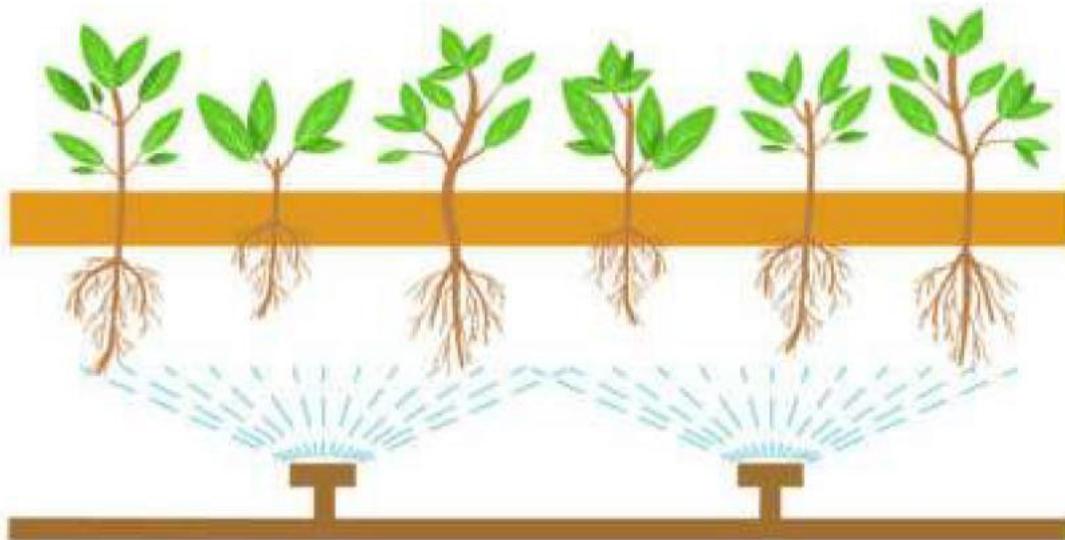
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# Aeroponics

A popular indoor farming system, aeroponics is a method for growing plants with no soil and minimal water – plants are nourished with nothing more than nutrient-laden mist



- The concept builds off that of hydroponic systems, in which the roots are held in a soilless growing medium, such as coco coir, over which nutrient-laden water is periodically pumped
- Aeroponics simply dispenses with the growing medium, leaving the roots to dangle in the air, where they are periodically puffed by specially-designed misting devices
- In aeroponics systems, seeds are “planted” in pieces of foam stuffed into tiny pots, which are exposed to light on one end and nutrient mist on the other. The foam also holds the stem and root mass in place as the plants grow.

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# Hydroponics

Hydroponics is a form of gardening that uses no soil, but instead grows plants in a solution of water and nutrients



- Plants grown this way usually yield more, require less space, and conserve soil and water
- This system is an ideal solution if you are an apartment dweller who does not have an outdoor gardening plot
- Throughout the growing process, you will need to control several factors, such as lighting, water quality, air circulation etc.

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# Compost piles/ bins



- Enriches soil, helping retain moisture and suppress plant diseases and pests
- Reduces the need for chemical fertilizers
- Encourages the production of beneficial bacteria and fungi that break down organic matter to create humus, a rich nutrient-filled material
- Reduces methane emissions from landfills and lowers your carbon footprint

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# Addendum

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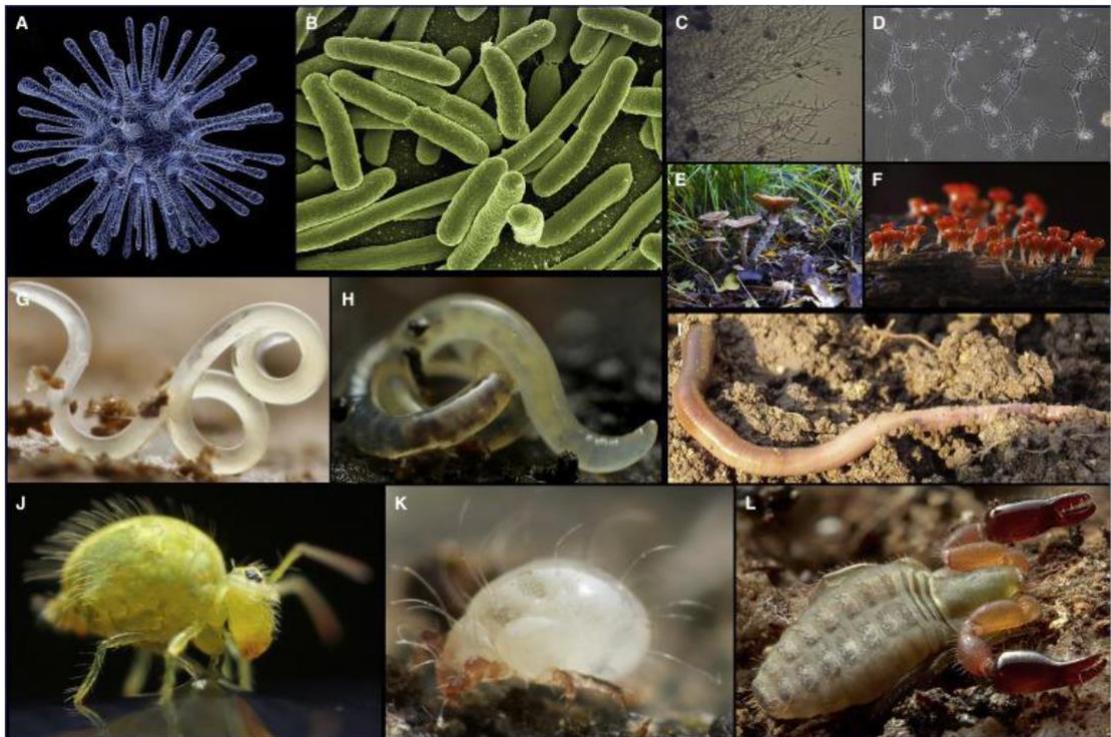
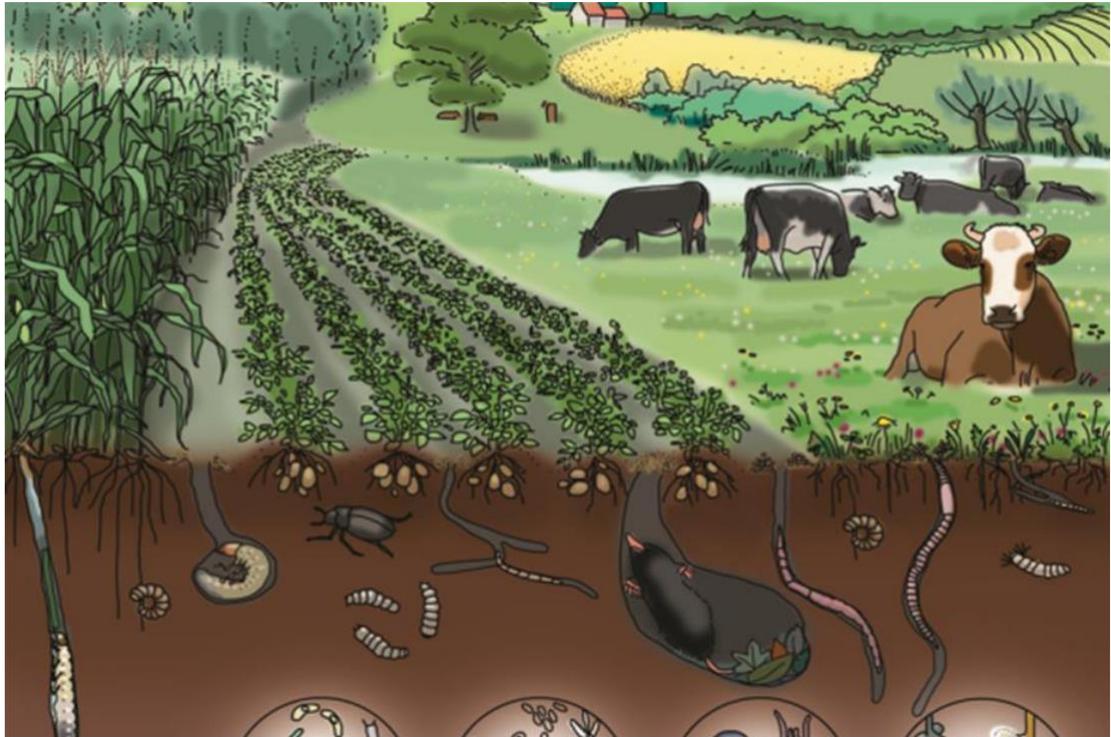
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# Soil organisms are helpers in agriculture



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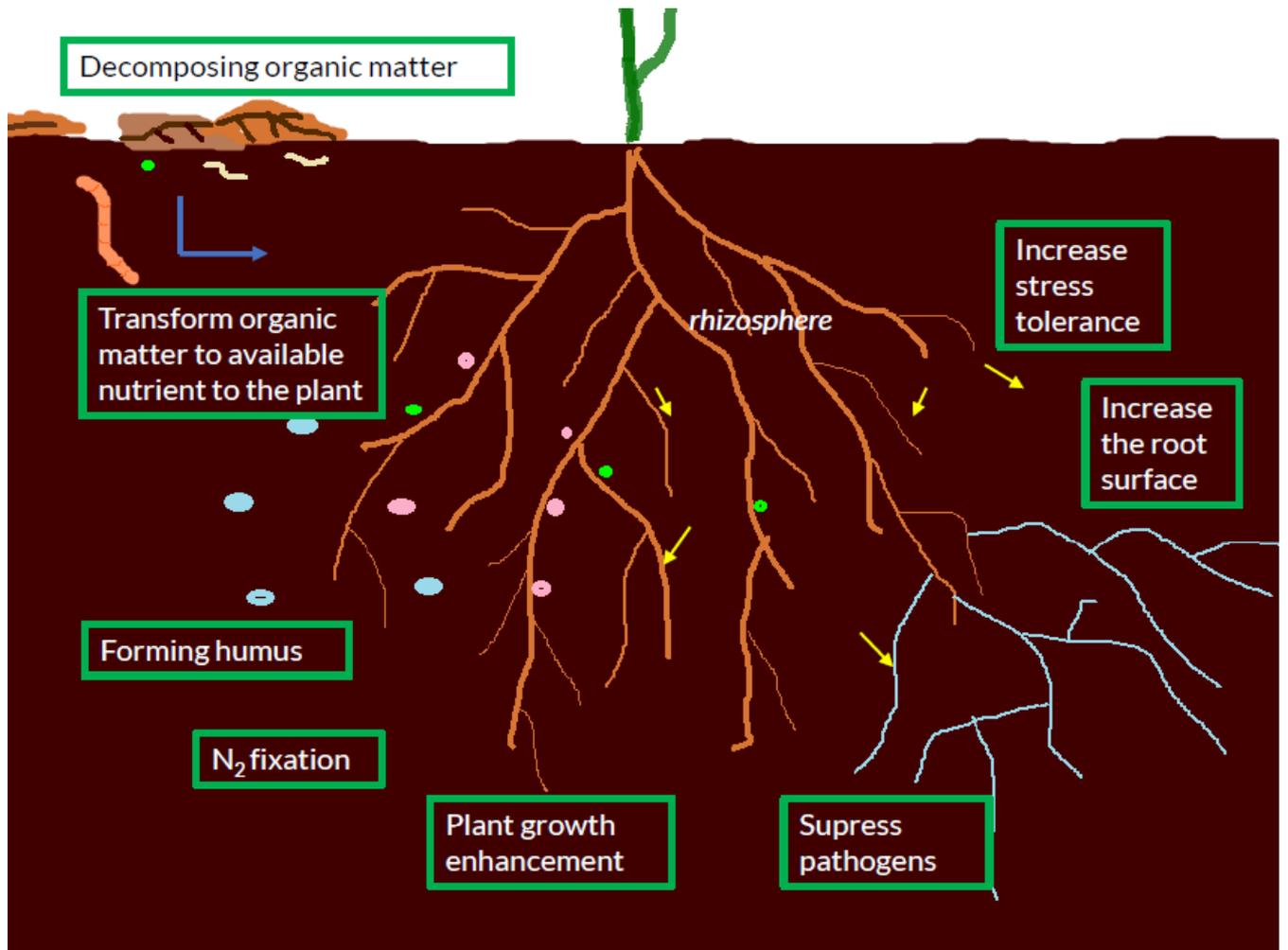
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# How to do that?

- Feed them!
- Organic matter!



## Living Soil



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# The effect of synthetic fertilizer

Microbes in Living Soil Provide Nutrients to Plants



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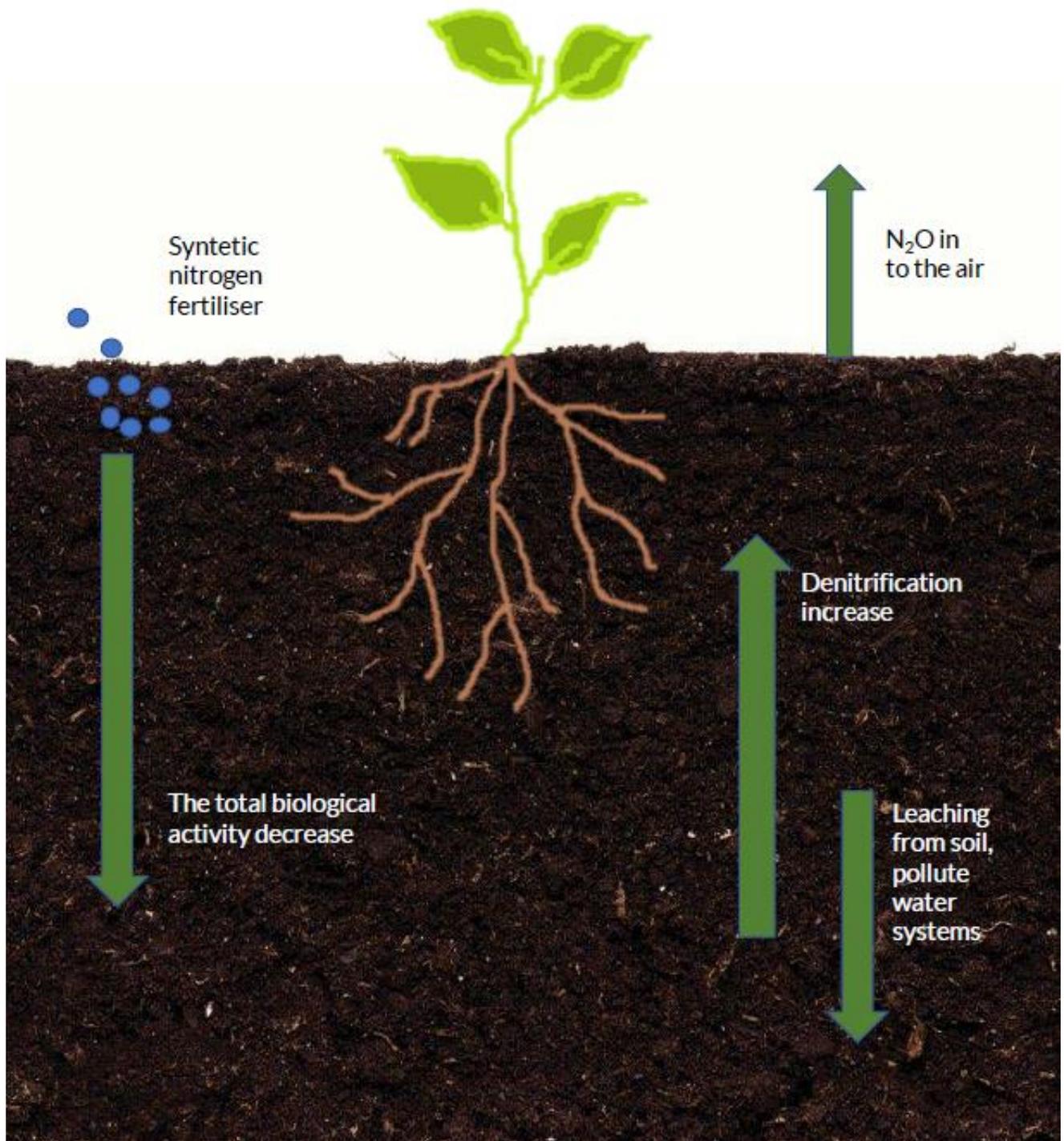
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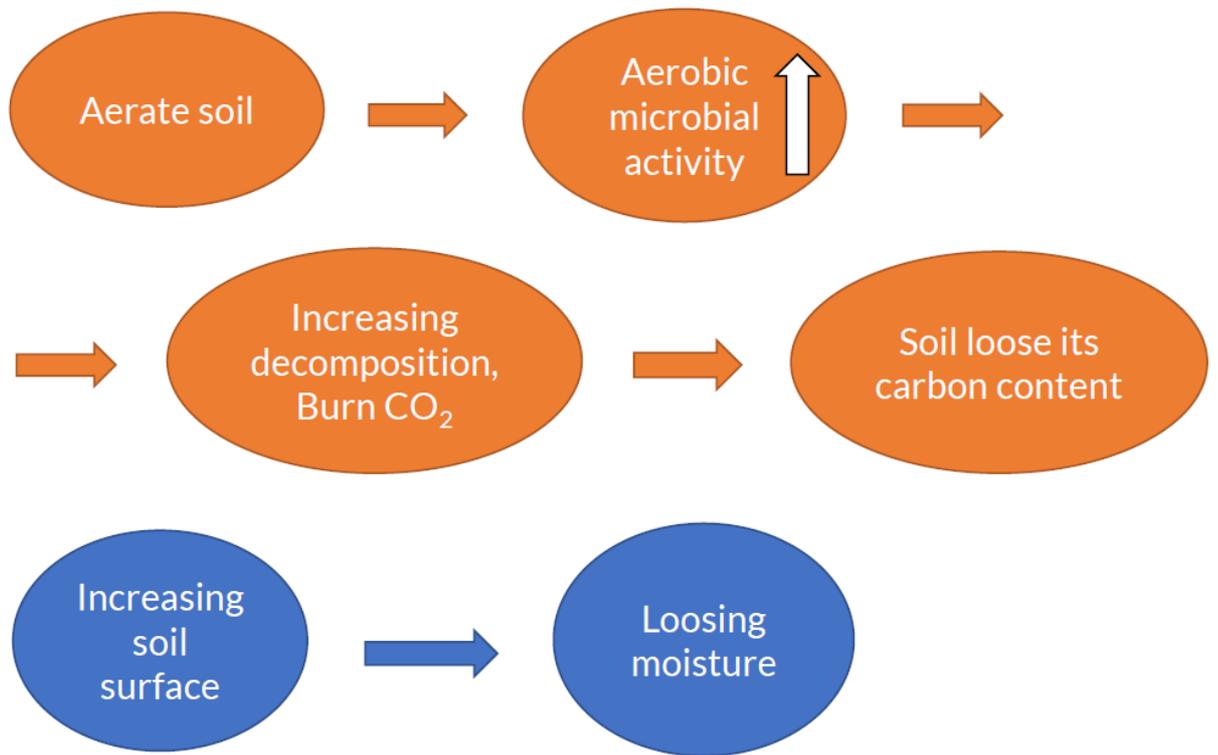


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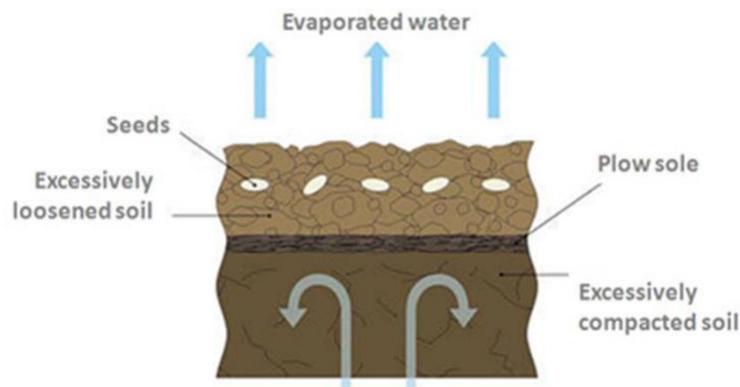


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# The negative effects of intensive tillage



Plough sole (soil compaction):



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**Conservation tillage-  
Mulch leaving tillage  
No-till system**

- Leave (at least 30%) of residue on the soil surface
- Mulch cultivator
- Mulch seed drill machine



[https://www.youtube.com/watch?v=qbbnerV\\_Pws](https://www.youtube.com/watch?v=qbbnerV_Pws)  
<https://www.youtube.com/watch?v=W-suSow738g>

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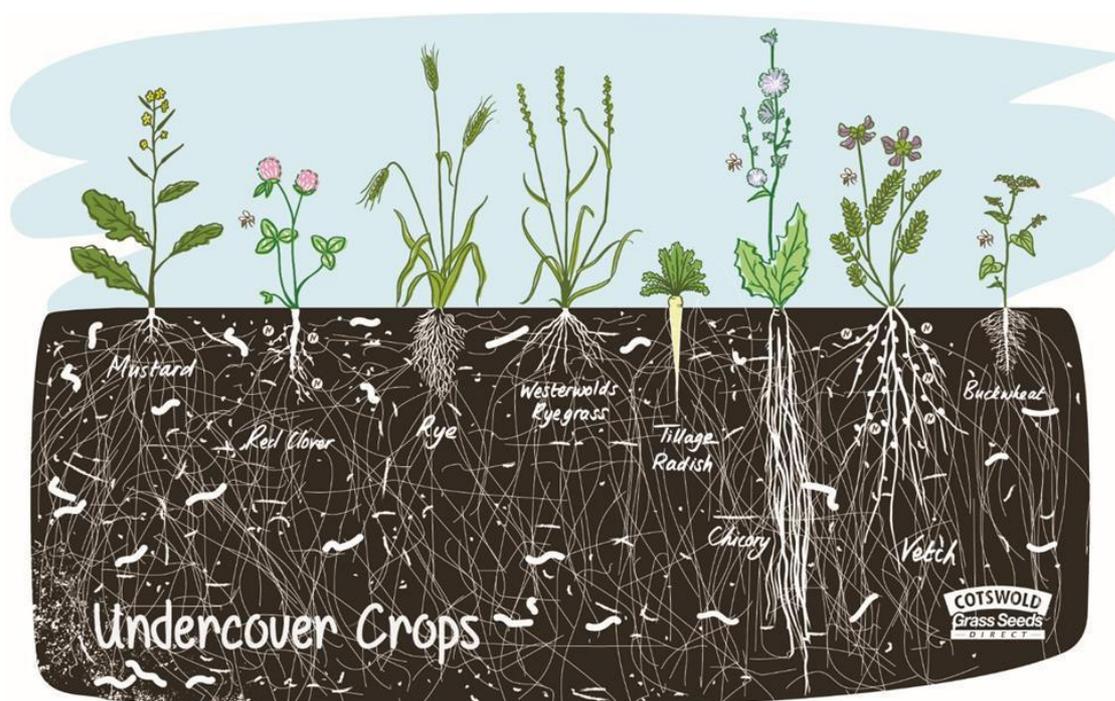


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# Use cover crops – living roots in the soil

Cover crops are sown to improve soil quality

- conserve soil moisture
- reduce soil erosion
- improve soil physical properties
- Increase nutrient retention
- Increase soil fertility
- suppress weeds
- reduce diseases and insects
- reduce globalwarming potential
- increase crop yields
- Increase diversity in agroecology



<https://www.youtube.com/watch?v=3j5MRJeCoYs>

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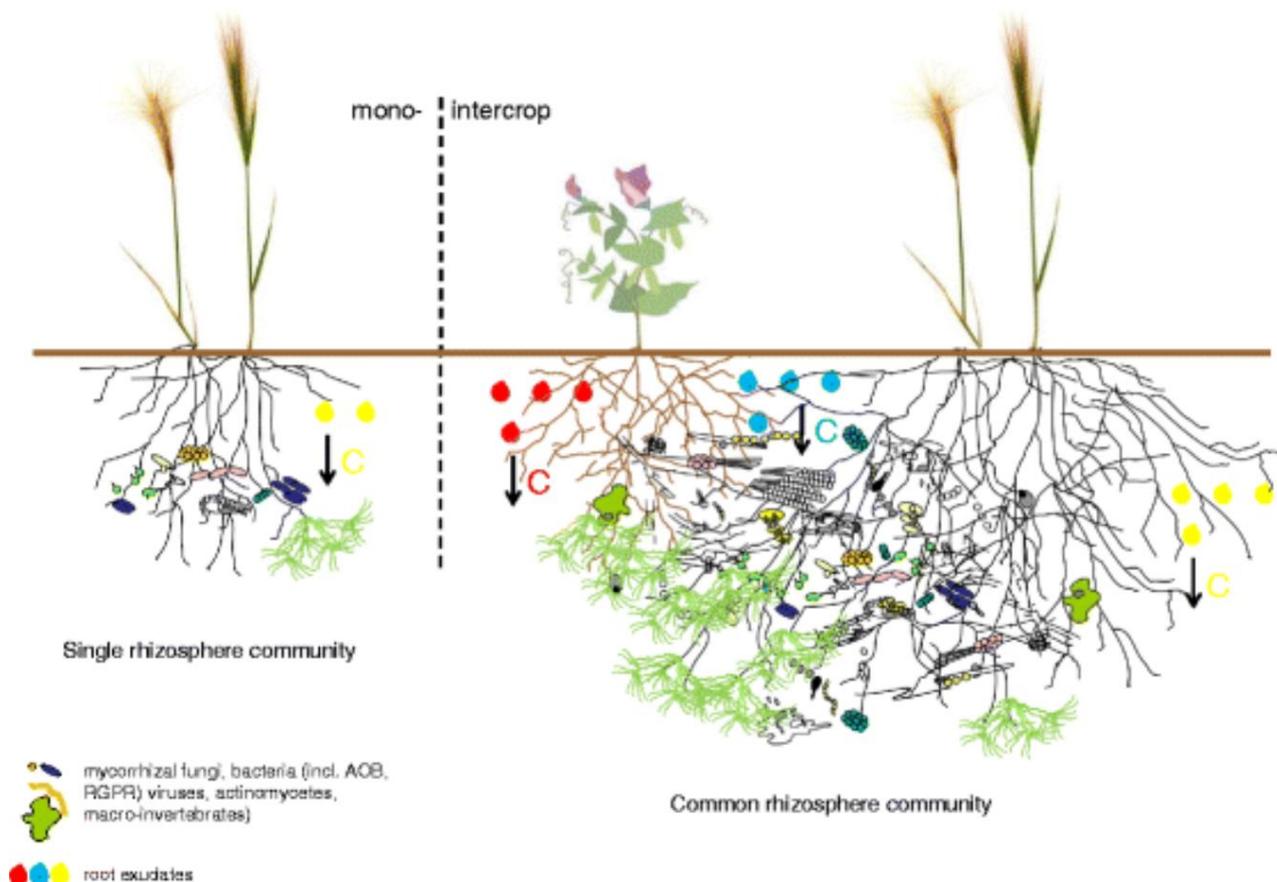


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# Intercropping, bi-cropping



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# Small scale farming

- Preparing no-dig beds
- Using compost
- Mulching, or mulching the road between beds – fix beds
- Leaving roots in the soil of the main crop
- After main crop sow cover crops
- Tools: fork, broad fork, without machinery



<https://www.youtube.com/watch?v=JxcrppyqiHA>

<https://www.youtube.com/channel/UCFF20WbbyKSiYQe0J6a7HTQ>

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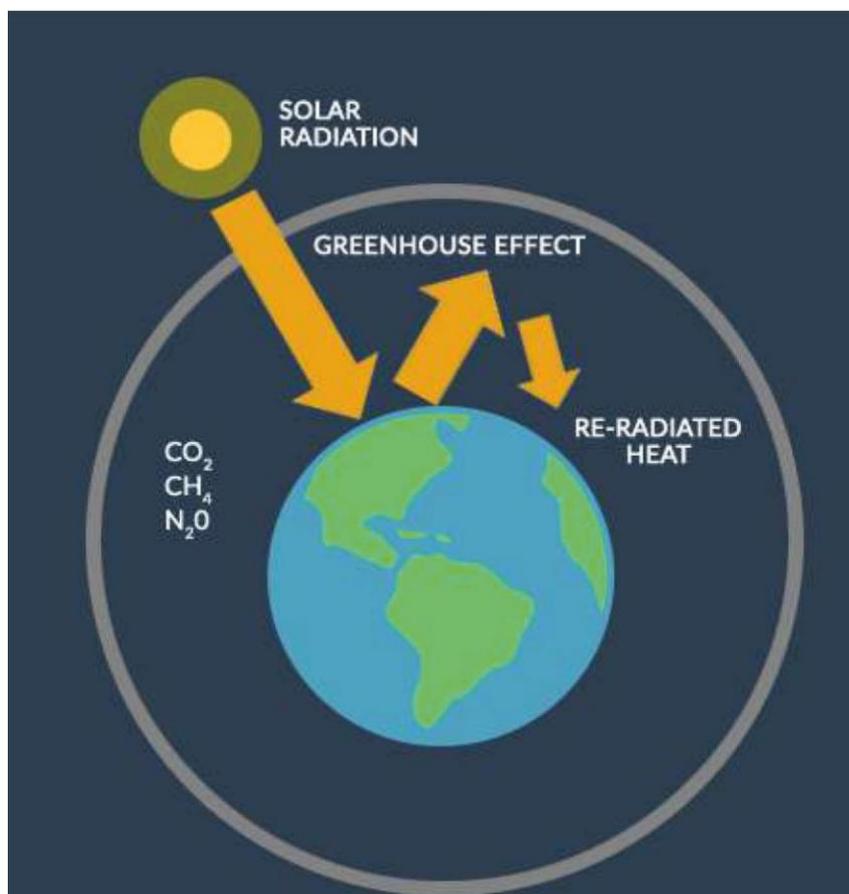
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# What is it?

**GWP:** global warming potential

**GHG:** greenhouse gases

CO<sub>2</sub> equivalent GWP CH<sub>4</sub> = 20xCO<sub>2</sub> N<sub>2</sub>O = 300xCO<sub>2</sub>



<https://www.youtube.com/watch?v=fYqdKiT0Eeq>

## GHG emission by sectors

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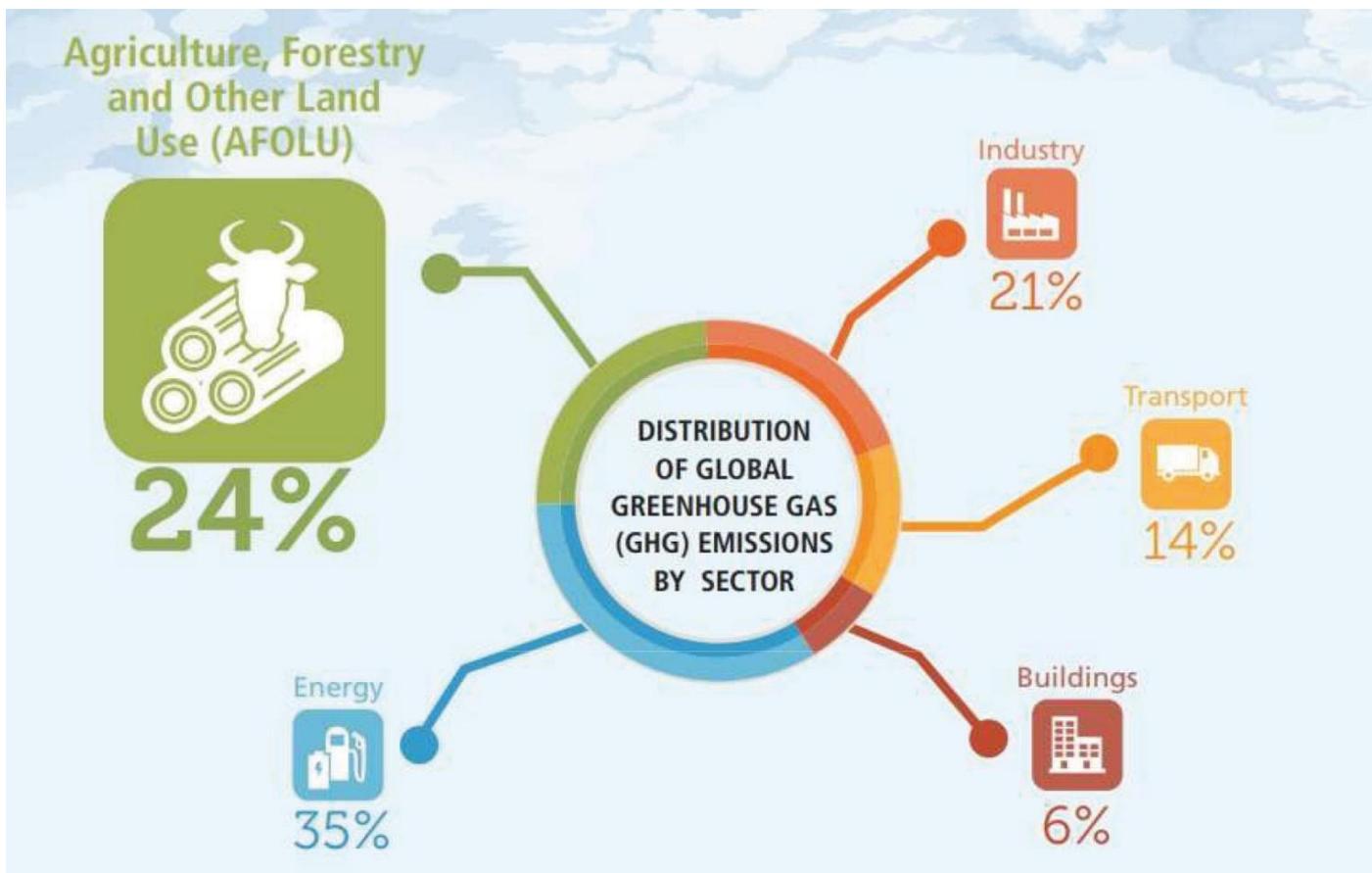
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Source: IPCC, 2014 <https://en.calameo.com/read/000640872ef8d659a01b4>

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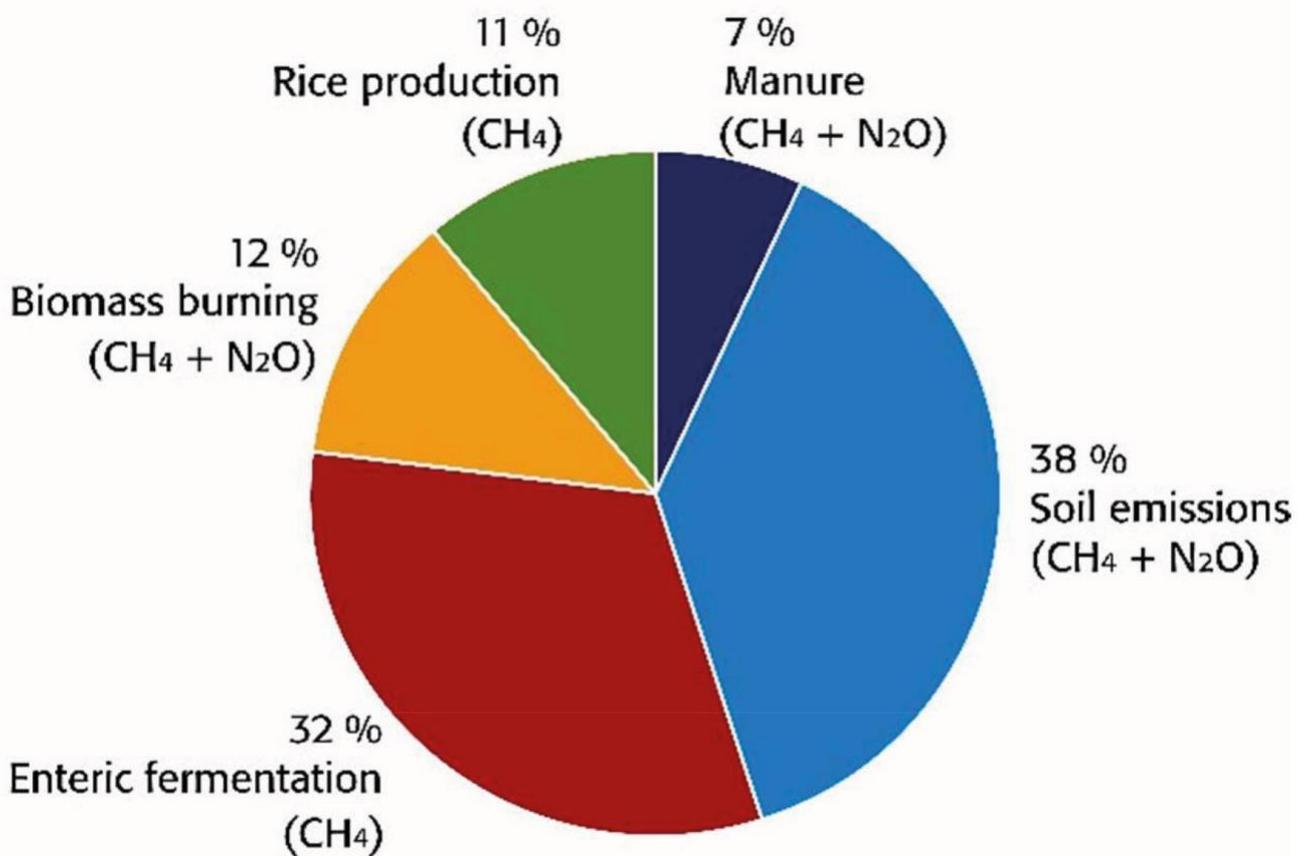
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# Agriculture GHG emission

- N<sub>2</sub>O
- high soluble N level
- soil compaction
- animal housing + manure management



Source: Smith et al., 2007

[https://www.researchgate.net/publication/28684793\\_Organic\\_Farming\\_and\\_Climate\\_Change](https://www.researchgate.net/publication/28684793_Organic_Farming_and_Climate_Change)

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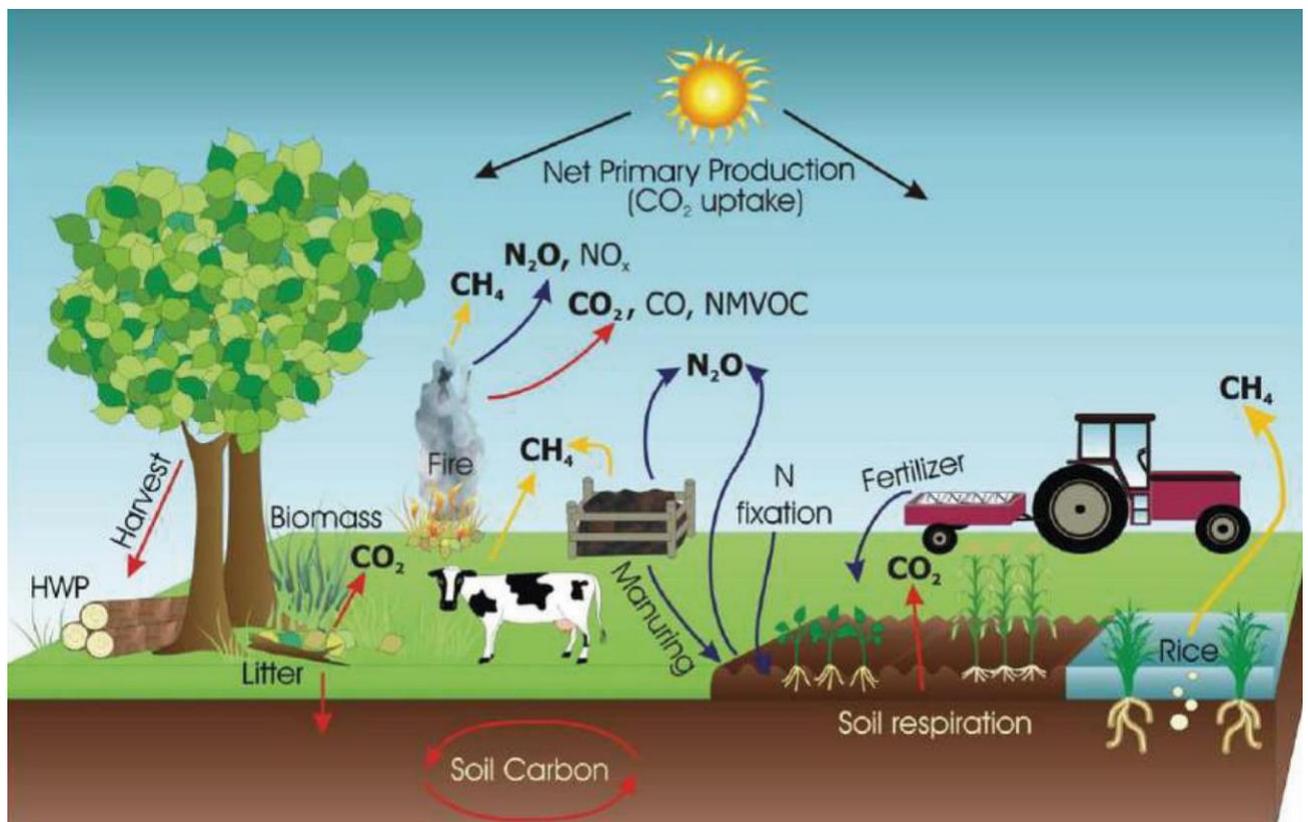


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# Agriculture GHG emission

- CH<sub>4</sub>
- enteric fermentation
- rice paddies
- manure handling
- biomass burning
- compacted soil
- CO<sub>2</sub>
- almost in balance in agriculture



Source: IPCC, 2006 <https://www.ipcc-nggip.iges.or.jp/public/2019rf/vol4.htm>

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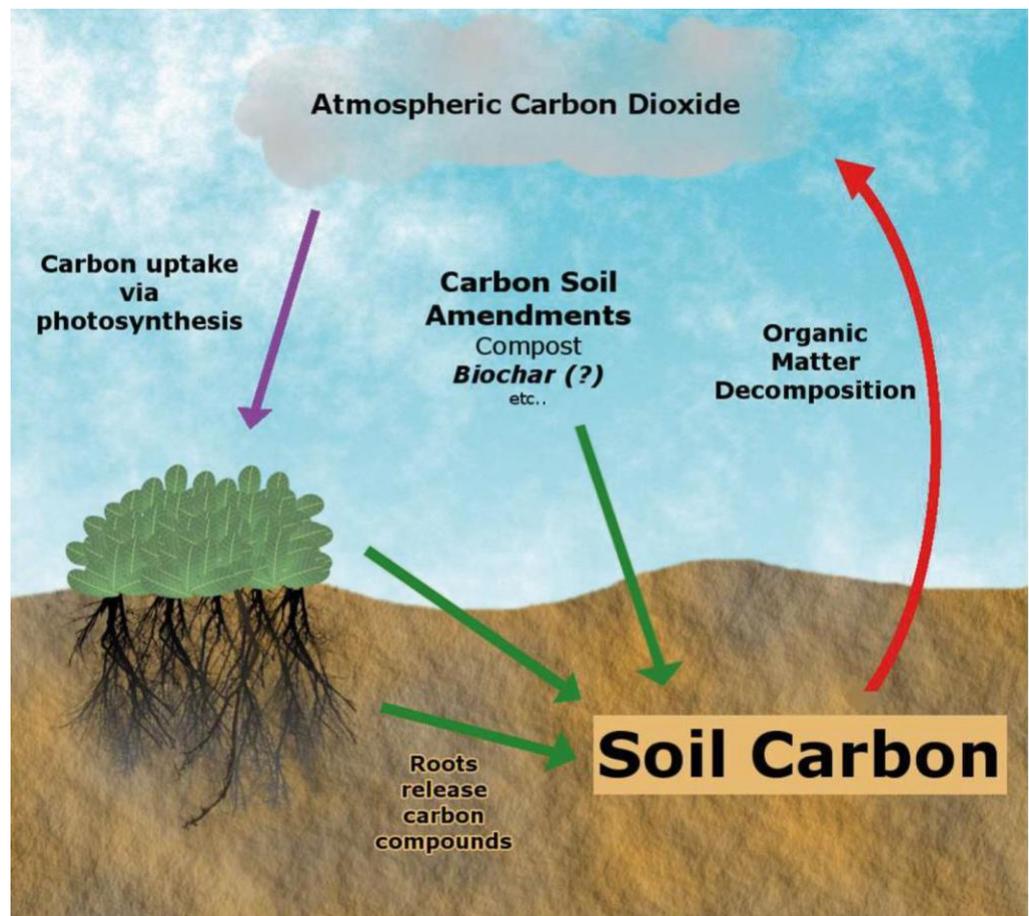
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# Aims

- reduce emission and loss
- store carbon – C sequestration
- agriculture as CO<sub>2</sub> sink – good agricultural practices (knowledge intensive agriculture)
  - organic farming (OF)\*
  - minimum tillage
  - agroforestry
  - permaculture, etc.



\*<https://www.yumpu.com/en/document/read/51590543/the-contribution-of-organic-agriculture-to-climatechange-mitigation>

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# Reduce emission and loss

- no mineral N fertilization
- diverse crop rotation – better soil structure, no erosion



## Diversity – Complexity - Resilience

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# Reduce emission and loss

- lower LU\*/ha = no industrialized animal husbandry, no overgrazing - switch to a more sustainable diet
- integration of livestock and crop production
- good manure management (eg. controlled anaerobic digestion – biogas)

\*LU = livestock unit, 500 kg live weight



<https://www.agricology.co.uk/field/blog/back-future-exploringbenefits-mixed-farming>

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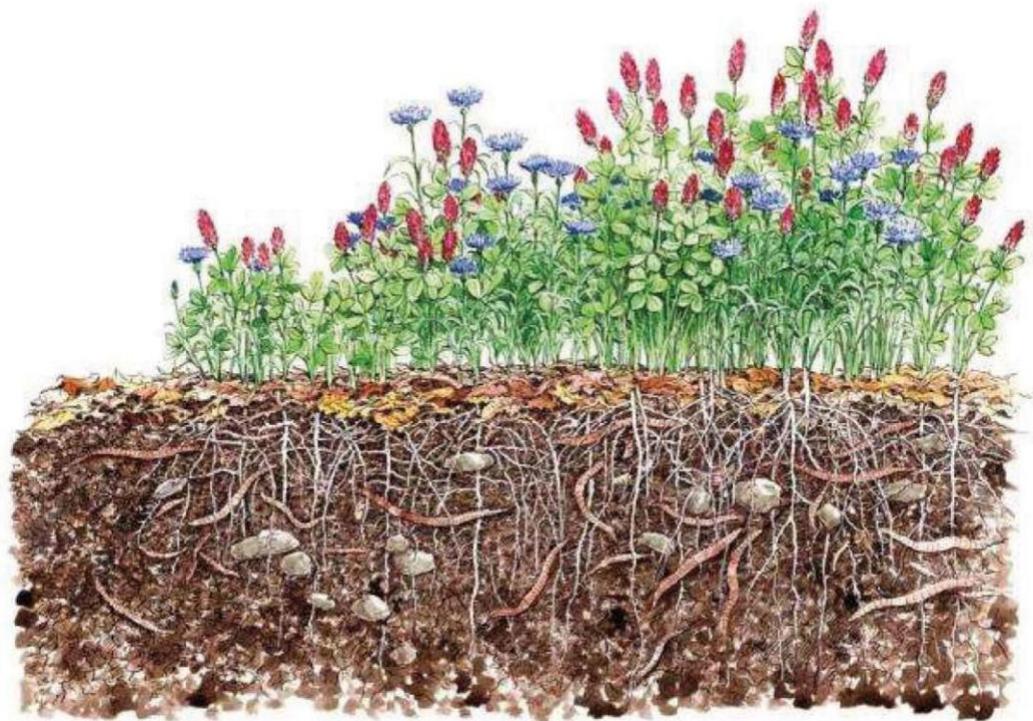
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# Store carbon

- cover the soil – build organic material
- green manure, inter-cropping, cover crops
- intensive rotational grazing – intensive growing - CO<sub>2</sub> uptake
- agroforestry – forest garden, diversity, chop and drop
- composting



<https://www.youtube.com/watch?v=1aE4nfC5cYE> (from 12:38)

<https://transterraform.com/permaculture-strategies-intensiverotational-grazing/>  
[https://www.youtube.com/watch?v=4Z75A\\_JMBx4](https://www.youtube.com/watch?v=4Z75A_JMBx4)

<https://www.youtube.com/watch?v=GFbcn06h8w4>

small scale: <https://www.youtube.com/watch?v=oLTGjiYHHbl>

<https://www.youtube.com/watch?v=HAZwj23DxVE>

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