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Focusing on global environmental problems

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Introduction

The objective is to change the mindset of gardeners

Global environmental problems such as climate change, deforestation, pollution, biodiversity loss and water scarcity affect us all. But change depends not only on compliance with regulations, but also on the contribution of each individual. The aim of this course is to change the mindset of gardeners so that they do not only protect themselves from environmental damage because of regulations, but also see the importance of doing so based on their own inner convictions.

Adopting sustainable practices not only protects the environment, but can also bring long-term economic benefits to gardeners. The sum of individual actions can have a significant impact in solving global environmental problems. It is therefore important that all gardeners recognise their own responsibility and contribution to sustainable development.

We hope that this document will help you understand the complexity of environmental problems and provide inspiration for implementing sustainable practices. The sum of individual contributions can make a significant difference and the role of each gardener is key to this process.

Focus on global environmental problems

Global environmental problems have reached a critical point where their impacts are felt worldwide, crossing national borders and affecting the well-being of all living organisms. The most pressing environmental problems include climate change, deforestation, pollution, biodiversity loss and water scarcity. These problems are interlinked, forming a web of complex challenges that require concerted global efforts to solve.

Biodiversity loss

Biodiversity - the variety of living things on Earth and the interactions and relationships between them - is essential for ecosystem resilience and human well-being. However, human activities such as habitat destruction, pollution, overexploitation and climate change are causing species extinctions at unprecedented rates. Biodiversity loss disrupts ecosystems and the services they provide, which are essential for human survival. An ecosystem is a system in which living organisms (plants, animals, bacteria, etc.) and their non-living environment interact as a functioning unit.

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Climate change

Climate change is one of the most significant environmental challenges facing the planet. It is primarily driven by the increase in greenhouse gas emissions from human activities, in particular the burning of fossil fuels (mainly oil, natural gas and coal). Climate change is most significantly manifested in global warming, extreme weather events and sea level rise. Its impacts are wide-ranging, affecting weather patterns, agricultural productivity and human health.

Deforestation

Deforestation, the large-scale cutting of forests, is also a critical problem worldwide. It leads to a loss of biodiversity, disrupts the water cycle and contributes significantly to climate change by reducing the number of trees capable of sequestering carbon dioxide. The main drivers of deforestation include agriculture, livestock, logging and infrastructure development.

Pollution

Different forms of pollution – air, water and soil – pose a serious threat to the environment and human health. Its main sources include industrial activities, transport, agricultural practices and improper waste management. Pollution worsens air quality, pollutes water sources and degrades soil quality, causing many health and environmental problems.

Lack of water

Water scarcity affects nearly a third of the global population and is expected to worsen with climate change and population growth. Factors contributing to water scarcity include over-extraction of groundwater, pollution of freshwater sources, and wastage of water. Water scarcity has serious consequences for food security, health and economic stability.

Encouraging a change in gardeners' thinking

In order to effectively address these global environmental problems, it is essential that gardeners feel a sense of personal responsibility. They must act not only to comply with regulations, but also because they understand the wider effects of their activities and the importance of their own contribution to environmental sustainability. By adopting sustainable practices, gardeners can play a key role in alleviating these global problems and promoting a healthier planet.

In the following chapters, we will delve deeper into these issues, exploring their causes, effects and practical solutions that gardeners can apply to achieve positive change.

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Climate change

Climate change is arguably the most significant environmental challenge facing the planet. It is primarily driven by the increase in greenhouse gas emissions from human activities, especially the burning of fossil fuels, which are derived from the remains of decomposed plants and animals. Climate change manifests itself primarily in global warming, extreme weather events and rising sea levels. According to Rick Spinrad, administrator of the National Oceanic and Atmospheric Administration (NOAA), the annual increase is "a direct result of human activity," primarily the burning of fossil fuels for transportation and electricity generation. Carbon dioxide (CO_2) levels have never been higher. While carbon dioxide levels have consistently hovered around 280 ppm during the nearly 6,000 years of human civilization, CO_2 levels in the atmosphere are now well over 420 ppm. This means that there are 419 carbon dioxide molecules in 1 million air molecules, meaning that carbon dioxide makes up about 0.042% of the volume of the atmosphere today. This value is more than double what it was before the beginning of the industrial revolution in the 19th century, so unfortunately it started to grow rapidly.

The Intergovernmental Panel on Climate Change (IPCC) reports that global average temperatures have risen by about 1.2°C since pre-industrial times and are still rising. In particular, 2023 was the warmest year on record, with global average temperatures 1.46°C above pre-industrial levels and 0.13°C above the eleven-month average of 2016, currently the warmest calendar year as recorded. The year saw six record-breaking months and two record-breaking seasons. Warming of this magnitude and speed is particularly felt in the agricultural sectors and in our health well-being.

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The effects of climate change

The effects of climate change are wide-ranging and directly affect all aspects of nature as well as human society. Major effects include:

- **Extreme weather events:** hurricanes, heat waves, droughts, floods and hailstorms occur more frequently and more intensely. These events cause significant damage to infrastructure, disrupt people's livelihoods, and lead to loss of life.
- **Sea level rise:** threatens coastal communities and ecosystems. Sea level rise leads to coastal erosion, increased salinity of freshwater systems, and habitat loss. Low-lying areas are particularly vulnerable and millions of people could be displaced by sea level rise.
- **Impact on agriculture:** changes in rainfall patterns affect crop yields and food security. In some regions, agricultural productivity may decrease due to different growing seasons and more frequent occurrence of pests and diseases.
- **Health risks:** heat-related illnesses and the spread of vector-borne diseases. Higher temperatures can exacerbate air pollution, which can lead to respiratory problems, while climate change can alter the distribution of disease-carrying insects such as mosquitoes and ticks.

Dealing with climate change

Tackling climate change requires comprehensive and coordinated efforts at local, national and global levels. Key strategies include:

- **Reduction of greenhouse gas emissions:** we must increasingly use renewable energy sources, such as wind, solar and hydropower. Energy efficiency must be promoted and cleaner, less environmentally burdensome technologies must be used in transport, industry and agriculture.
- **Increasing climate resilience:** various measures need to be implemented in order to adapt to the effects of climate change. These include, for example, the construction of resilient infrastructure, the protection of coastal areas and the development of early warning systems for extreme weather events.
- **Promote sustainable land use:** encourage practices that increase carbon sequestration and reduce deforestation. Sustainable agriculture, reforestation and the preservation of natural habitats play a key role in mitigating climate change.

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- **International cooperation:** strengthen international agreements such as the Paris Agreement to limit global warming. Cooperation is essential to address the transitory nature of climate change impacts.

Practical advice and individual contributions

In order to effectively manage climate change, it is essential that individuals and communities participate in the introduction of sustainable practices. Although the contribution of a single person or economy may seem small, the cumulative effect can be significant, so every person's attitude and activity matters!

Efficient use of water

- **Drip irrigation systems:** the use of drip irrigation systems can reduce water consumption by up to 30-50% compared to traditional irrigation methods. If all small farms switched to this system, the annual global water use would be significantly reduced, contributing to the alleviation of water scarcity.
- **Rainwater collection:** rainwater collection reduces the depletion of groundwater resources and reduces the amount of drinking water used for irrigation. A well-designed rainwater collection system can save thousands of liters of water per year in a single household or farm.

Sustainable soil management

- **Composting:** composting organic waste reduces the load on landfills and increases the soil's organic matter content, which improves the soil's ability to sequester carbon. If all gardeners and farmers composted, it would prevent the emission of millions of tons of carbon dioxide each year. In addition, it replaces or reduces the need for synthetic fertilizers, the production and use of which involves significant greenhouse gas emissions.
- **Crop rotation:** crop rotation reduces soil depletion and increases crop yield. This practice makes agriculture more sustainable in the long run and also reduces the need for synthetic fertilizers.

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Energy saving

- **Use of renewable energy sources:** the use of solar panels and wind turbines in farms reduces the demand for fossil fuels and moderates the emission of greenhouse gases. A small farm that fully switches to renewable energy sources can avoid the emission of several tons of carbon dioxide annually.
- **Energy-efficient devices:** the use of energy-efficient devices reduces energy consumption and related emissions. A simple step, such as the use of energy-saving light bulbs, can lead to the prevention of several kilograms of carbon dioxide emissions each year.

Global impact of individual steps – everyone matters!

In dealing with climate change, the cumulative effect of individual and community-level actions can be enormous. Many times we reject a sustainable, environmentally friendly practice because we think that what our individual actions matter in solving global problems. It does matter a lot! If all smallholder farmers and gardeners were to implement the sustainable practices mentioned above, the following results would be achieved:

- **Water conservation:** if all gardeners and farmers switched to drip irrigation, it could save billions of liters of water every year, which would significantly alleviate the global water shortage.
- **Reduction of carbon dioxide emissions:** the use of energy-efficient devices and renewable energy sources could prevent the emission of several million tons of carbon dioxide annually.
- **Improving soil quality:** the introduction of composting and crop rotation would improve soil quality, increase crop yields and reduce the need for fertilizers, which would result in further reductions in carbon dioxide emissions.

Local and regional effects

Individual steps not only contribute to mitigating climate change on a global level, but also provide significant local and regional benefits:

- **Improving the local climate:** the introduction of sustainable practices reduces local pollution, improves air quality and mitigates the effects of heat waves**.**

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- **Community benefits:** promoting sustainable practices in local communities strengthens community cohesion, increases the resilience of local economies and promotes healthy lifestyles.
- **Regional stability:** sustainable agricultural practices at the regional level contribute to long-term food security and economic stability.

Deforestation

Deforestation is a serious global environmental problem, leading to the loss of the world's forests at an alarming rate. Forests play a vital role in maintaining ecological balance by sequestering carbon dioxide, providing habitat for biodiversity and regulating water cycles. Forests also help prevent soil erosion, as the roots of trees hold the soil together and prevent it from being washed away, which also prevents landslides.

The main drivers of deforestation include agricultural expansion, livestock farming, logging, infrastructure development, and fires.

300 football fields of forest are cut down every hour. At this rate, only 10% of the planet's forests may remain by 2030; if we don't stop deforestation, in less than 100 years all our forests may disappear completely. The three countries with the most deforestation are Brazil, the Democratic Republic of the Congo and Indonesia. The Amazon, the world's largest rainforest - spanning 6.9 million square kilometers and covering about 40% of the South American continent - is one of the most biodiverse ecosystems, home to around three million species of plants and animals. Despite efforts to protect forest land, deforestation is still common, and about a third of global tropical deforestation occurs in Brazil's Amazon forest, affecting 1.5 million hectares each year.

However, we should not think that the deforestation taking place in regions of the world far away from us does not affect us. Climate change, the increase in the carbon dioxide content of the air, etc. we are all sufferers. Furthermore, the threat of deforestation is also a problem in our country, which WWF Hungary is constantly dealing with.

The world clears 10 million hectares of forest each year to make room for crops and livestock, and the production of materials such as paper. Agriculture is the main cause of deforestation, another major environmental problem on this list. Land is cleared to grow fodder crops for livestock or other crops for sale, such as sugarcane and palm oil.

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The main effects of deforestation:

- **Decrease in biodiversity:** the destruction of habitats leads to the extinction of plant and animal species.
- **Climate change:** the decrease in carbon dioxide sequestration capacity aggravates global warming. When trees are cut down or burned, the carbon dioxide stored in their biomass is released into the atmosphere.
- **Disruption of water cycles:** impact on local and global rainfall patterns that can lead to severe droughts or floods.

Practical advice and individual contributions

While addressing deforestation requires large-scale efforts, individual actions can also significantly contribute to mitigating the effects. Here are some practical steps that smallholder farmers and gardeners in particular can take:

Sustainable land management

- **Agroforestry:** integrating trees into agricultural systems can help restore degraded areas, improve soil health and increase biodiversity. Agroforestry practices such as silvopastoral systems, where trees are combined with plants and animals, provide multiple benefits.
- **Reforestation and afforestation:** planting trees in degraded areas (reforestation) or in new areas (afforestation) helps restore ecosystems and sequester carbon. The organization of tree planting events and active participation in them can have a significant impact.
- **Prevention of soil erosion:** the use of techniques such as contour ploughing, terrace cultivation, the creation of protective ramparts with trees and the maintenance of vegetation cover help to prevent soil erosion, which is a common consequence of deforestation. These practices keep the soil healthy and reduce water runoff, binding water.

Reducing the causes of deforestation

- **Sustainable agriculture:** through sustainable agricultural practices, the need for land expansion can be reduced and forests can be preserved. Examples of such practices include crop rotation, organic farming and reducing the use of chemical fertilizers and pesticides.

- **Support for certified products:** choosing products with certifications such as FSC (Forest Stewardship Council) or Rainforest Alliance ensures that the products come from sustainably managed forests.

The global impact of individual actions

Individual actions, when multiplied through communities, can have a profound impact on reducing deforestation and its impacts:

- **Carbon dioxide sequestration:** tree planting and agroforestry can significantly increase carbon dioxide sequestration, reducing atmospheric CO2 levels.
- **Biodiversity conservation:** sustainable land management practices preserve habitats and protect biodiversity.
- **Regulation of water cycles:** preventing soil erosion and maintaining vegetation cover helps to regulate local and global water cycles.

Local and regional effects

Individual efforts against deforestation have significant local and regional benefits:

- **Improved soil health:** sustainable practices improve soil quality, increasing agricultural productivity and resilience.
- **Community resilience:** reforestation and sustainable land management create jobs, improve livelihoods and increase community resilience to climate change.
- **Improved water sources:** protecting forests and preventing soil erosion provides cleaner and more reliable water sources for local communities.

Pollution

Different forms of pollution – air, water and soil pollution – pose a serious threat to the environment and human health. Major sources of pollution include industrial activities, transportation, agricultural practices, and improper waste management.

Air pollution: Emissions from vehicles and camels associated with various industries emit harmful pollutants such as particulate matter, nitrogen oxides and sulfur dioxide, which cause respiratory and cardiovascular diseases. According to a 2023 study, air pollution in South Asia – one of the most polluted areas in the world – will reduce life expectancy by about 5 years. The study blames a number of factors for high pollution levels in some countries, including a lack of infrastructure and funding. The majority of countries in Asia and Africa, which together account for 92.7% of the years of life lost due to global air pollution, do not have the necessary air quality standards to establish appropriate policy regulations. Furthermore, only 6.8% and 3.7% of governments in these two continents provide fully open air quality data to their citizens. In Europe, a recent report by the European Environment Agency (EEA) showed that more than half a million people living in the European Union died directly from exposure to toxic pollutants in 2021.

Water pollution: industrial emissions, agricultural pollution and plastic waste pollute bodies of water, harming aquatic life and disrupting ecosystems. Water pollution affects the world's oceans, rivers, lakes and groundwater. Pollutants disrupt aquatic ecosystems, killing or harming marine and freshwater organisms and causing biodiversity loss. Eutrophication (i.e. algae growth caused by too much phosphorus and nitrogen in the water, mainly due to sewage and fertilizers entering the water) caused by nutrient pollution creates oxygen-depleted zones that have devastating effects on marine life and habitats, such as coral reefs and marshes. In addition, pollution reduces the availability of clean water for drinking, agricultural and industrial purposes. Treating contaminated water is costly and often beyond the capacity of many communities, exacerbating the problems of global water scarcity.

Soil pollution: the use of plant protection agents and chemical fertilizers, as well as industrial waste, lead to the deterioration of soil quality, affecting food safety. Organic matter is an essential component of soil as it allows carbon sequestration from the atmosphere. Plants naturally and efficiently absorb CO2 from the air during photosynthesis, and some of this is stored in the soil as soil organic carbon (SOC). Healthy soil contains at least 3-6% organic matter. However, almost everywhere in the world this rate is much lower. According to the United Nations, about 40% of the planet's soil is degraded. Soil degradation refers to the loss of organic matter, changes in its structural state and/or reduction in soil fertility, and is often caused by human activities such as traditional farming practices, including the use of toxic chemicals and pollutants. If current practices continue until 2050, experts project further degradation over an area nearly the size of South America. But perhaps even more worryingly, if we don't urgently change our thoughtless, harmful practices and take action to preserve soil health, food security worldwide is irreversibly at risk, and is projected to be 40% less in 20 years we will produce food while the world population is expected to reach 9.3 billion people. All of this can lead to mass starvation and waves of migration.

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Practical advice and individual contributions

Sustainable practices

- **Organic farming:** avoid the use of chemical fertilizers and pesticides and switch to organic methods! Organic farming reduces soil and water pollution while improving soil health and biodiversity.
- **Composting:** compost organic waste and use the compost as a natural fertilizer! Composting reduces the amount of waste and improves soil fertility, while reducing the use of polluting fertilizers.
- **Water-saving irrigation systems:** use drip irrigation systems or rainwater collection systems in order to use water more efficiently! These systems reduce water wastage and minimize soil erosion.

Waste management

- **Recycling and waste reduction:** support recycling and reduce the amount of waste in your own farm! Use recyclable or degradable packaging materials!
- **Waste management:** ensure proper waste management to minimize the risk of pollution! Obtain and install appropriate waste containers and regularly check waste management practices.

The global impact of individual actions

- **Energy efficiency:** reducing energy consumption by using energy-saving equipment or switching to renewable energy sources can reduce greenhouse gas emissions. If every household and economy took energy-saving measures, it would make a significant contribution to the fight against global warming.
- **Sustainable agriculture:** sustainable agricultural practices such as crop rotation, use of cover crops, and organic fertilization can improve soil health and reduce carbon footprints. Widespread adoption of these practices by farmers would significantly improve global food security and environmental sustainability.

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- **Water-saving irrigation:** using drip irrigation and other water-saving irrigation techniques can reduce water wastage and improve water use efficiency. This is especially important in water-scarce, drought-prone areas, where the sustainable management of water sources is essential to ensure agricultural production and drinking water supply.
- **Waste reduction:** waste reduction measures such as composting, selective waste collection, recycling and avoiding single-use plastics can reduce the burden on landfills and pollution. If every single person and business reduced their waste production, it would make a significant contribution to solving the global waste problem.

The importance of individual contribution at the local and global level

Case study – Impact of pesticide reduction in one region

In the following, we present the specific regional effects of a case study, where the use of pesticides would be reduced by 50% and natural insecticides would be used.

1. **Reduction of soil and water pollution:**
    - **Example:** in a region where 200,000 tons of pesticides are used annually, a 50% reduction would mean using 100,000 tons less pesticides.
    - **Effect:** reduced pesticide use reduces soil and water pollution, reducing the amount of pesticide residues in soil and water sources. THis improves water quality and reduces drinking water treatment costs.

2. **Reduction of greenhouse gas emissions:**
    - **Example:** the production and transport of pesticides involves significant energy consumption and the emission of greenhouse gases. In a region where 100,000 tons of CO_2 equivalent greenhouse gas emissions come from pesticides every year, a 50% reduction would result in 50,000 tons less emissions.
    - **Impact:** reducing emissions contributes to the achievement of the region's climate goals and mitigates global warming.

3. **Increase of biodiversity**:
    - **Example:** reducing pesticides and using natural insecticides increases the biodiversity of soil and aquatic life. In a region, they can increase the population of pollinating insects by 30-50%, which improves plant pollination and crop yield.

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- **Impact:** increasing biodiversity promotes the presence of natural enemies, which reduces the need for pest control and maintains the balance of the ecosystem.

4. **Economic impact**:
    - **Effect:** reducing the use of pesticides reduces the costs of farmers. If the annual cost of pesticides in a region is US$50 million, a 50% reduction would save US$25 million.
    - **Example:** the use of natural insecticides can be a more sustainable and cost-effective solution in the long term, as it reduces the development of pest resistance and improves long-term soil and water quality.

5. **Yield and quality improvement**:
    - **Example:** the use of natural insecticides reduces the chemical load on plants, which improves the quality of the crop yield and increases the market value. In a region where the annual crop yield is 1 million tons, a 5-10% increase in crop yield can result in an additional 50,000-100,000 tons.
    - **Effect:** better quality, healthier products can be sold at a higher price, increasing farmers' incomes and the economic stability of the region.

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Water scarcity

Water scarcity affects nearly a third of the world's population and is expected to worsen as a result of climate change and population growth. Factors contributing to water scarcity include over-extraction of groundwater, pollution of freshwater sources, and wasteful use of water. In terms of water security, only 3% of the world's water supply is fresh water, and two-thirds of that is stored in glaciers or other forms inaccessible to us. As a result, around 1.1 billion people worldwide do not have access to clean water, and a total of 2.7 billion people suffer from water shortages for at least one month of the year. By 2025, two-thirds of the world's population may suffer from water shortages.

The consequences of water shortage are as follows:

1. **Food security:** the decrease in the availability of water for irrigation affects crop production. The global population is expected to grow to 9 billion by mid-century, and the Food and Agriculture Organization of the United Nations (FAO) predicts that global food demand could increase by 70% by 2050. Thus, more than 820 million people worldwide will not have access to enough food.
    - According to UN Secretary-General António Guterres: "If immediate action is not taken, it is clear that an imminent global food security emergency is emerging, with long-term effects for hundreds of millions of adults and children." He called on countries to rethink their food systems and encourage more sustainable agricultural practices.
2. **Health risks:** limited access to clean water increases the incidence of waterborne diseases.
3. **Economic difficulties:** lack of water can hinder industrial activities and energy production.

Practical advice and individual contributions

Sustainable practices

- **Efficient irrigation systems:** use drip irrigation systems or rainwater collection systems for more efficient use of water! These systems reduce water wastage and minimize soil erosion.
- **Plant selection:** choose drought-tolerant plant varieties that require less water! This can help maintain productivity during dry periods.
- **Soil management:** improve soil health with organic farming methods! Healthy soil retains moisture better and reduces the need for frequent watering.

Water management

- **Rainwater harvesting:** install rainwater harvesting systems to collect and store rainwater for irrigation and other purposes! This can provide a reliable source of water during dry periods.
- **Mulching:** use mulch around plants to conserve soil moisture and reduce evaporation. This practice can significantly reduce the need for irrigation.
- **Water recycling:** implement gray water recycling systems to recycle water from household activities for irrigation purposes! Gray water means the water we already use, which is no longer suitable for consumption, but it is not considered waste water (despite the fact that almost everyone currently treats it as waste water), since it does not contain excrement.

The global impact of individual actions

- **Water conservation:** reducing water consumption through efficient irrigation systems or rainwater harvesting can significantly reduce the demand on fresh water sources. If every household and economy implemented water-saving measures, it would significantly reduce the global water footprint.
- **Sustainable agriculture:** Sustainable agricultural practices such as crop rotation, use of cover crops, and organic fertilization can improve soil health and water-holding capacity. Widespread adoption of these practices by farmers would significantly improve global food security and environmental sustainability.
- **Rainwater harvesting:** collecting and storing rainwater for irrigation and other purposes can reduce dependence on groundwater and surface water sources. This is especially important in water-scarce areas, where the sustainable management of water sources is essential to ensure agricultural production and drinking water supply.

Case study – Impact of drip irrigation in a region

This analysis shows the potential effects of switching to drip irrigation in one region.

1. **Water conservation**:
    - **Example:** in a region where traditional irrigation methods use 1,000,000 cubic meters of water per year, applying drip irrigation can reduce water use by up to 50%, saving 500,000 cubic meters of water.

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- **Impact:** this significant water saving reduces the pressure on local water sources and improves the security of water supply for other uses.

2. **Increase in crop yield**:
   - **Example:** drip irrigation delivers water directly to the roots of plants, improving the efficiency of water use and increasing crop yields. In a region where the annual crop yield is 500,000 tons, a 10-30% increase in yield can result in an additional 50,000-150,000 tons.
   - **Impact:** higher crop yields contribute to food security and can increase farmers' incomes.
3. **Reduction of water pollution**:
   - **Example:** traditional irrigation methods can cause nutrient leaching and fertilizers to enter natural waters. Drip irrigation reduces runoff, reducing nutrient pollution and improving water quality.
   - **Effect:** better water quality has a positive effect on local ecosystems and reduces the costs of water treatment.
4. **Energy saving**:
   - **Example:** drip irrigation systems are often more energy efficient than traditional methods. Reducing the energy use of irrigation can reduce greenhouse gas emissions. In a region where conventional irrigation uses 10,000 MWh of energy per year, drip irrigation can result in energy savings of 2,000-3,000 MWh with a 20-30% reduction.
   - **Effect:** lower energy consumption contributes to the achievement of climate goals and reduces the operating costs of farmers.

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Loss of biodiversity

Biodiversity, or the variety of life on Earth, is essential for ecosystem resilience and human well-being. However, human activities such as habitat destruction, pollution, overexploitation and climate change are leading to unprecedented rates of species extinction. According to a 2020 WWF report, population sizes of mammals, fish, birds, reptiles and amphibians declined by an average of 68% between 1970 and 2016. The report attributes this loss of biodiversity to a number of factors, but most notably to land-use change, particularly the conversion of habitats such as forests, grasslands and mangroves to agricultural systems. Animals such as conures, sharks and sea urchins are heavily involved in the illegal wildlife trade, and conures are critically endangered as a result. More generally, a recent analysis found that Earth's sixth mass extinction of wildlife is accelerating at an incredible rate. More than 500 species of terrestrial animals are currently on the brink of extinction and we are likely to lose them in the next 20 years; the same number have been lost throughout the past century. Scientists say that this rate of loss would have taken thousands of years without human destruction. Melting sea ice in Antarctica caused by climate change is severely affecting emperor penguins and could wipe out entire populations by 2100, according to a 2023 study. Hungary is also affected by the decline in biodiversity, just think of the Danube vulture, the peregrine falcon, the crayfish viper, or the increasingly rare bee and swallow populations.

Effects of biodiversity loss:

- **Disruption of ecosystem balance:** disruption of ecological processes such as pollination, nutrient cycling, and pest control.
- **Economic costs:** loss of ecosystem services that support agriculture, fisheries and tourism.
- **Health implications:** reduced availability of natural resources and medicinal compound.

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Practical advice and individiual contributions

Sustainable practices

- **Habitat preservation:** protect and restore natural habitats in the environment and on your farm! This may include maintaining hedgerows, woodlands and wetlands.
- **Pollinator Friendly Practice:** Plant native flowers and create habitats for pollinators like bees and butterflies! For example, create bee pastures instead of water-demanding and biodiversity-poor lawn areas, establish insect houses and swallow nests! Avoid using pesticides that harm pollinators!
- **Diverse planting:** encourage biodiversity by planting a variety of plants and cover crops! This not only helps support a wider range of species, but also improves soil health and resilience.

The impact of individual contribution on biodiversity conservation

- **Habitat restoration:** if all gardeners planted native species and avoided invasive (ie non-native) plants, local ecosystems would flourish, supporting wider wildlife.
- **Reducing pesticide use:** reducing the use of pesticides and choosing natural pest control methods can significantly improve local biodiversity. For example, if farmers in a region reduced their use of pesticides by 50%, the population of beneficial insects and birds could increase by 30-50%, improving natural pest control and pollination.
- **Support for conservation initiatives:** participation in and support for conservation projects can help protect endangered species and restore critical habitats. Financial and voluntary support of conservation organizations can lead to the preservation of thousands of hectares of habitat worldwide.

Case study – Transition to sustainable practices and its impact on biodiversity

In this analysis, we present the concrete effects of this transition in a region.

1. **Improvement of habitat quality:**
    - **Example:** a region where farmers collectively adopt agroforestry practices, integrating trees into agricultural land.

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- **Impact:** increased vegetation cover provides habitat for more species, improves soil health and increases water retention. This can result in a 20-30% increase in local biodiversity, supporting pollinators, birds and other wildlife.

2. **Increased pollination:**
    - **Example:** planting wildflower strips and maintaining natural hedges.
    - **Impact:** these practices create habitat for pollinators, which increases yield and crop quality. In a region where it is widely used, crop yields can increase by 10-20%, while pollinator diversity can increase by 30-50%.
3. **Reduced soil degradation:**
    - **Example:** no-till farming and use of cover crops.
    - **Impact:** these practices reduce soil erosion and improve soil health, creating a stable environment for soil-dwelling organisms. Healthier soils support a wider range of flora and fauna, which can result in a 15-25% increase in soil biodiversity.
4. **Improvement of water quality:**
    - **Example:** reducing the leaching of chemical substances by using organic fertilizers and integrated pest management.
    - **Effect:** cleaner water bodies support aquatic life and reduce the occurrence of harmful algal blooms. A region that switches to these practices can achieve a 20-30% increase in aquatic biodiversity with improved water quality, benefiting fish, amphibians and other water-dependent species.

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The importance of education and advocacy in preventing environmental problems

As we have seen in previous chapters, global environmental problems are interconnected and complex, and therefore require coordinated and continuous efforts from governments, businesses and individuals alike. By implementing complex strategies that target root causes and promote sustainable development, we can mitigate the effects of these challenges and ensure a healthier planet for future generations. The need for immediate action cannot be overemphasized, as the opportunity to prevent irreversible damage is quickly closing.

As it turned out from the above, as a gardener, global and local environmental problems can have a significant impact on your daily work and livelihood. In addition, the combined effect of the various agricultural sectors on our environment is cardinal. So it doesn't matter what agricultural and everyday practices you use in order to mitigate the harmful effects and prevent further environmental problems. Just as it doesn't matter how you communicate about it. Remember, education and information transfer are the key to the future!

Practical advice for education and advocacy

- **Increase awareness:** keep track of current recommendations at international, regional and local levels as well! The links placed in the practical advice of the previous chapters can help with this, which mostly lead to international and local organizations and regulations! Inform others about the importance of the environmental problems discussed above and about the steps they can take to protect them! Organize community events and workshops to share knowledge and encourage collective action!
- **Advocacy:** support policies and regulations that protect natural habitats and promote sustainable land use! Participate in local and global campaigns in person or online to pressure governments and companies to adopt stronger environmental measures and sustainable practices!

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Focusing on the Mediterranean region

The Mediterranean region, which includes southern Europe, parts of North Africa and parts of the Middle East, faces unique environmental challenges due to its geographical and climatic characteristics. The Mediterranean region is particularly vulnerable to the effects of warming, especially longer and more intense heat waves, increased drought in an already dry climate and the risk of coastal flooding. Southern and eastern countries tend to be more vulnerable than northern countries. Several countries (Tunisia, Algeria and Libya) are on the verge of water scarcity, as defined by the Food and Agriculture Organization (FAO); others (e.g. Morocco) are close to severe water scarcity. Uncertainty in the timing, duration, intensity and interval of extreme climate events particularly threatens sectors such as agriculture and tourism in the Mediterranean region. In the following, we will review how certain environmental problems appear in the Mediterranean region, what the prospects are, and what can be done to prevent and mitigate the damage.

Climate change

Climate change is a critical issue in the Mediterranean region, characterized by rising temperatures, changes in precipitation patterns, and increased frequency of extreme weather events.

- **Rising temperatures**: the Mediterranean region is warming faster than the global average. This leads to more intense and longer heat waves that can cause health problems, increase the load on energy resources due to increased cooling demands, and exacerbate drought conditions. Since the 1980s, the warming of the Mediterranean atmosphere has exceeded the global average. In the future, annual and summer warming rates are expected to be 20% and 50% greater than the global annual average, respectively. Summer warming will be particularly strong in the north. The intensity, number and length of temperature extremes and heat waves have increased in recent decades, especially in summer, and are expected to continue to increase.

- **Change in precipitation patterns:** the region is experiencing a change in precipitation patterns, with more intense but less frequent rains. This can lead to both severe droughts and flash floods. Changes in annual precipitation are only significant in some areas and in some periods, and are stationary (fixed to one place, stable) in the region as a whole in the long term. Precipitation is expected to decrease (especially for global warming greater than 2°C) by about 4% for every 1°C of global warming in all seasons in the central and southern basins, and especially in summer in the north.

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Precipitation extremes have increased in some northern areas and are expected to increase in the north (especially with global warming greater than 2°C), possibly accompanied by an increase in flash floods.

- **Sea-level rise:** Mediterranean coastal areas are particularly vulnerable to sea-level rise, which can lead to coastal erosion, increased salinity in freshwater systems and habitat loss. Currently, sea level rise is almost three times faster than before 1990. If this continues, the level of the Mediterranean Sea will rise by +0.50 m by 2150.

Water scarcity

Water scarcity is a major concern in the Mediterranean region caused by climate change, population growth and unsustainable water management practices.

- **Droughts:** more frequent and severe droughts affect the supply of water for agricultural, drinking and industrial purposes. This exacerbates the competition for water resources between different sectors. Irrigation demands could increase by 25% in the north and double in the southeastern Mediterranean region, where arid areas in the south could face insufficient water resources by 2100. In the northern Mediterranean region, the use of supplementary irrigation of winter wheat may become more common. Overall, declining crop yields and fisheries catches, as well as other factors such as rapid population growth and urbanization, increased competition for water and changing lifestyles, are likely to affect food security, particularly in North Africa and the Middle East.

- **Overuse:** the overexploitation of groundwater for agricultural and urban purposes is aquifers (natural formations, usually underground, that can store and transport water). leads to depletion and deterioration of water quality. Furthermore, groundwater recharge may decrease due to decreased rainfall.

- **Inefficient water use:** inefficient water use, especially in agriculture (which accounts for the majority of water use in the region), contributes to the problem of water scarcity.

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Loss of biodiversity

The Mediterranean region is rich in biodiversity, but faces major threats such as habitat destruction, pollution and climate change.

- **Habitat destruction:** urbanization, agricultural developments and infrastructure projects lead to the loss and fragmentation of habitats, threatening the survival of many species. An increase in aridity (ie drought, permanent insufficiency of precipitation) affects forest ecosystems. Increasing heat waves, drought and land-use change are reducing soil moisture, thereby increasing fire risk, lengthening fire seasons and increasing the likelihood of large, severe fires. Fires affect the regeneration of vegetation, thus transforming landscapes.
- **Invasive species:** the introduction of alien species disrupts local ecosystems, displacing native species and altering habitats. This is especially true in marine ecosystems. The Mediterranean Sea is undergoing a tropical process as the water temperature rises, mainly due to climate change. In addition, many species have migrated to foreign territories through known shipping routes such as the Straits of Gibraltar or the Suez Canal, often attached to the hulls of ships or in ballast waters. Other species, such as the Pacific cup mussel and the Japanese carpet mussel, were introduced for aquaristic purposes in the 1960s and 1970s, but have since escaped into the wild and colonized Mediterranean ecosystems.
- **Marine biodiversity:** overfishing, water pollution and coastal development damage marine ecosystems, including critical habitats such as seagrass beds and coral reefs. About 78% of the fish stocks in the Mediterranean are currently fished at unsustainable levels (Galli et al., 2015). The rate of stock overuse has decreased from 88% to 75% since 2012 (FAO, 2020). Almost half of the catches are small pelagic species (sardines, anchovies, herring), which are very sensitive to an increase in seawater temperature.

Pollution

Pollution in the Mediterranean comes from various sources, including industrial activities, agriculture and urbanization.

- **Marine pollution:** the Mediterranean Sea is also known worldwide as the main basin for the accumulation of marine waste and plastic pollution. Every year, 230,000 tons of plastic enter the Mediterranean Sea from land-based sources; furthermore, 20,000 tons per year may come from shipping activities. Coastal areas are particularly affected by waste from tourism and marine activities, which contains not only plastic but also oil spills and chemical pollutants.

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- **Air pollution:** urban and industrial areas in the Mediterranean region suffer from high levels of air pollution, which affects human health and contributes to climate change. The concentration of fine particles (PM2.5) exceeds 100 micrograms per cubic meter in certain areas (the global average is 39.6 µg/m3). In 2016, it is estimated that more than 228,000 people died prematurely from exposure to air pollution.

- **Agricultural pollution:** contamination from pesticides and fertilizers used in agriculture pollutes various water bodies, causing eutrophication and harming aquatic life. This sector has a particularly close relationship with natural cycles and must be able to quickly develop new strategies to prevent pollution. Restoring a destroyed area is very difficult and expensive.

Land degradation and desertification

Land degradation and desertification are major problems in the Mediterranean region, exacerbated by climate change and unsustainable land use practices.

- **Soil erosion:** the Mediterranean region was found to be particularly vulnerable to soil degradation. Within the EU, this region has the highest erosion rates, the lowest soil organic matter levels and serious desalination problems. Intensive agriculture, deforestation and overgrazing lead to soil erosion, reducing soil fertility and agricultural productivity.

- **Desertification:** parts of the Mediterranean region face a high risk of desertification, where fertile land becomes desert due to a combination of climate factors and human activities. Desertification occurs in large parts of the region, usually due to unsustainable land use. An increase in drought is likely to exacerbate desertification in North Africa and, in the case of high warming, in southern Spain. In some areas, hardwood vegetation may replace deciduous forests. Increasing temperatures and drought may trigger the retreat of Mediterranean oaks, potentially in combination with biotic factors such as pathogens.

- **Deforestation:** forest destruction in the northern Mediterranean area is mainly caused by land abandonment and fires, while in the southeastern areas, excessive use of firewood, overgrazing and population pressure are problems. Climate change remains the most significant threat to all Mediterranean forests. Rising temperatures, erratic rainfall and longer droughts will significantly change the cover and distribution of forests and trees in the coming years. For example, as trees try to withstand droughts, they deplete their carbon stores and produce less carbohydrates and resins, which are vital to their health.

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This has already led to the decline or retreat of oak, spruce, beech and pine forests in Spain, France, Italy and Greece, as well as a decline in the distribution of Atlas cedar trees in Algeria.

Solutions and regional efforts

Addressing the environmental problems of the Mediterranean region requires a coordinated and multifaceted approach, including policy measures, technological innovations and community participation.

- **Climate action:** we must work to emit less greenhouse gases. This includes improving energy efficiency and reducing polluting sources. It is necessary to increase the use of solar energy, wind energy and other renewable energy sources instead of fossil fuels. Building buildings and systems that are more resilient to the effects of climate change, such as floods and droughts, should be encouraged.

- **Water management:** this includes the promotion of sustainable water management practices, including efficient irrigation techniques, wastewater reuse and protection of water resources. Adaptation options for dealing with water scarcity at the national level include cross-border resource management, promoting fair, sustainable water trade on international markets, regional, national and basin-level water resource management plans, improving groundwater monitoring and strategic management. Technical options include loss reduction in drinking water and irrigation water distribution networks, desalination, often combined with electricity generation, artificial groundwater recharge and underground dams, and wastewater reuse. On the demand side, opportunities include changing diet and water consumption habits, and improving the efficiency of water use in tourism and the food industry.

- **Protection of biodiversity:** It includes the expansion of protected areas, the restoration of damaged habitats and the protection of endangered species. Marine Protected Areas (MPAs) are particularly important for the conservation of marine life. Part of preparing for increased fire risks is to redesign residential areas, improve firefighting capacities and strategies, and manage understory through thinning, prescribed burning, and grazing. In order to protect forests, it is important to continuously monitor the condition of forests and monitor the effects of disasters. This requires the involvement of local communities in forest management and planning. In order to protect riparian ecosystems, it is important to plan and protect catchment areas and preserve the natural water flow patterns of rivers and streams.

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- **Pollution control:** tightening regulations to reduce industrial, agricultural and urban pollution is also a very important prevention practice. Initiatives to reduce the use of plastic and improve waste management systems are essential.

- **Sustainable land use:** encouraging sustainable agricultural practices, reforestation and soil conservation techniques to combat land degradation and desertification are of great importance. In the agricultural sector, improving the efficiency of irrigation practices can be achieved by switching from surface water irrigation to other techniques and introducing more sustainable practices. Overall, the region could save 35% of its water resources by modernizing irrigation techniques. However, inadequate irrigation subsidies and developments can lead to unsustainable use of resources and excessive agricultural intensity, necessitating careful strategic planning, regulation and monitoring of these options. In order to reduce animal losses caused by heat waves in the animal breeding sector, it can be done by selecting more adaptable, more resistant genetic breeds.

Good practices and case studies

In the following, we present some exemplary domestic and international economies that successfully apply sustainable practices. These good practices point to how sustainability can be integrated into agricultural and food production processes and how these practices can be effectively communicated to the public.

Laposa estate

Location: Badacsony, Hungary

Activity: winemaking

Sustainable practices:

- **Cultivation of local grape varieties:** Laposa Estate produces wines from local grape varieties (Italian Riesling, Rhine Riesling, Szürkebarát, Kéknyelű, Furmint) that have been adapted to the characteristics of the area.

- **Conservation of natural resources:** the estate places great emphasis on soil and water conservation, including sustainable tillage techniques and the use of drip irrigation systems.

- **Community building:** Laposa Estate organizes community events, such as wine tastings and cellar visits, during which sustainable winemaking practices are presented.

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- **Webshop:** by selling their wines online, they reduce the length of the supply chain and the associated carbon footprint.

Results: the sustainable practices of Laposa Estate not only protect the environment, but also increase the quality and value of the wines, as well as strengthen the relationship between consumers and the community.

Korosajt handicraft workshop

Location: Nemesbük, Hungary

Activity: production of artisanal cheeses

Sustainable practices:

- **Happy cows:** the farm keeps Jersey cows and provides them with the best living conditions, because "only a happy cow gives high-quality milk".
- **Natural feed:** the cows are fed with natural feed that does not contain chemicals or artificial fertilizers.
- **Composting:** the organic waste generated on the farm is composted and returned to the ground, thus improving soil fertility.
- **Barefoot farmer training:** educational programs are organized where visitors can learn sustainable methods of animal husbandry and cheese production.

Results: the sustainable practices of the Korosajt Handicraft Workshop ensure the production of high-quality cheeses, while reducing environmental impact and educating the community about the importance of sustainability.

Rendek eco-farming and farm museum

Location: Kiskunság, Hungary

Activity: organic farming and farm museum

Sustainable practices:

- **Native plants and animals:** the farm keeps native plants and animals that are well adapted to the local environment.

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- **Traditional methods:** traditional agricultural methods are used, such as crop rotation and natural fertilization.
- **Community programs:** educational programs and camps are organized where participants can learn the basics of sustainable farming.
- **Biodiversity:** a variety of plants and animals are kept on the farm to maintain biodiversity and ecosystem balance.

Results: the sustainable practices of the Rendek Eco-Farming and Farm Museum contribute to the preservation of the local environment and the transmission of traditional agricultural methods, while educating the community and supporting the local economy.

Cliento bio-district, Italy

Location: Campania, Italy

Activity: bio-district

Sustainable practices:

- **Local cooperation:** the bio-district is operated jointly by local farmers, public institutions, research institutes and civil organizations, promoting the development of sustainable agriculture and tourism.
- **Organic farming:** farmers use organic methods that do not use synthetic chemicals and preserve the health of the soil.
- **Promotion of local products:** the bio-district pays special attention to the promotion and direct sale of local organic products in local markets and restaurants.
- **Sustainable tourism:** visitors can take part in economic tours, where they can learn about ecological farming methods and enjoy local gastronomic specialties.

Results: the example of the Cilento Bio-District shows how the cooperation of local communities and organizations can promote sustainable development and environmental conservation, while improving the local economy and tourism.

Summary

The importance of sustainable gardening and individual contribution

Sustainable gardening is not only essential for environmental protection, but also offers economic and social benefits. Gardeners who use sustainable methods contribute to the conservation of natural resources, increased biodiversity and the well-being of local communities. Individual contributions, however small in scale, can become a collective effort that has significant impact on a global scale.

The importance of individual contributions:

- **Local impacts:** improving the local environment by reducing pollution, preserving soil and water quality, and increasing local biodiversity.
- **Regional effects:** the collective efforts of individual gardeners can reduce the environmental load at the regional level and support the spread of sustainable agricultural practices.
- **Global impacts:** individual actions, if widespread, can contribute to solving global environmental problems, such as climate change mitigation and the sustainable use of resources.

Motivation and benefits

Demonstrating the benefits and motivations behind sustainable gardening is key for gardeners to understand and adopt these practices. Benefits include:

Environmental benefits:

- **Conservation of natural resources:** sustainable practices such as water-saving irrigation and organic fertilization help preserve soil and water quality.
- **Increase biodiversity:** using natural insecticides and a variety of plant species increases biodiversity, which promotes healthy ecosystems.

Economic benefits:

- **Cost savings:** reducing the use of chemicals and synthetic fertilizers can be more cost-effective in the long run. Using organic methods can improve soil quality, which increases crop yields and lowers long-term costs.

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- **Market benefits:** the increase in demand for sustainably grown products can provide gardeners with a market advantage. Consumers are increasingly looking for environmentally friendly products, which can increase the market value of sustainable products.

Social benefits:

- **Community building:** sustainable gardening helps strengthen local communities. Community gardens and local markets help strengthen social ties and support the local economy.
- **Education and awareness:** sustainable gardening helps to increase environmental awareness in the community. Through educational programs and workshops, gardeners can share their knowledge and encourage the spread of sustainable practices.

Motivation for gardeners:

- **Long-term sustainability:** sustainable gardening allows gardeners to maintain their farms and the quality of their products in the long term.
- **Environmental commitment:** gardeners can be motivated by their commitment to environmental protection and rightly feel that they are contributing to the preservation of the planet for future generations.
- **Community support:** community events and programs allow gardeners to support each other and share experiences, which increases commitment to sustainable practices.

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