



Eco-Literacy Guide

WAWW!

What A Wonderful World!

WAWW – What A Wonderful World is a youth-focused European project designed in line with the environmental and climate priorities of the Erasmus+ Programme. It addresses the growing need for both individual and collective responses to climate change by promoting awareness, responsible behavior, and civic engagement among young people.

WAWW! 
What A Wonderful World!

Eco-Literacy Guide

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Partner organisations contributed actively to the delivery of learning activities and workshops:

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Input from youth workers, facilitators, trainers, and participants significantly informed the development of the guide's content.

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About ECO-LITERACY

CHAPTER
1

Understanding Eco-Literacy

Ecological literacy (Eng. ecological literacy) is a concept that refers to the capacity of individuals to understand ecosystems and human-nature relationships, to critically evaluate information in this field, and to develop sustainable life skills. In the literature, the terms “environmental literacy,” “ecological literacy,” and “eco-literacy” have been used interchangeably by different authors from time to time, and their scopes have been expanded. Indeed, many researchers have emphasized that these terms are defined in such different and inclusive ways that a semantic ambiguity has occurred. However, there are intensive efforts in the literature to clearly define these concepts and to base their basic components on deep theoretical foundations. Thanks to these studies, educational standards and assessment criteria for environmental/ecological literacy have begun to be developed; frameworks covering the dimensions of knowledge, emotion, skill, and behavior have been put forward.

Therefore, the concept of ecological literacy has gained a clearer face in environmental education literature over time and has become one of the important theoretical foundations that determine the direction of education (McBride et al., 2013). The historical development of the concept of ecological literacy is based on pioneering discussions in the field of environmental education. First, in 1986, at the Ecology Society of America annual meeting, President Paul Risser brought the term “ecological literacy” to the literature by drawing attention to the fact that the public did not sufficiently comprehend ecological relationships. Risser stated that ecologists have a responsibility to help society understand ecological realities; he advocated that basic principles such as “everything is interconnected” and that people are part of the global community through atmospheric changes should be taught to the public. He also stated that the relationship between ecological processes and cultural heritage should be better explained and that ecology content should be strengthened in school curricula. This call initiated an important discussion on the integration of ecological literacy into formal educational institutions, and in the following years, many academics turned to developing framework proposals on this subject (Risser, 1986, as cited in McBride et al., 2013).



“

**Education can be a powerful tool for
transforming our relationship with nature.
We must invest in this field in order to
preserve the planet.**

Audrey Azoulay, UNESCO Director-General

”

In addition to environmental awareness and reflection, the study found that eco-literacy significantly increased student motivation and engagement in language classes. The relevance of ecological topics to students' lives and the world around them led to more active participation in class discussions.

In the late 1980s and 1990s, thinkers such as David Orr and Fritjof Capra deepened the theoretical foundations of ecological literacy and placed the concept at the center of the field of education. Orr (1989) stated that an “ecologically literate” individual must possess certain basic competencies, just like reading and writing or numeracy skills, and even, in the words of Garrett Hardin, must develop a sense of curiosity and wonder that will enable him to ask the question, “What happens next?” Orr’s 1990 study emphasized that ecological literacy requires a sustainable understanding of the relationships of human societies with each other and with natural systems; he also defined a comprehensive awareness of “vital indicators of the planet” such as population growth, loss of biodiversity, climate change, and pollution as part of ecological literacy. In this context, Orr argued that the ecological crisis is essentially an educational crisis, and that the current education system must undergo a radical transformation and integrate ecological knowledge into all disciplines. In his 1992 work titled *Ecological Literacy: Education and the Transition to a Postmodern World*, Orr stated that the Western education model trivializes nature and disconnects students from ecological realities, and therefore the content and methods of education must be redesigned.

According to Orr, ecological literacy requires that educational programs be taken outside the classroom, interdisciplinary and experiential learning, and broad-scale (holistic) thinking skills be encouraged. Orr’s views, which are shaped around the goal of creating a sustainable society, have been shared and developed by many researchers in the following years (Orr, 1989; Orr, 1992; Jordan et al., 2009)

On the other hand, Fritjof Capra has framed ecological literacy as a school-based transformation movement by introducing the concept of “ecoliteracy” since the 1990s. Capra defines ecoliteracy as a holistic education model that aims to restructure educational institutions with ecological principles. He particularly suggests organizing schools according to the principles of ecosystem functioning with a systems theory perspective (Capra, 1999; 2007). Capra’s curriculum approach is centered around what he calls the “fundamental facts of life” in nature: fundamental ecological principles such as networks and interdependence, cycles and energy flow, biodiversity, dynamic balance, and cooperation must be incorporated into educational content.



Unsplash
Ales Krivec, 2022

Capra (2005) emphasizes that by teaching these principles, children will gain critical understandings such as “ecosystems do not produce waste, matter moves continuously in a cyclical manner within the web of life, the energy of life comes from the Sun, diversity provides resilience, and life’s conquest of the planet is possible not through war but through cooperation and networks.” In this context, Capra suggests a systemic reform that includes the participation of all stakeholders in schools through project-based learning and a community-based leadership approach. Capra’s vision of eco-literacy emphasizes the importance of not only cognitive but also affective and ethical dimensions in education: It encourages students to establish an emotional connection with nature and to grasp systems thinking through art. The perspectives put forward by Capra and Orr have shaped the theoretical framework of ecological literacy; it has ensured that the concept is addressed in terms of both ecological system knowledge and values and behavior (Mitchell & Mueller, 2011; Capra, 2007). In conclusion, ecological literacy is a deeply philosophically based and historically developed concept in environmental education literature today. It implies a paradigm shift in education from schools to society as a whole and aims to transform the knowledge, skills and attitudes of citizens for a sustainable future.

The Importance of Being Eco-Literate

The global environmental problems that humanity is facing today make the importance of ecological literacy more evident than ever. Global problems such as climate change, biodiversity loss, environmental pollution and epidemics may remain unsolved if societies have insufficient environmental knowledge and awareness. Therefore, it is considered critical for societies to be composed of ecologically literate individuals for a sustainable future. Indeed, the Sustainable Development Goals (SDGs), adopted by the United Nations in 2015, have emphasized the importance of ecological literacy for both the general public and students by aiming to increase environmental awareness through education. In line with the SDGs, developing effective policies in areas such as combating climate change, rational use of natural resources and waste management is only possible with an informed and sensitive audience on these issues (Bilianska & Yaroshenko, 2020). In this respect, ecological literacy is considered a basic competence that today's citizens must possess, as it means the capacity to understand global environmental crises and produce solutions to them. For example, Pitman and Daniels (2020) emphasized that ecological literacy is not just a “nice to have” trait, but provides a critical foundation for making sound and sustainable decisions about how we live, how we develop our communities, and how we address the environmental and socioeconomic issues we face. Prioritizing ecological literacy within education systems is of great importance not only in terms of environmental protection, but also in terms of active citizenship and social responsibility. Individuals who are sensitive to the environment and who can understand ecological connections make more conscious decisions in the society they live in and play a more active role in initiatives aimed at solving environmental problems. In this sense, ecological literacy forms the basis of the concept of environmental citizenship. Ecologically literate individuals not only make sustainable choices in their personal lives, but also contribute to change on a societal scale by participating in policy-making processes or taking part in civil society initiatives. For example, environmental education research shows that increasing ecological knowledge improves individuals' civic behaviors on environmental issues (Jordan et al., 2009; Pitman & Daniels, 2020).

As Orr points out, achieving the goal of a sustainable society is only possible by increasing the ecological literacy of citizens; this view has been adopted by many studies in the following years (Jordan et al., 2009). Therefore, integrating the ecological dimension into the science and social studies curriculum in schools will help students gain environmental responsibility awareness from an early age. Blumstein and Saylan (2007) stated that today's education systems have not been able to create a society with the expected ecological sensitivity, and this is a significant deficiency in the face of crises such as climate change and biodiversity loss. This criticism reveals that current educational approaches are inadequate in developing ecological literacy and need to be urgently restructured (Blumstein & Saylan, 2007). Therefore, increasing the impact of environmental education and ensuring a transformation of ecological awareness throughout society is seen as vital both in finding solutions to the critical problems facing our planet and in strengthening democratic participation.

In summary, the importance of being ecologically literate emerges on three basic levels: (1) Being able to produce sustainable solutions in the face of global environmental challenges, (2) Providing individuals with the skills to comprehend intersystem connections and critical thinking in educational processes, and (3) Ensuring individuals' participation in environmental decisions and social transformation by developing a sense of citizenship and ethical responsibility. In these aspects, ecological literacy is a concept that has the power to shape both individual life practices and social policies in our age. Indeed, educational scientists emphasize that education should build a sense of agency and the capacity to take action in individuals in order to cope with the uncertainties of the Anthropocene era (Monroe et al., 2023). As a result, ecological literacy is an indispensable component not only for environmental protection but also for development, public health and democratic participation in today's world. Integrating this concept into educational systems and common education programs will play a key role in building a sustainable future.



Unsplash
A. C., 2022

How Eco-Literacy Can Make a Difference:

Youth Perspective

The role and participation of young people in environmental crises is an important area that demonstrates how ecological literacy can make a difference in practice. It is noteworthy that in recent years, millions of young people around the world have raised their voices on climate change and sustainability issues, demanding stronger action from leaders. These youth movements demonstrate how critical it is for social change to raise an ecologically literate generation. Ecological literacy enables young people to make environmentally friendly choices in their daily lives, make informed decisions, and participate as active environmental citizens in the communities they live in. For example, a recent study has shown that ecological literacy includes environmental understanding, skills, and a critical perspective, which enables young people to make informed decisions and actively participate in environmental issues. Indeed, eco-literate young people actively participate in discussions on difficult issues such as the climate crisis, overconsumption, and social injustice, both on online platforms and in face-to-face events (Firinci Orman, 2024). A qualitative study conducted with young people in Turkey has shown that young people are involved in discussions on climate change and consumer culture at local, global and planetary scales, and that in doing so, they are expressing themselves through online activism, creative expression and sustainable lifestyles in their daily life practices. It has been determined that these young participants develop their environmental ideologies through a reflective agenda (reflexive thinking and self-criticism) and are resolutely committed to daily activism and environmentally friendly lifestyles. In other words, ecological literacy empowers young people not only to understand environmental problems but also to shape their own values and attitudes, translate these into action and involve others in the process. The acquisition of ecological literacy by young people produces concrete outputs at the level of social participation and sustainable action. Research has shown that young people who participate in environmental education and action programs have increased citizenship skills, leadership skills and sense of belonging to society (Schusler et al., 2009). For example, Schusler and colleagues (2009) emphasized in their study that young people who were included in environmental action projects made significant progress in problem solving, cooperation and social responsibility; thus, they became active citizens and change agents in the communities they were in. This finding shows that ecological literacy is reflected not only in individual behaviors but also in collective action at the community level. In fact, ecologically literate young people can initiate initiatives such as tree planting, recycling campaigns, energy saving projects in their local environments such as their schools and neighborhoods; they can even develop suggestions that will contribute to the environmental policies of local governments.



“

Youth involved in eco-literacy programs
expressed a greater sense of agency,
believing they could contribute
meaningfully to *environmental solutions* at
both local and global levels.

(de Brito Miranda, Jófili, & Carneiro-Leão, 2017)

”

Thus, the knowledge and skills of the young generation regarding the environment serve as a catalyst that accelerates the sustainability transformation of society. In parallel, de Brito Miranda and colleagues (2017) state that equipping children with ecological literacy skills from an early age is key to raising a generation that is more prepared and sensitive to the environmental challenges of the 21st century. Individuals who interact with nature starting from early childhood, observe ecological processes and understand their importance exhibit more consistent and permanent positive attitudes towards the environment in later years (de Brito Miranda et al., 2017). The impact of young people in the context of ecological literacy also ensures the formation of a learning and interaction network that extends beyond the education system. In a study conducted by Firinci Orman (2024), it was revealed that young people are not limited to the school curriculum, but develop a kind of “public eco-pedagogy” with the information sharing environments and collective learning experiences they create among themselves. This shows that young people disseminate environmental knowledge and values outside of formal education through social media, youth organizations or volunteer movements. In the study in question, Turkish young people used the research environment as a collective learning and action platform, demonstrating their own eco-literacy and demanding a more inclusive environmental education that does not fit into traditional education.

This situation demonstrates the potential of the young generation to transform environmental knowledge into social awareness and action. Moreover, global youth movements – such as school strikes and protests for the climate – show that ecologically literate youth can send a powerful message to decision-makers, creating a demand for accountability and change. Thus, the youth perspective proves that ecological literacy is not only an individual virtue, but also a force that drives social transformation. As a result, young people equipped with ecological literacy set an example by implementing sustainable practices in their daily lives, and they make a difference by taking an active role in political and social processes aimed at solving environmental problems. From this perspective, investing in ecological literacy education is of vital importance in order for young people to become decision-makers and conscious members of society who will shape the world of the future. The international sharing of environmental awareness and experiences of young people through programs such as Erasmus+ also supports this process. Thus, a generation of young people with high ecological literacy will enable us to move towards the goal of a more sustainable, fair and livable world.

perspectives from countries
ENVIRONMENT & CLIMATE

2 CHAPTER

LTTA in Romania

Climate, Water and Forests





LTТА in Romania

Climate, Water and Forests

The first **Learning, Teaching and Training Activity (LTТА)** under the **WAWW** project took place from **1-6 June 2024** in **Brebu** commune, **Caras-Severin County, Romania**. The activity was hosted and coordinated by **Nevo Parudimos Association** and brought together 26 young participants, 2 trainers, and 1 support staff member from six different countries: Austria, Turkey, Serbia, Italy, Greece, and the host country Romania. The gender distribution included 15 female and 11 male participants, reflecting the increased interest of young women in environmental themes.

Participants engaged in an intensive, four-day learning program focused on the interconnections between **climate change, water resources, and forest ecosystems**. The training was led by environmental experts from WWF Romania, including the Director of WWF Reșița, Raluca Peternel. Activities included theoretical sessions, practical workshops, field visits to protected natural areas, and collaborative group work. The event also laid the foundation for the first draft of the WAWW Eco-Literacy Guide.





Brebu, Romania
LTTA, 2024

Throughout the activity, participants were not only recipients of information but also actively engaged in applying and discussing what they learned in collaborative settings. One of the key moments of the program was the **“The Current Situation, Challenges and Efforts”** presentation session, where country representatives shared insights from their national contexts regarding climate change, water resources, and forest ecosystems.

These exchanges allowed for a comparative **understanding of environmental issues** from both **local** and **international perspectives**. The moment captured in the image reflects this hands-on learning process, highlighting how participants became actively involved learners through direct interaction with nature and one another.

The Current Situation

Perspectives from Countries

In **Romania**, water and forest ecosystems are among the country's most vital natural resources. Over 29% of Romania's land area is forested, and the country hosts some of Europe's last remaining old-growth forests. However, climate change, deforestation, and water mismanagement pose significant threats. Participants shared that Romania's water stress level remains moderate, but rising temperatures and irregular precipitation patterns are increasing pressure on freshwater systems.

In **Türkiye**, forest cover has increased slightly in recent years due to reforestation efforts, now covering around 30% of the country. However, climate-induced drought, forest fires—especially in the Mediterranean region and water scarcity in central Anatolia highlight ongoing vulnerabilities. Türkiye is classified as a water-stressed country, and inefficient agricultural irrigation further strains resources.

In **Italy**, nearly 35% of the national territory is forested, but changing climate conditions have led to biodiversity loss, forest degradation, and more frequent extreme weather events such as floods and landslides. The north of Italy faces glacial melt and water scarcity, while the south struggles with prolonged droughts, threatening agricultural livelihoods.

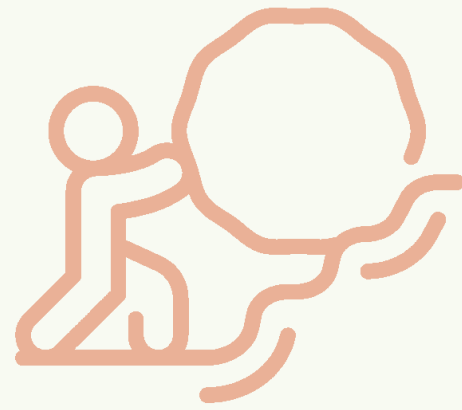
Serbia has approximately 30% forest cover and is facing a growing risk of water scarcity, particularly during summer months. Pollution of river systems, outdated water infrastructure, and illegal logging are major environmental concerns. The Danube and its tributaries remain critical water sources, but their ecosystems are under pressure from industrial and urban development.

In **Austria**, forests cover more than 47% of the land area, and water availability remains high. However, alpine ecosystems are extremely sensitive to temperature rise, leading to glacier retreat and reduced snowpack, which threatens long-term freshwater supply. Austria invests heavily in sustainable forestry and water protection policies, setting an example for climate adaptation in mountainous regions.

Greece faces both water and forest stress, with intense summer wildfires and uneven rainfall patterns. Forests account for around 30% of national land, but many regions suffer from desertification risks. In terms of water, several islands experience seasonal shortages, prompting the need for rainwater harvesting, desalination, and sustainable land-use strategies.

Globally, deforestation and freshwater scarcity continue to accelerate due to unsustainable practices, industrialization, and population growth. Countries are increasingly challenged to balance conservation with development, underscoring the importance of cross-border learning and coordinated climate action.

(Intergovernmental Panel on Climate Change, 2023).



Challenges

Perspectives from Countries

The **major challenges** identified across countries included:

1

Climate vulnerability and biodiversity loss:

Climate change is increasingly disrupting the natural balance, particularly in fragile ecosystems such as alpine regions, mountain forests, and wetland habitats. Rising temperatures, altered precipitation patterns, and extreme weather events have accelerated biodiversity decline and endangered species across partner countries.

2

Deforestation and land degradation:

Illegal logging, monoculture agriculture, and urban sprawl continue to reduce forest cover, especially in parts of Central and Eastern Europe. These practices not only threaten biodiversity but also weaken the soil's ability to retain water, increasing the risk of erosion, flooding, and desertification in vulnerable areas.

3

Water scarcity and pollution:

Poor wastewater management, contamination of freshwater sources, and increasing demand from agriculture and urban populations have created widespread water stress. Romania, Türkiye, and Greece all face localized shortages, while global freshwater availability continues to decline due to overextraction and pollution.

4

Lack of eco-literacy and public engagement:

Many participants highlighted the persistent gap in environmental education—particularly among youth—in several partner countries. The absence of structured, accessible eco-literacy programs limits young people's understanding of climate and sustainability issues, and reduces their capacity to take informed, responsible action in their communities.



Efforts

Perspectives from Countries

Efforts shared during the activity highlighted growing youth engagement in climate action and conservation. In Romania, NGOs such as WWF, alongside local authorities, are working to protect national parks, implement sustainable forest management, and raise awareness about the importance of water conservation. Participants also shared examples from their home countries:

Austria and Italy emphasized the role of renewable energy and sustainable agriculture in reducing water and forest stress.

Türkiye highlighted national afforestation campaigns and wetland protection projects.

Serbia and Greece reported increasing youth involvement in climate education and reforestation projects.

The LTTA concluded with a symbolic tree-planting activity and collective drafting of the Eco-Literacy Guide, reinforcing shared commitment to environmental stewardship. The Romanian chapter set a strong precedent for transnational learning, combining scientific knowledge with community action to address global ecological challenges.



LTTA Romania
2024



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It was eye-opening to realize that while our countries face different symptoms – droughts, floods, deforestation – the root causes are strikingly similar. We need **shared action, *not isolated solutions.***”

(from LTTA Romania WAWW Project Participants)

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LTTA in Türkiye

Climate and Gas

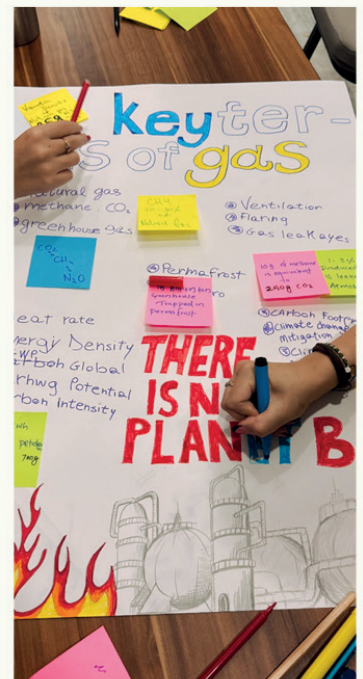


LTTA in Türkiye

Climate and Gas

The **second Learning, Teaching and Training Activity (LTTA)** of the **WWAW project** was hosted by **KARGENC Environment Sports Club in Türkiye**. The activity brought together participants from Romania, Italy, Serbia, Austria, Greece, and Türkiye, and focused on the interrelation between climate change and greenhouse gas emissions, with a particular emphasis on natural gas usage and carbon footprints.

Kargenc E.S.C. coordinated the content and structure of the activity, including a seminar on the history of climate change, interactive workshops on carbon footprint awareness, and field-based activities in the **climate and gas** topic. Participants conducted shopping experiments based on product carbon emissions, engaged in community-based carbon footprint assessments, and interviewed local citizens about energy consumption habits.



Sakarya Türkiye
LTTA

Additionally, the second volume of the WAWW Eco-Literacy Guide, focusing on climate and gas, was drafted collaboratively. Around 100 local residents were engaged in outreach activities aimed at reducing personal carbon footprints.

Each country team contributed presentations summarizing the **current gas-related environmental situation** in their respective countries, allowing for a comparative understanding of energy dynamics and climate impact across Europe. Throughout the activity, participants were not only recipients of information but also actively engaged in applying and discussing what they learned in **co-creation**.

The Current Situation

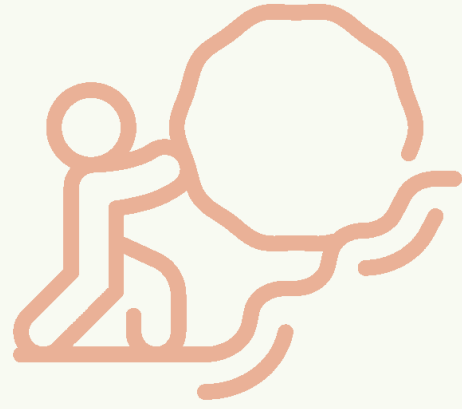
Perspectives from Countries

During the LTTA, participants from partner countries contributed valuable perspectives that revealed both commonalities and differences in national energy strategies.

Natural gas plays a critical role in **Türkiye**'s energy landscape, constituting a major share of its energy mix. As of 2023, approximately 99% of Türkiye's natural gas is imported, mainly from Russia, Iran, and Azerbaijan. While often considered a "cleaner" fossil fuel, natural gas is still a major contributor to Türkiye's greenhouse gas emissions, which reached 422.4 million tons of CO₂ equivalent in 2022, according to TÜİK. The country's growing energy needs, infrastructural constraints, and geopolitical dependencies create a complex challenge for achieving both energy security and climate neutrality. **Austria** shared its progress in reducing natural gas dependency, noting a 17.5% decrease in gas consumption in 2023, supported by coal plant closures and significant investment in renewable energy. Nevertheless, Austria remains heavily reliant on Russian gas (up to 98%), which raises concerns about energy sovereignty and resilience in the face of geopolitical instability. **Romania** highlighted its offshore Black Sea gas project, intended to reduce reliance on imports and bolster energy independence. However, Romanian participants also expressed concerns over the trade-off between exploiting new fossil fuel sources and meeting climate commitments, acknowledging the tension between short-term security and long-term sustainability. **Greece** emphasized its 60% dependency on Russian gas and the volatility this creates. Participants explained how EU-level regulations and geopolitical shifts directly affect national energy planning, urging greater investment in renewables and decentralized energy systems. **Italy** reported a rapid transformation in its gas supply structure following the Ukraine conflict, with Algeria becoming the country's primary gas provider. Italian participants also stressed the government's dual strategy of diversifying imports while accelerating the transition to renewables, especially solar and wind power, as a long-term solution to fossil fuel dependency.

Together, these diverse inputs painted a multifaceted picture of how natural gas dependency intersects with climate goals across Europe and its neighboring regions. The session emphasized the need for regional cooperation, shared innovation, and youth-driven awareness to rethink energy futures in a climate-conscious era.

(Intergovernmental Panel on Climate Change, 2023).



Challenges

Perspectives from Countries

The **major challenges** identified across countries included:

1

High dependency on imported gas:

Many countries, including Türkiye, Austria, and Greece, rely heavily on external gas suppliers. This dependence creates vulnerability to geopolitical tensions, supply disruptions, and price volatility, undermining national energy security.

2

Methane leaks and carbon emissions:

Though often promoted as a cleaner fossil fuel, natural gas production and transport can result in methane leaks—a potent greenhouse gas with 25 times more warming impact than CO₂. Even minor leaks during extraction, storage, or distribution can significantly accelerate climate change.

3

Aging infrastructure:

Outdated gas pipelines, compressor stations, and storage systems, particularly in countries like Türkiye and Austria, lead to energy loss, increased maintenance costs, and elevated safety and environmental risks, highlighting the urgent need for modernization.

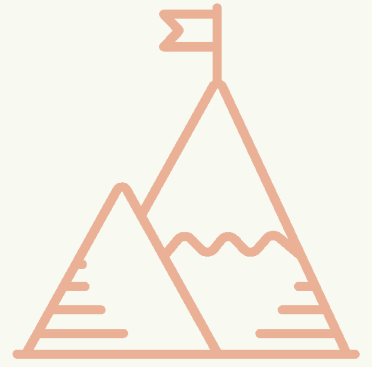
4

Low public awareness and eco-literacy:

Many citizens are unaware of the environmental footprint of natural gas use. Participants noted a general lack of education on how household behaviors—like heating, cooking, or insulation can be adapted to reduce emissions and energy consumption.

Efforts

Perspectives from Countries



Despite the challenges, multiple efforts were highlighted:

Türkiye is diversifying energy imports and gradually increasing investments in renewables and domestic energy production, including LNG terminals and solar fields.

Austria is promoting energy efficiency and considering early termination of long-term gas contracts with Russia to reduce geopolitical dependency. Italy has ramped up renewable energy infrastructure, particularly solar and wind, and is working to transition its residential heating systems away from gas.

Romania continues to push for energy independence while balancing it with its EU-aligned climate goals.

Across all participating countries, youth engagement and educational initiatives like the WAWW project are key to driving community awareness and behavioral change.

Through this LTTA, participants not only deepened their understanding of energy-climate interdependencies but also took concrete steps to raise public awareness and empower local citizens to become more climate-responsible energy consumers.



LTTA Türkiye
Sakarya



“

Despite our different contexts, we all face the same issue: **fossil fuel dependency.** Real change needs shared responsibility.

(from LTIA Turkiye WAWW Project Participants)

”



LTTA in Italy

Climate and Recycling

LTTA in Italy

Climate and Recycling



The third **Learning, Teaching and Training Activity (LTTA)** of the WAWW project was hosted by **L'ORMA SSD** a.r.l. in **Rimella**, Italy—a rural village known for its natural heritage. Held between 7–12 April 2025, the event brought together 31 participants from Austria (6), Italy (5), Romania (5), Greece (5), and Turkey (5), with a gender balance of 11 male and 20 female participants.

The activity aimed to foster environmental awareness and sustainable behavior among youth by emphasizing the links between climate change and recycling. Utilizing nature-based pedagogical methods, the LTTA promoted experiential learning and encouraged critical thinking about the environmental impact of individual choices. A central output of the event was the third draft volume of the Eco-Literacy Guide, focused on **"Recycling."**





Rimella, Italy
LTTA



Key objectivities are enhancing awareness of the environmental impact of recyclable waste, encouraging sustainable lifestyles through creative, hands-on workshops, providing intercultural dialogue and peer learning opportunities and supporting content development for the **Eco-Literacy Guide's Recycling** chapter.

The Current Situation

Perspectives from Countries

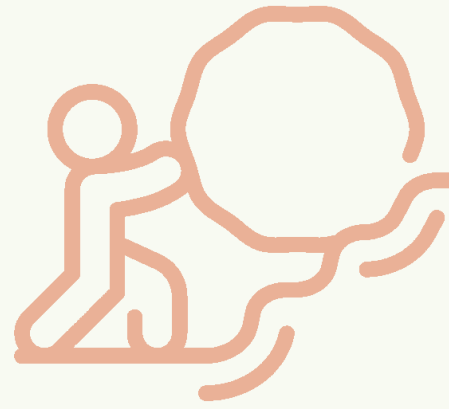
Italy produces over 30 million tonnes of waste annually, with household waste making up more than half. In 2023, the country achieved a 52% recycling rate, outperforming the EU average of 48.7%. However, this national success masks significant regional disparities: while northern regions benefit from advanced waste management infrastructure, stronger local governance, and greater public awareness, southern areas often struggle with limited services, illegal dumping, and lower participation rates.

Within the WAWW partner countries, **Austria** stands out with one of the highest recycling rates in Europe at 58%. This success is supported by decades of policy development, a well-organized separation-at-source system, and strong citizen engagement. **Romania**, by contrast, remains below 14%, with rural regions especially lacking in access to recycling services and educational campaigns. **Türkiye's** recycling rate is around 13%, hindered by insufficient separation at the source and public engagement. However, national initiatives such as the “Sıfır Atık” (Zero Waste) campaign, launched by the Ministry of Environment, are gaining visibility—particularly in schools, municipalities, and public institutions. **Greece** continues to make gradual progress through EU-funded infrastructure improvements and awareness projects, yet still falls short of EU benchmarks.

Globally, the picture is even more urgent. According to UNEP, approximately 2.12 billion tonnes of waste are generated each year, yet less than 20% is formally recycled. The rest ends up in landfills, incinerators, or the natural environment, contributing to soil degradation, water pollution, and significant greenhouse gas emissions especially methane, which has a far greater global warming potential than carbon dioxide.

These patterns underscore a shared challenge: despite differences in infrastructure and resources, countries around the world must prioritize circular economy strategies, community-based education, and cross-border cooperation to build a more sustainable and waste-conscious future.

(Intergovernmental Panel on Climate Change, 2023).



Challenges

Perspectives from Countries

The **major challenges** identified across countries included:

1

Illegal dumping in rural and underserved areas:

In many rural and remote areas, especially in southern Italy and parts of Romania and Türkiye, limited access to waste collection services leads residents and small businesses to resort to illegal dumping. This not only pollutes local ecosystems but also poses public health risks and undermines community trust in waste management systems.

2

Weak enforcement of waste regulations:

While national policies may align with EU directives, enforcement on the ground remains inconsistent. Insufficient monitoring, lack of penalties, and bureaucratic delays hinder the implementation of recycling laws, especially in regions with lower administrative capacity.

3

Public apathy, misinformation about proper recycling practices:

Many citizens are unaware of what can be recycled, how to separate waste, or why it matters. Misconceptions (e.g., “all waste is mixed later anyway”) reduce motivation to participate. In some countries, public campaigns have been limited or inconsistent, especially outside urban centers.

4

Urban-rural infrastructure gaps limiting waste collection:

Many participants highlighted the persistent gap in environmental Urban areas tend to have centralized systems and access to modern recycling facilities. In contrast, rural regions often lack regular waste pick-up, recycling bins, or local sorting centers making sustainable waste management impractical, even for residents who are willing to participate.



Efforts

Perspectives from Countries

Italy's Circular Economy Strategic Document outlines key national strategies:

Increasing producer responsibility in waste generation, supporting innovation in waste-to-resource technologies, promoting citizen engagement and environmental education.

In partner countries:

Turkiye's "Zero Waste" program involves public campaigns, new infrastructure, and incentives for schools and businesses. Romania is piloting rural waste programs and aligning national targets with EU waste directives. Austria continues to refine its advanced sorting systems and offers incentives for households. Greece implements EU-funded recycling projects and awareness campaigns to improve citizen participation.

At the international level, organizations like UNEP and EU Circular Economy Action Plan promote a global transition toward sustainable waste practices, encouraging nations to adopt integrated waste management systems and community-based recycling efforts.



LTTA
Italy



“

It was inspiring to see how different approaches to recycling in each country could spark new ideas our diversity **became a source of innovation** for common environmental goals.

(from LTITA Italy WAWW Project Participants)

”

LTTA in Greece

Climate, Energy and Eco-Garden





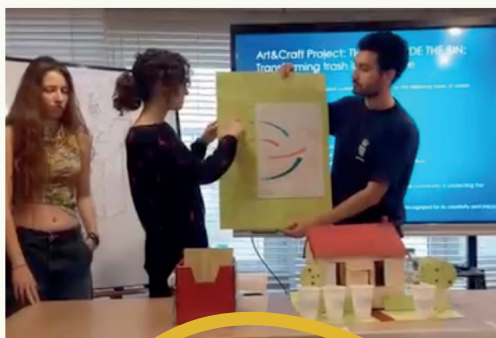
LTTA in Greece

Climate, Energy and Eco Garden

The fourth and final LTTA was organized by **Hellas For Us** in Greece and focused on the intersection of **climate change, renewable energy, and eco-gardening**. Bringing together participants from Romania, Italy, Turkiye, Austria, Serbia, and the host country, the event emphasized active participation, intercultural exchange, and environmental responsibility.

Participants engaged in a series of practical and theoretical sessions: sorkshops on eco-agriculture and use of natural fertilizers, seminars on renewable energy sources and rainwater collection mechanisms, street interviews and community-based exhibitions on climate adaptation.

At the conclusion of the LTTA, participants collaboratively developed the fourth volume of the Eco-Literacy Guide, centered on sustainable energy and eco-garden practices.



The Current Situation

Perspectives from Countries

Greece continues to navigate a complex energy landscape shaped by both environmental and geopolitical factors. As of 2023, 60% of Greece's natural gas imports originate from Russia, with the remainder supplied via EU-regulated networks.

The country is heavily reliant on imported fossil fuels, increasing its exposure to external shocks and price fluctuations.

Despite this dependence, Greece has made significant progress in renewable energy, with wind and solar contributing to nearly 40% of electricity generation.

Eco-gardening and sustainable agriculture are growing trends, especially in rural and island areas, supported by national and local initiatives promoting permaculture, composting, and rainwater harvesting.

Italy promotes eco-gardens through school programs and community projects.

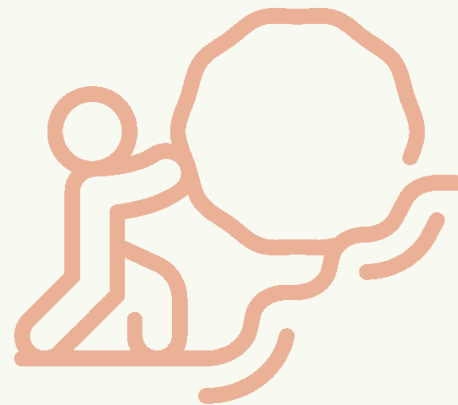
Austria leads Europe's green energy shift, with over 75% of its electricity coming from hydro and other renewables.

Turkiye is increasing solar capacity, but remains heavily reliant on fossil fuels.

Romania has made significant investments in solar and wind, targeting 30.7% renewables in total energy use by 2030.

Globally, the International Energy Agency (IEA) projects that renewables will provide over 50% of global electricity by 2030. However, meeting climate goals demands decentralized, community-led actions like eco-gardens and public education.

(Intergovernmental Panel on Climate Change, 2023).



Challenges

Perspectives from Countries

The **major challenges** identified across countries included:

1

High dependency on imported fossil fuels:

Many countries, including Greece, remain heavily reliant on imported energy—particularly natural gas and oil—which exposes them to geopolitical tensions, market volatility, and supply chain disruptions. This dependence makes energy planning uncertain and slows down the transition to domestic renewable sources.

2

Inadequate infrastructure and limited storage capacity:

Aging power grids, insufficient energy storage systems, and underdeveloped transport networks for renewables pose major barriers to expanding clean energy use. In several regions, existing systems are not yet equipped to handle the variability of solar and wind power.

3

Gaps in environmental education and community participation:

In rural and underserved areas, access to climate education, training on eco-practices, and environmental awareness campaigns is limited. This lack of knowledge hinders local engagement and reduces support for sustainability initiatives such as eco-gardening or zero-waste programs.

4

Structural and policy-related barriers to green transition:

Across partner countries, fragmented policies, low investment in green technologies, and uneven distribution of resources continue to hamper progress. Without stronger political commitment and coordinated strategies, local actions risk remaining isolated and underfunded.



Efforts

Perspectives from Countries

To address these challenges, Greece and its partners are implementing various strategies: government-backed projects in Greece are promoting eco-agriculture, organic food systems, and rainwater harvesting in community gardens.

The renewable energy sector continues to expand, with national policies encouraging solar, wind, and geothermal investments. Italy supports school-based eco-programs and local food initiatives tied to sustainability goals.

Austria invests in grid modernization, community-owned energy models, and citizen engagement campaigns. Türkiye and Romania are focusing on solar integration, particularly in underserved areas.

At the global level, grassroots initiatives like WAWW are essential to scaling climate literacy, promoting eco-innovation, and ensuring that climate adaptation efforts are equitable and inclusive.



LTTA Greece
2024



“

Eliminating our dependence on fossil fuels starts with simple acts like growing our own food and learning how energy flows through our **everyday choices**

(from LTTA Greece WAWW Project Participants)

”



VOLUME 1

WATER, FOREST and CLIMATE

3 CHAPTER

Key Terms Related to Water, Forests, and Climate

Forest-related key-terms



Agricultural Tree Crop

Trees grown for food, cultural, or economic reasons, including oil palm and cocoa.

Agroforestry

Agricultural systems integrating trees into landscapes.

Biodiversity Intactness

The proportion of original forest species remaining.

Biodiversity Significance

Importance of an area for the survival of forest-dependent species.

Boundary Plantings

Trees planted along property lines.

Carbon Dioxide Equivalent (CO₂e)

A measure aggregating greenhouse gas emissions based on their global warming potential.



Deforestation

Conversion of forest to another land use.

Forest

Tree cover over 30% canopy density and greater than 5 meters in height.

Forest Concession

Legal right to manage a public forest for production.

Forest Degradation

Reduction in a forest's ability to provide ecosystem services.

Forest Disturbance

Events altering forest ecosystem structure.

Forest Fragmentation

Breaking of large forests into smaller pieces with other land types in between.

Forest Landscape Restoration

Process of restoring landscapes to improve ecological and human well-being.

Forest Management Plan

Documentation of forest stewardship for environmental, economic, and social goals.



Global Land Squeeze

Pressure to balance land use for food, fuel, and biodiversity.

Hectare

A unit of area equal to 10,000 square meters or 2.47 acres.

Intact Forest

A forest with no signs of human activity, large enough to support native biodiversity.

Land and Environmental Defenders

Individuals protecting land and environmental rights.

Loss Driver

Direct cause of forest disturbance.

Low Tree Canopy Density

Less than 30% tree canopy cover.

Managed Forest Concession

Areas where private companies have rights to harvest timber from public lands.

Managed Natural Forest

Naturally regenerated forests with management signs.

Megacity

A city with over 10 million people.

Open Canopy Systems

Tree crowns not overlapping to form a continuous canopy.

Persistent Loss and Gain

Forests with one loss or gain event from 2001 to 2016.

Plantations

Areas planted with trees for commercial purposes.

Planted Forest

Forests with trees deliberately planted or seeded.

Primary Forest

Old-growth forests rich in carbon and biodiversity.

Production Forest

Forests managed for timber and other products.

Restoration

Actions to improve ecological functionality and human well-being in degraded landscapes.

Shifting Agriculture

Temporary or permanent deforestation due to agriculture.

Tree Cover

Vegetation over 5 meters in height, including natural forests and plantations.

Tree Cover Gain

Establishment of tree canopy in previously treeless areas.

Tree Cover Loss

Removal or death of tree cover due to various factors.

Trees Outside Forests (TOF)

Trees in urban areas, alongside roads, or within agricultural land.

Tree Plantation

Agricultural plantations of fast-growing tree species for timber or fruit.

Source: Global Forest Review - Key Terms & Definitions <https://research.wri.org/gfr/key-terms-definitions>



Unsplash
A. C., 2022

Key Terms Related to Water, Forests, and Climate

Water-related key-terms



Acequia

Gravity-driven waterways used in irrigation, particularly in the American Southwest.

Acid

A substance with a pH less than 7, having more hydrogen ions than hydroxyl ions.

Acre-foot

A volume of water covering one acre of land to a depth of one foot, equal to 325,851 gallons.

Adhesion

Water's attraction to other substances.

Alkaline

Water or soil with a pH above 7, potentially harmful to crops.

Alluvium

Material like clay, silt, sand, and gravel deposited by water bodies.

Appropriation Doctrine

A water allocation system based on "First in Time, First in Right" used in Western states.

Aquaculture

Farming of aquatic organisms like fish and algae.



Aquifer

A water-bearing geological formation.

Artesian Water

Groundwater under pressure that rises when tapped by a well.

Artificial Recharge

The process of adding water to groundwater storage.

Atmosphere

The layer of gases surrounding Earth that transports water globally.

Base Flow

Sustained streamflow in the absence of direct runoff.

Basin

Land area draining all streams and rainfall to a common outlet.

Capillary Action

Movement of liquids through porous spaces in solids, essential for nutrient transport in plants and animals.

Condensation

The transformation of water vapor into liquid water.
Consumptive Use: Water withdrawn and removed from the immediate water environment.



Desalination

Removal of salts from saline water to produce freshwater.

Dew

Water droplets formed by condensation on cool surfaces.

Discharge

The volume of water flowing past a location over time.
Domestic Water Use: Water used for household purposes.

Drainage Basin

The land area from which precipitation drains into streams and rivers.

Drawdown

Lowering of groundwater levels due to pumping.

Drought

A period of below-normal precipitation causing water shortages.

Drip Irrigation

A low-pressure irrigation method minimizing water loss through evaporation.

Key Terms Related to Water, Forests, and Climate

Climate change-related key-terms

Climate change refers to significant alterations in global temperature, precipitation, wind patterns, and other climate measures that occur over several decades or longer. These extreme changes are largely linked to rising levels of carbon dioxide and other greenhouse gases in the atmosphere, primarily due to human activities. Carbon dioxide, methane, and other gases trap heat, contributing to global warming. Observable effects include rising sea levels, changing ecosystems, and threats to food supplies.

Key terms described in the text include:



Aerosols

Small suspended particles in a gas, detectable in the atmosphere.

Antarctic sea ice

Ice surrounding the Antarctic landmass, different from Arctic sea ice, which covers the Arctic Ocean.

Anthropogenic

Processes or results generated by human activities.

Biofuels

Renewable fuels derived from biological materials like algae and plants.

Carbon cycle

The process by which living organisms absorb and release carbon.



Global warming

The increase in Earth's temperature due to rising greenhouse gas levels.

Ocean acidification

The process by which oceans become more acidic due to increased carbon dioxide levels.

Greenhouse gases

Gases such as carbon dioxide, methane, and nitrous oxide that trap heat in the atmosphere.

Ice loss

The reduction of sea ice and land ice, contributing to rising sea levels.

Renewable energy

Energy from sources that naturally replenish, like wind, solar, and geothermal.



Particulate matter

Tiny solid or liquid particles in the air, including dust and soot, that can cause health problems.

Ozone

A gas that forms a protective layer in the stratosphere but can contribute to smog at ground level.

Methane

A potent greenhouse gas that contributes to global warming and is emitted from sources like livestock and landfills.

Sea level rise

The increase in the average level of the world's oceans due to melting ice and thermal expansion.

Water: The Lifeblood of Our Planet

Water is essential for life and covers approximately 71% of the Earth's surface, existing in liquid, solid, and gas forms. It plays a key role in the hydrological cycle, which includes processes like evaporation, condensation, precipitation, and infiltration. This cycle is vital for maintaining ecosystem balance and regulating the climate.

For humans, water is crucial for numerous functions: it makes up about 60% of our bodies and is necessary for digestion, temperature regulation, waste elimination, and joint lubrication. In agriculture, water is used to irrigate crops and sustain livestock, while in industry, it is vital for manufacturing and energy production.

Despite its abundance, fresh, potable water is scarce, with only about 2.5% of the world's water being fresh and a small portion accessible for use. The uneven distribution of freshwater resources results in varying levels of availability and quality, causing water stress in many regions where demand surpasses supply.

The importance of water and the need for its conscious use are underscored by the pervasive issue of water pollution. This pollution arises when human activities introduce substances into natural water sources—such as streams, groundwater, lakes, and seas—that exceed their ideal concentration levels. Such contamination significantly impacts the quality of water, which is crucial for sustaining life, supporting economic development, and maintaining environmental health.

Water pollution, which results from various pollutants including acids, alkalis, detergents, household wastes, fertilizers, food industry wastes, gases, heat, metals, nutrients, oils, organic toxic wastes, pathogens, and pesticides, has far-reaching consequences. It disrupts the natural balance of ecosystems, leading to the deterioration of water quality and the depletion of essential resources. Polluted water does not just affect aquatic environments but also has cascading effects on soil, plants, and animals. Harmful substances from polluted water can transfer to soil and from there to plants, vegetables, and fruits through irrigation, ultimately affecting food safety and agricultural productivity.

One liter of wastewater can contaminate up to eight liters of clean water, illustrating the severity of the issue. With approximately 1.4 billion people currently lacking access to clean water, the scale of the problem is significant. Water pollution impacts human health by causing diseases, reducing agricultural productivity, decreasing biodiversity in aquatic habitats, and increasing the costs associated with water treatment.

Chemical pollutants from industrial activities, agricultural practices, and other sources further compromise water quality. Key contributors include agricultural runoff, disinfection practices, faulty industrial processes, leachate from storage tanks, mining activities, and chemical waste. Contaminated water can be transported through the hydrological cycle, affecting various ecological systems and posing risks to human health.

To ensure safe drinking water, it should be colorless, odorless, and tasteless, containing essential minerals like calcium, magnesium, and sodium while being free from harmful substances such as nitrites, nitrates, organic matter, chemicals, heavy metals, and disease-causing microorganisms.

Pollution can sometimes be detected by appearance, but issues such as taste, smell, and the presence of microorganisms or chemicals often require laboratory testing. Proper water usage and conservation are critical to mitigating these problems.

Misconceptions about water consumption lead to unnecessary wastage, making it essential to adopt water-saving practices.

These include repairing dripping taps, using water-efficient appliances, washing vegetables and fruits in bowls rather than under running water, operating ----

dishwashers and washing machines only when full, insulating hot water pipes, and using adjustable shower heads. Additionally, efficient garden watering techniques and the use of rainwater harvesting systems can conserve water.

In agriculture, adopting efficient irrigation methods like sprinkler or drip systems, applying water only when plants need it, and using techniques to maintain soil moisture are vital. Overuse of commercial fertilizers degrades soil quality, so practices such as using green manure and animal manure can enhance soil's water-holding capacity. Reducing tillage can prevent moisture loss, and developing drought-resistant plant varieties is essential for sustainable agriculture.

Given the increasing global population and corresponding water scarcity, protecting existing water resources and avoiding contamination are imperative. Efforts should focus on reducing the impact of settlements and industrial facilities on water basins, increasing clean water sources, and improving natural water management. Recycling and reusing wastewater are crucial strategies to address the growing demand for water and ensure long-term sustainability.

Source: https://www.researchgate.net/publication/350210868_The_importance_of_water_and_conscious_use_of_water



Unsplash
A. C.,2022

Forest: The Lungs of the Earth

Forests vary significantly depending on their climatic conditions and geographic location. In high-latitude subpolar regions, such as Alaska, the boreal forest, or taiga, dominates. This type of forest features hardy conifers like pines, spruces, and larches, with long winters and moderate rainfall ranging from 250 to 500 mm annually. Similarly, coniferous forests can also be found on temperate mountain ranges.

In temperate high-latitude climates, mixed forests of conifers and broad-leaved deciduous trees are common. These forests thrive in areas with temperatures above 10 °C for at least six months and annual precipitation over 400 mm. They are characterized by tree species such as oaks, elms, birches, and maples.

Tropical rainforests, found in equatorial regions, support high biodiversity due to their heavy rainfall and warm temperatures. These forests feature evergreen trees with broad leaves. In contrast, monsoon forests in tropical areas have deciduous trees that adapt to long dry seasons followed by intense rainfall. In the Southern Hemisphere's lower latitudes, temperate deciduous forests also reappear.

Forests vary widely based on their climatic conditions and geographic locations.

1. Boreal forests (Taiga): Found in high-latitude subpolar regions such as Alaska, boreal forests are dominated by hardy conifers like pines (*Pinus*), spruces (*Picea*), and larches (*Larix*). These forests experience prolonged winters and receive 250 to 500 mm of rainfall annually. They are also present in temperate mountain regions.

2. Mixed temperate forests: In temperate high-latitude climates, mixed forests of both conifers and broad-leaved deciduous trees are predominant. These forests grow where temperatures exceed 10 °C for at least six months and annual precipitation is above 400 mm. Common tree species include oaks (*Quercus*), elms (*Ulmus*), birches (*Betula*), maples (*Acer*), beeches (*Fagus*), and aspens (*Populus*).

3. Tropical rainforests: Located in the humid equatorial belt, tropical rainforests are known for their incredible biodiversity. They support evergreen trees with broad leaves and receive heavy rainfall throughout the year.

4. Monsoon forests: These are deciduous forests in tropical areas characterized by a long dry season followed by an intense rainy season. They adapt to the cyclical nature of tropical monsoons.

5. Temperate deciduous forests: Reappearing in the lower latitudes of the Southern Hemisphere, these forests are similar to those found in temperate regions of the Northern Hemisphere. They are characterized by broad-leaved trees that shed their leaves annually.

The Rio Conventions



(All About CSS PMS, 2023)

The three Rio Conventions—on Biodiversity, Climate Change and Desertification—derive directly from the **1992 Earth Summit**. Each instrument represents a way of contributing to the sustainable development goals of **Agenda 21**. The three conventions are intrinsically linked, operating in the same ecosystems and addressing interdependent issues.

Problems faced by deforestation driven by agriculture, logging, and infrastructure development.

Climate change: Alters ecosystems, leading to forest degradation and increased susceptibility to pests.

Biodiversity loss: Habitat destruction leads to species extinction.

Desertification: Land degradation reduces forest areas.

Illegal logging: Depletes resources and disrupts ecosystems.

Forest fires: Often exacerbated by climate change, causing extensive damage.

Solutions to overcome these problems:

Sustainable management: Implement policies for sustainable forestry.

Reforestation and afforestation: Plant trees to restore and expand forests.

Protected areas: Establish and enforce protected zones to conserve biodiversity.

Community engagement: Involve local communities in conservation efforts.

Climate action: Mitigate climate change impacts through global cooperation.

Legal frameworks: Strengthen laws against illegal logging and enforce penalties.

Water, Forest and Climate Connection

(importance of forests in climate change and protection of water resources)

Water is vital for life and **covers about 71% of the Earth's surface** in liquid, solid, and gas forms. It is a key part of the hydrological cycle, which involves evaporation, condensation, precipitation, and infiltration. This cycle helps maintain ecosystem balance and regulate the climate.

The hydrologic cycle describes the continuous movement of water within the Earth-Atmosphere system, moving from the ground to the atmosphere and back. Key processes include:

Evaporation: Water changes from liquid to gas, powered by sources like the sun or body heat, which helps cool the body and dry surfaces.

Transpiration: Water evaporates from plants through small openings called stomata, with 99% of this water entering the atmosphere.

Condensation: Water vapor turns back into liquid, forming clouds or dew when air reaches its dew point. This process releases heat, influencing weather patterns.

Precipitation: Water falls back to Earth as rain, snow, sleet, or hail when condensation particles become too heavy for the air to hold.

Runoff: Excess precipitation that can't be absorbed flows into rivers and lakes, eventually returning to the oceans. Runoff can lead to saltier lakes due to evaporation leaving impurities behind.

These processes work together to sustain the water cycle, supporting ecosystems and weather systems.

GLOBAL WATER CYCLE

The **global water cycle** continuously moves and transforms water through evaporation, condensation, precipitation, and runoff. Powered by solar energy, it helps regulate climate and connect various water sources. Human activities, such as deforestation and water management, impact this cycle, **influencing climate and water availability**.

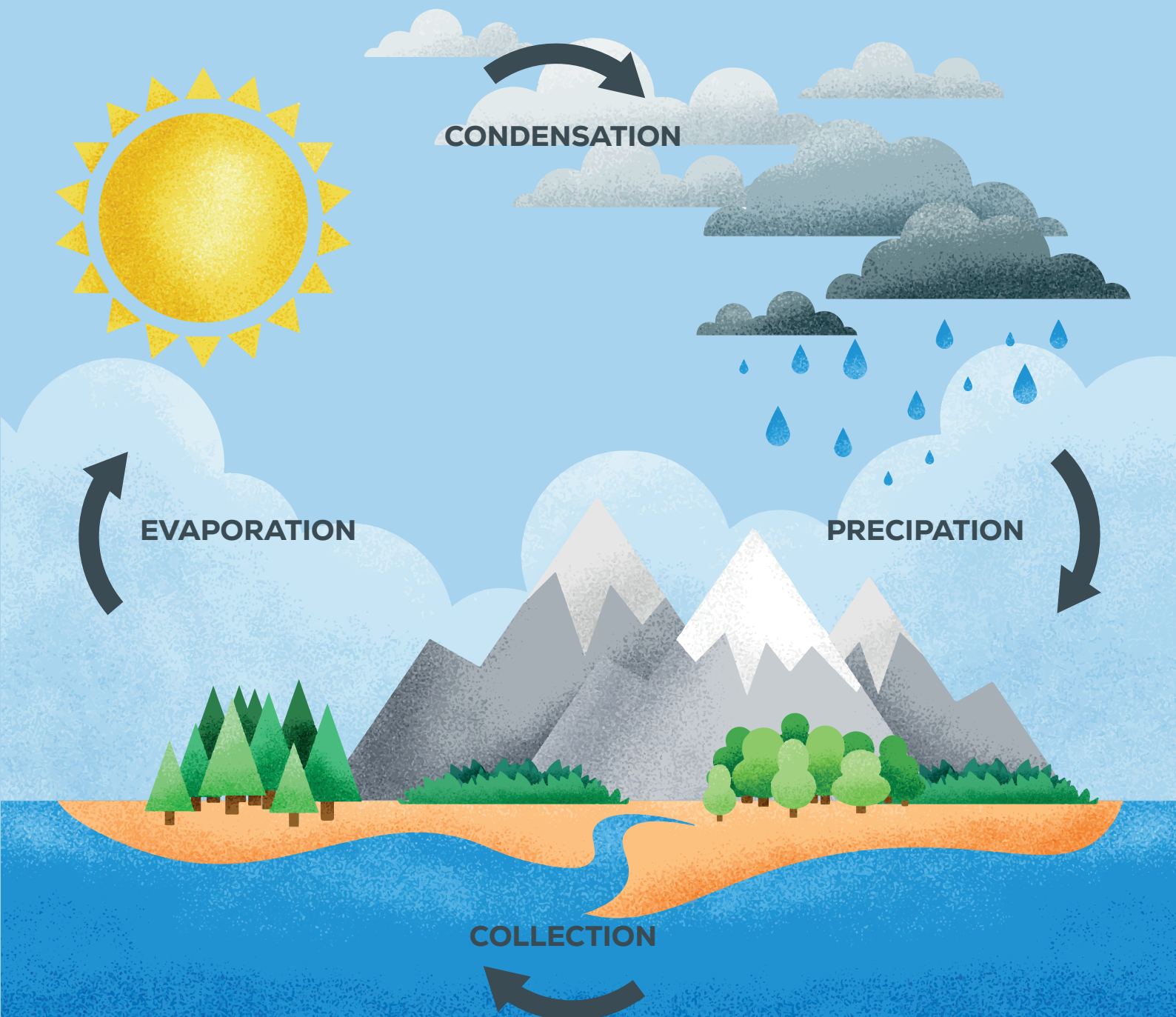
Carbon capture and storage (CCS) is often presented as a key technology for reducing emissions, but there are significant concerns about its effectiveness and feasibility. CCS involves capturing greenhouse gases from sources like fossil fuel power stations and then storing them underground. However, it has several limitations:

Emissions increase: CCS might allow continued use of fossil fuels, potentially leading to increased overall emissions rather than reducing them.

Not zero-emissions: CCS cannot achieve zero emissions, especially when applied to high-pollution coal and gas projects.

High costs: Implementing CCS is extremely expensive. For example, Chevron's Gorgon Gas Plant in Western Australia, the world's largest CCS project, has faced major challenges and high costs without delivering the promised results.

While CCS may contribute to reducing emissions from certain industries, it is not a comprehensive solution to climate change.



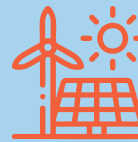
Climate change mitigation involves actions taken to **reduce or prevent greenhouse gas emissions** or enhance carbon sinks that absorb these gases from the atmosphere. These gases trap heat, contributing to global warming and climate change. Effective mitigation is essential to slowing the rise in greenhouse gases and avoiding the most severe impacts of climate change.

Key strategies for mitigation include:

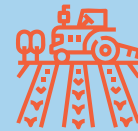
Transitioning from fossil fuels: Shifting to renewable energy sources such as solar, wind, and geothermal, and adopting sustainable transportation methods, to reduce reliance on fossil fuels, which are major greenhouse gas emitters.



Improving energy efficiency: Reducing overall energy use across buildings, industries, and transportation by employing better insulation, energy-efficient appliances, and improved design and technology.



Altering agricultural practices: Implementing regenerative agriculture techniques to lower methane and nitrous oxide emissions from farming. Practices like enhancing soil health, reducing livestock emissions, and using cover crops contribute to lower emissions and greater resilience.



Sustainable forest management: Protecting and restoring forests, which act as carbon sinks by absorbing CO₂, while also supporting biodiversity and water cycles. Reducing deforestation and forest degradation is crucial for climate mitigation.



Conserving critical ecosystems: Protecting and restoring ecosystems like wetlands, peatlands, grasslands, and mangroves, which also sequester carbon and enhance biodiversity and climate resilience.



Supporting policies and investments: Encouraging emission reductions through policies, regulations, and financial incentives, such as carbon pricing and emission limits, to foster a supportive environment for climate action.



Biodiversity refers to the variety of life on Earth, encompassing all forms of living organisms, including:

Microorganisms: bacteria, fungi, and viruses

Plants: trees, flowers, grasses

Animals: birds, fish, reptiles, insects, mammals, including humans

Biodiversity is crucial for maintaining ecosystems and ensuring a clean, safe, and sustainable environment. It affects essential aspects of life, such as:

The air we breathe

The food we eat

Other factors that support life

Ecosystems are composed of all organisms within a given area and their interactions with the environment. They include both living (biotic) and non-living (abiotic) components, connected through factors like water, nutrients, climate, and predator-prey relationships. Ecosystems range from small areas, like a single tree, to large systems, like river basins.

A healthy ecosystem is resilient and sustainable, able to recover from disturbances (natural or human-caused) while continuing to support life. Healthy ecosystems provide cultural, social, and economic benefits, and a province rich in biodiversity helps build a future with sustainable economies and vibrant ecosystems.

Ecosystem resilience depends on species diversity and the ecosystem's structure and function. Loss of biodiversity can decrease resilience, making ecosystems less able to withstand and adapt to disturbances. Maintaining biodiversity is crucial for long-term ecosystem health and sustainability.

Ecosystem services are the benefits people derive from ecosystems, categorized into four types:



PROVISIONING SERVICES

products obtained from ecosystems, such as:

Food from plants and animals
Freshwater
Natural medicines and pharmaceuticals
Resources from fisheries, forestry, and agriculture



REGULATION SERVICES

processes that maintain environmental conditions, such as:

Erosion control
Water filtration
Carbon storage
Habitat support for biodiversity
Pollination
Seed dispersal
Water purification
Flood and storm mitigation
Soil retention and landslide prevention
Air quality improvement



CULTURAL SERVICES

non-material benefits gained from ecosystems, including:

Spiritual and cultural values of landscapes and species
Inspiration for art, folklore, and architecture
Outdoor recreational opportunities
Support for mental well-being



SUPPORTING SERVICES

Fundamental processes necessary for all other services, such as:

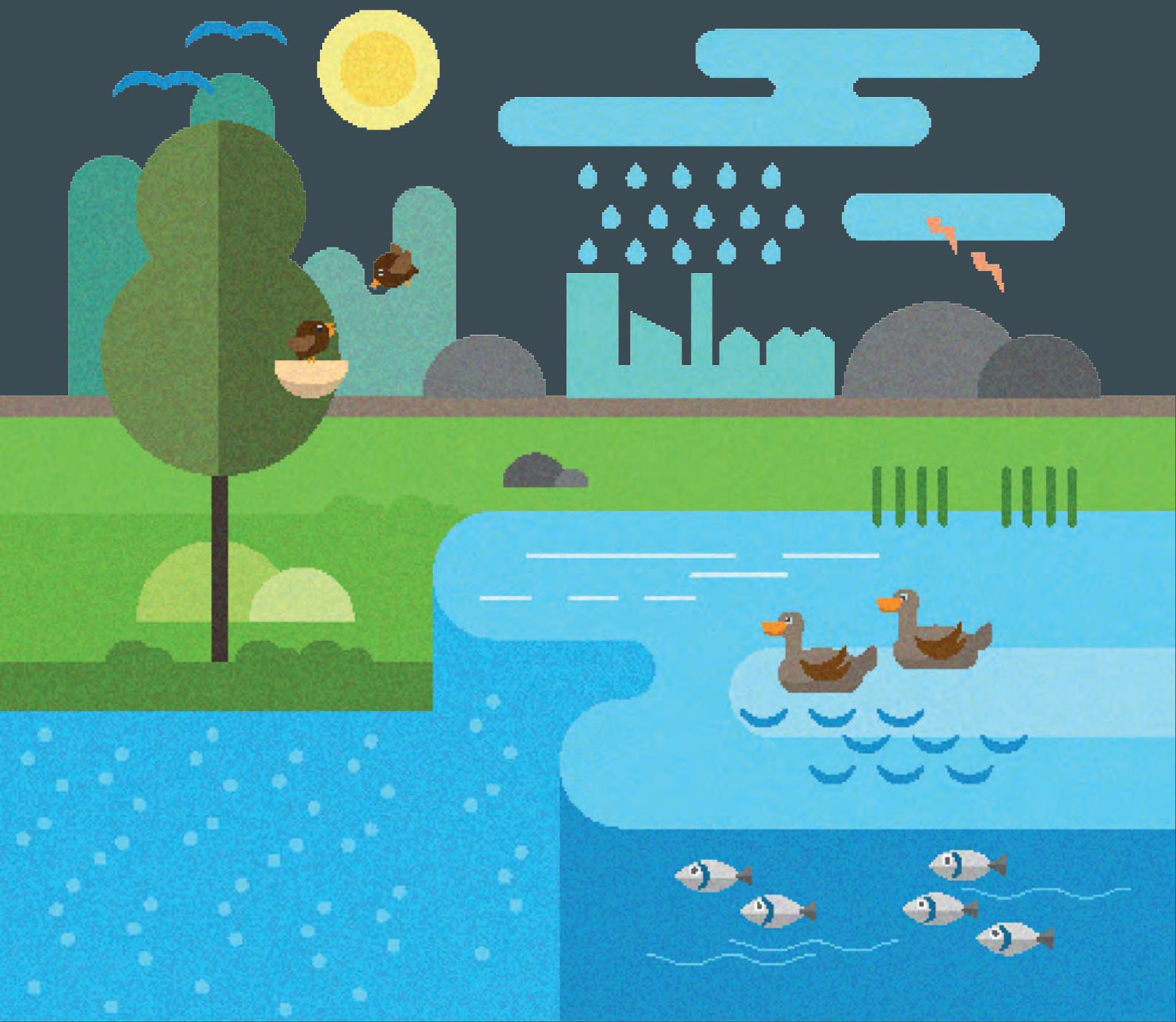
Biomass production
Habitat provision
Soil formation and retention
Photosynthesis

Strategies for Reducing Water Footprint

The water footprint is an environmental metric that measures the total volume of fresh water used throughout the entire production chain of a product or service, expressed in liters or cubic meters. It is similar to the carbon footprint, but focuses on water consumption. This indicator can assess water use for various purposes, from the production of individual items, like a pair of trousers, to the overall water usage of a country or company.

Origin and purpose:

The concept of the water footprint was introduced in 2002 by Arjen Hoekstra at the IHE Delft Institute for Water Education (UNESCO-IHE). In 2008, Hoekstra established the Water Footprint Network to raise awareness about the extensive water use involved in production processes and lifestyles, aiming to promote more rational and sustainable water use.

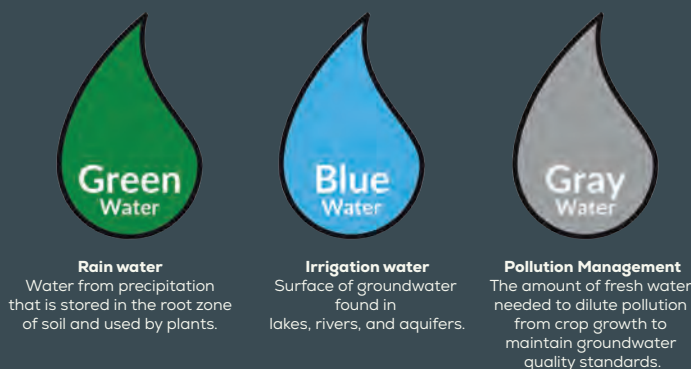


Types of water footprint:

Green Water Footprint: Refers to the water from precipitation that is stored in the soil's root zone and used by plants. This type is particularly relevant for agricultural, horticultural, and forestry products.

Blue Water Footprint: Measures the water sourced from surface or groundwater that is used for evaporation, incorporation into products, or returned to the sea. It applies to irrigated agriculture, industrial processes, and domestic water use.

Grey Water Footprint: Represents the amount of fresh water needed to dilute pollutants to meet water quality standards.



Measuring the water footprint:

To measure a country's water footprint, four factors are considered:
Total consumption volume: Higher GDP often correlates with a larger water footprint.

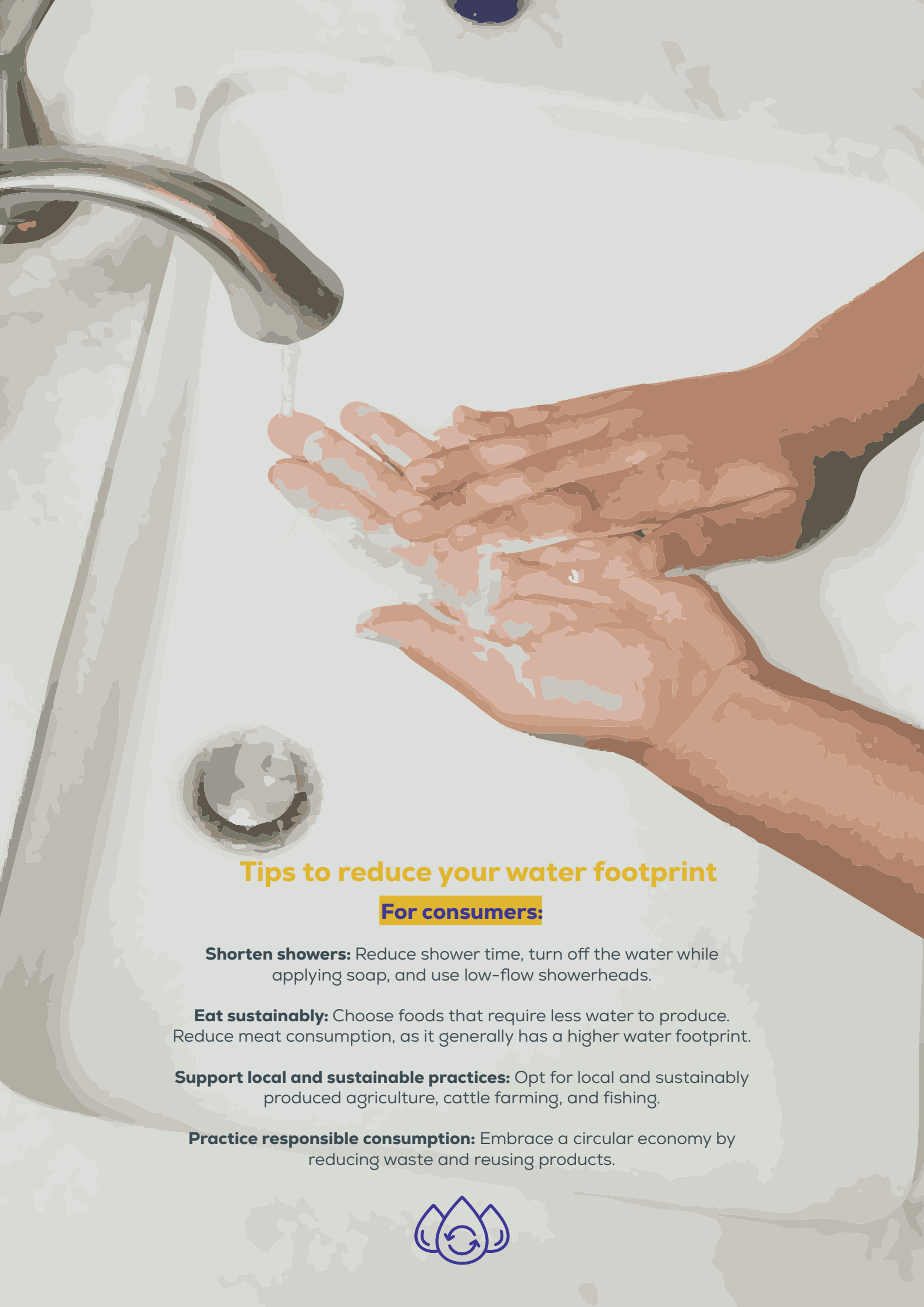
Consumption patterns: Countries with higher consumption of water-intensive products have larger water footprints.

Climate: Hotter climates with higher evaporation rates increase water needs for crops.

Agricultural practices: Inefficient agricultural practices can lead to a higher water footprint.

Global water footprint statistics:

According to the Water Footprint Network, the highest per capita water footprints are in Mongolia (10,000 liters per day), Niger (9,600 liters), Bolivia (9,500 liters), the United Arab Emirates (8,600 liters), and the United States (7,800 liters). In absolute terms, the largest water footprints are in China (1,400,000 million cubic meters annually, 16% of the global total) and India (1,100,000 million cubic meters, 13%).

A close-up photograph of a hand cupping water flowing from a modern, curved faucet into a white sink. The water is clear and creates a small splash in the palm. The background is a soft, out-of-focus white.

Tips to reduce your water footprint

For consumers:

Shorten showers: Reduce shower time, turn off the water while applying soap, and use low-flow showerheads.

Eat sustainably: Choose foods that require less water to produce. Reduce meat consumption, as it generally has a higher water footprint.

Support local and sustainable practices: Opt for local and sustainably produced agriculture, cattle farming, and fishing.

Practice responsible consumption: Embrace a circular economy by reducing waste and reusing products.





Tips to reduce your water footprint

For businesses:

Adopt Environmental Quality Systems: Implement systems to monitor and improve environmental impact.

Promote Recycling and Reuse: Encourage practices that focus on recycling, reusing materials, and ecological consumption within the company.

Choose Water-Conscious Suppliers: Partner with suppliers who are committed to reducing their water footprint.

Digitalize Operations: Minimize paper use by adopting digital solutions and operating paperless offices.





VOLUME 2

CLIMATE and GAS

4 CHAPTER

Key Terms Related to Climate and Gas



Natural gas

Methane CO₂

Greenhouse gas

Ventilation

Flaring

Gas leakage

(1-3% of produced gas is leaked to atmosphere) (10 g of methane is equivalent to 250g of CO₂)



Carbon footprint

Climate change mitigation

Climate impact assessment



Net zero

Emissions produced, emissions removed)

Permafrost leakage

Carbon budget to limit to 1.5 degree Celsius is to emit 400-500 billion metric ton CO₂

Fun Facts



Climate Change

1. The concentration of carbon dioxide (CO₂) in our atmosphere is the highest it has been in human history¹.
2. The 10 warmest years on record have all occurred in the past decade¹.
3. As much as 20% of all global greenhouse gas emissions caused by humans are due to deforestation¹.
4. Tropical forests provide at least a third of the mitigation action needed to prevent the worst climate change scenarios¹.
5. Scaling up natural climate solutions, such as restoring degraded forests, could create as many as 20 million new jobs¹.



Recycling

1. Recycling one aluminum can save enough energy to power a TV for three hours⁵.
2. Each ton of recycled paper can save 17 trees, 380 gallons of oil, and 7,000 gallons of water⁵.
3. Recycling steel saves enough energy to supply a decade's worth of electricity to Los Angeles⁵.
4. It takes as few as 30 days for a glass container to go from a recycling bin back to a store shelf⁵.
5. By recycling all of its newspapers, America could save 250,000,000 trees a year⁵.



Gas Industry & Carbon Footprint

1. Cement production accounts for 8% of global CO₂ emissions⁹.
2. Short flights emit more carbon dioxide per person than longer flights⁹.
3. LED lightbulbs use 75% less energy and last 25 times longer than incandescent bulbs⁹.
4. Public transit produces significantly fewer greenhouse gas emissions than cars⁹.
5. The cement industry would rank third in the world for emissions if it were a country⁹.



Sustainability

1. The last decade recorded the five warmest years since recordings started¹⁶.
2. Human-caused emissions of carbon dioxide need to fall 45% from 2010 levels by 2030 to limit climate change catastrophe¹⁷.
3. Energy is the dominant contributor to climate change, accounting for around 60% of total global greenhouse gas emissions¹⁷.
4. Switching to energy-efficient light bulbs could save the world 105 billion euros annually¹⁷.
5. The production of one pound of beef requires 1,799 gallons of water¹⁸.



Green Policies

1. The Paris Agreement aims to limit global warming to well below 2°C above pre-industrial levels¹.
2. Many countries are adopting renewable energy sources to reduce their carbon footprints¹⁷.
3. Green policies often include incentives for electric vehicles and renewable energy installations¹⁷.
4. Sustainable urban design can significantly reduce a city's carbon footprint¹⁶.
5. Governments are increasingly investing in nature-based solutions to combat climate change¹.



Energy Industry

1. A single lightning bolt unleashes five times more heat than the sun¹³.
2. Liquified natural gas is reduced by 600-fold before transport¹³.
3. 60 minutes of solar energy could power the Earth for a year¹³.
4. The world has more than 2 million miles of pipeline¹³.
5. The term 'energy' is derived from the Greek word 'energeia'¹³.



Food Industry

1. The food industry accounts for 10-30% of a household's carbon footprint¹⁰.
2. Meat products have larger carbon footprints per calorie than grain or vegetable products¹⁰.
3. Livestock emitted 195 million metric tons of methane in 2021¹⁰.
4. Shifting to a vegetarian meal one day a week could save the equivalent of driving 1,160 miles¹⁰.
5. Beef's greenhouse gas emissions per kilogram are 7.2 times greater than those of chicken¹⁰.



AI and Technologies

1. AI can optimize energy use in buildings, reducing their carbon footprint⁹.
2. Smart grids use AI to balance supply and demand, improving energy efficiency⁹.
3. AI can help predict and mitigate the impacts of climate change⁹.
4. Technologies like blockchain can enhance transparency in carbon trading⁹.
5. AI-driven agriculture can reduce water and fertilizer use, lowering emissions⁹.

Greenhouse Gases and Their Impact on Climate

Policies and Agreements in Gas Supply

Ensuring a reliable and sustainable energy future requires well-defined policies and agreements in gas supply. Policies are essential to regulate safety, quality, customer service, billing, and emergency response, while agreements establish clear terms between suppliers and customers.

Policies focus on key areas such as safety, where strict industry standards and regular maintenance ensure secure operations. Quality control measures guarantee the integrity of gas supply, while eco-friendly practices contribute to environmental sustainability. Customer service policies prioritize timely responses to inquiries, and transparent billing ensures smooth financial transactions. Additionally, emergency protocols help mitigate risks, confidentiality policies protect sensitive data, and continuous policy improvements enhance overall efficiency.

On the other hand, agreements define the legal and operational framework between suppliers and customers. These contracts outline the involved parties, the scope of gas supply, contract duration, delivery details, and pricing structures. Payment schedules, liability clauses, termination conditions, and dispute resolution methods ensure smooth contractual execution. Furthermore, agreements must comply with applicable governing laws to provide a solid legal foundation.

International gas agreements play a significant role in global energy distribution, with major treaties such as the Nord Stream Agreements, the Trans Anatolian Pipeline, and the Turkmenistan-China Pipeline facilitating cross-border energy trade. Well-structured policies and agreements are crucial in maintaining a secure, efficient, and sustainable gas supply network.



Unsplash
Marcin Jozwiak, 2020

Climate Change: from **past** to **future**

GAS 100 – CUT EMISSIONS, FUEL THE FUTURE.

Gas is the state of matter in which the particle

They are highly compressible and are known to exert some finite pressure on the walls of their containers. By burning gas, we create heat which powers a turbine. The rotation of this turbine spins a generator which creates electricity.

Types of gases:

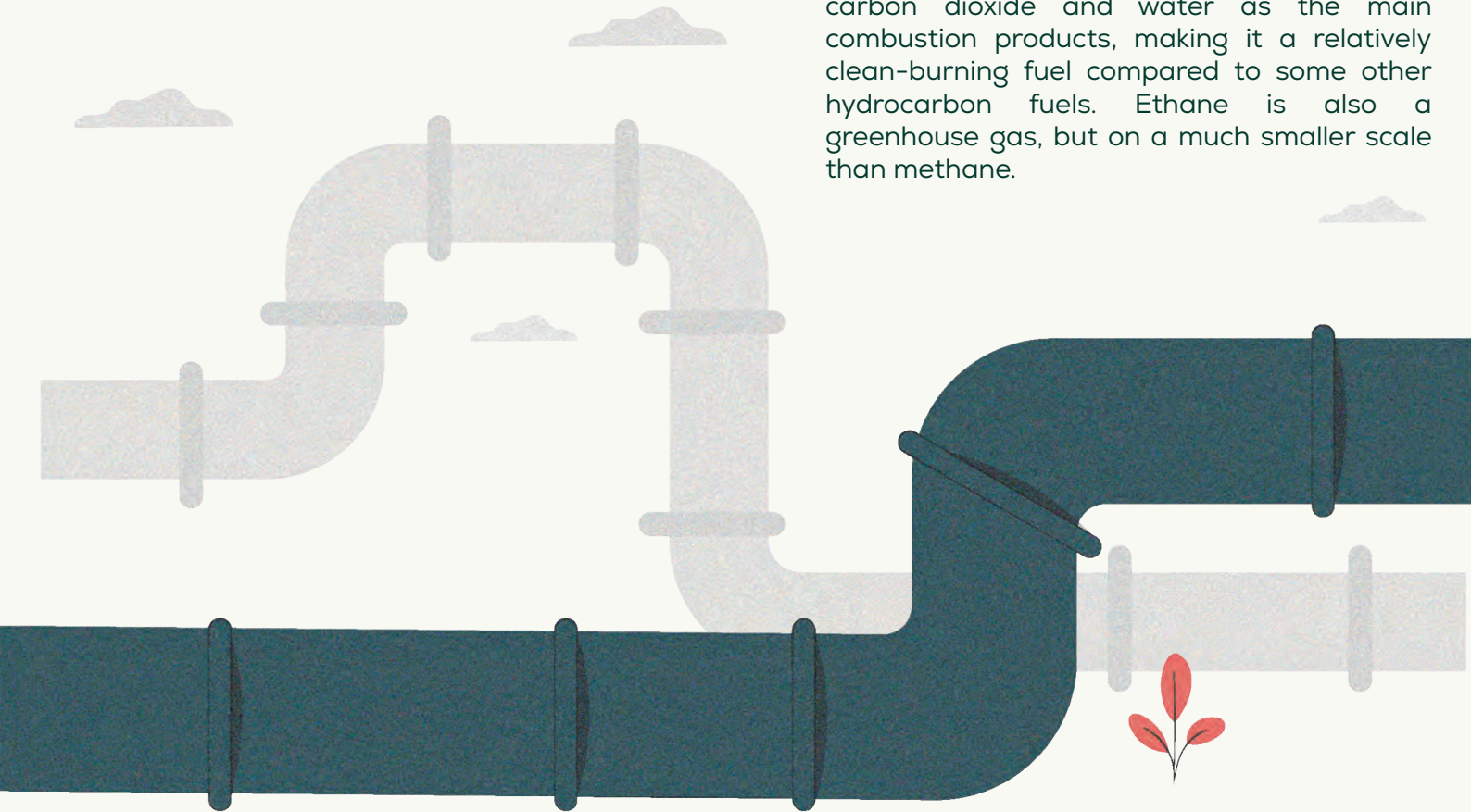
- 1) **Elemental gases:** pure elements, such as hydrogen or helium
- 2) **Toxic gases:** are harmful or deadly to people, such as carbon monoxide
- 3) **Mixed gases:** are not pure substances; instead they are a mixture.



Types of natural gas;

1) Methane: chemical formula is CH_4 . It non-toxic gas, is the main ingredient in natural gas. Since methane is odorless, smelly sulfur compounds are added to it when it's used as a gas so that we're able to detect leaks. When burned, methane emissions release into the atmosphere, where they become greenhouse gas.

2) Ethane: chemical formula is C_2H_6 . it the second-largest fossil fuel component. Ethane's primary use is as a petrochemical feedstock for ethyleneproduction. A petrochemical feedstock is a material (feedstock) derived from petroleum (petrochemical) for manufacturing countless everyday items-including batteries, clothing,digital devices etc. When burned, ethene produces carbon dioxide and water as the main combustion products, making it a relatively clean-burning fuel compared to some other hydrocarbon fuels. Ethane is also a greenhouse gas, but on a much smaller scale than methane.



3) Butane: the chemical formula is C_4H_{10} . butane is considered odorless, it does have a faint, disagreeable smell, similar to natural gas or petroleum. Butane is highly flammable and is an easily liquified gas. Butane makes up a small part of the natural gas mixture, but it's better known for its use in cigarette lighters, blowtorches, and portable stoves, and as an aerosol propellant, a refrigerant, and a heating fuel.

4) Propane: The chemical formula for propane is C_3H_8 . Small amounts of propane are a component of the natural gas mixture. we mainly use it as fuel for grills, portable stoves, buses, taxies, forklifts, and recreational vehicles. In rural areas of the United States, we also use propane for appliances, such as furnaces, laundry dryers, and water heaters. Propane combustion is not as clean as natural gas, but it is much cleaner than gasoline.

Energy use, especially from fossil fuels, is a major source of greenhouse gas emissions, driving climate change. Shifting to renewable energy like wind and solar is key to reducing these emissions. Energy production and consumption are major sources of greenhouse gas emissions, particularly from fossil fuels like coal, oil, and natural gas. These emissions contribute to climate change by increasing the concentration of carbon dioxide (CO₂) and other gases in the atmosphere. Renewable energy sources, such as wind, solar, and hydro, produce little to no emissions, making them crucial for reducing the global carbon footprint. Transitioning to cleaner energy is essential for mitigating environmental impact and achieving sustainability.

Strategies for Reducing Carbon Footprint

Practical Tips for Reducing Your Carbon Footprint

Reducing your carbon footprint doesn't have to be overwhelming. This guide provides a range of actions you can take, categorized by difficulty level. Remember, every small step counts. You don't need to implement all these changes at once – start with what feels manageable and gradually incorporate more over time. Your journey to a lower-carbon lifestyle is unique, and it's okay to progress at your own pace.



Unsplash
Anne Nygård, 2020



HOME

EASY

Switch to LED bulbs: LED lights use significantly less energy and last longer than traditional bulbs.

Turn off lights: Make it a habit to switch off lights when leaving a room.

Turn off electronic devices: Unplug or switch off devices when not in use to avoid standby power consumption.

MEDIUM

Improve home insulation: Better insulation reduces energy needed for heating and cooling.

Install water regulation pipes: This helps conserve water and reduce energy used for water heating.

Recycle trash: Proper recycling reduces waste and conserves resources.

HARD

Install solar panels: Generate clean, renewable energy for your home.

Use sustainable heating methods: Consider options like heat pumps for more efficient heating.

Invest in home energy storage: This can help optimize your use of renewable energy.

FOOD

EASY

Don't throw away leftovers: Reduce food waste by properly storing and consuming leftovers.

Buy local food: This reduces transportation emissions and supports local economies.

Buy seasonal food: Seasonal produce often requires less energy-intensive farming methods.

MEDIUM

Produce your own food: Growing your own fruits and vegetables reduces transportation emissions and packaging waste.

Avoid beef: Beef production has a particularly high carbon footprint compared to other foods.

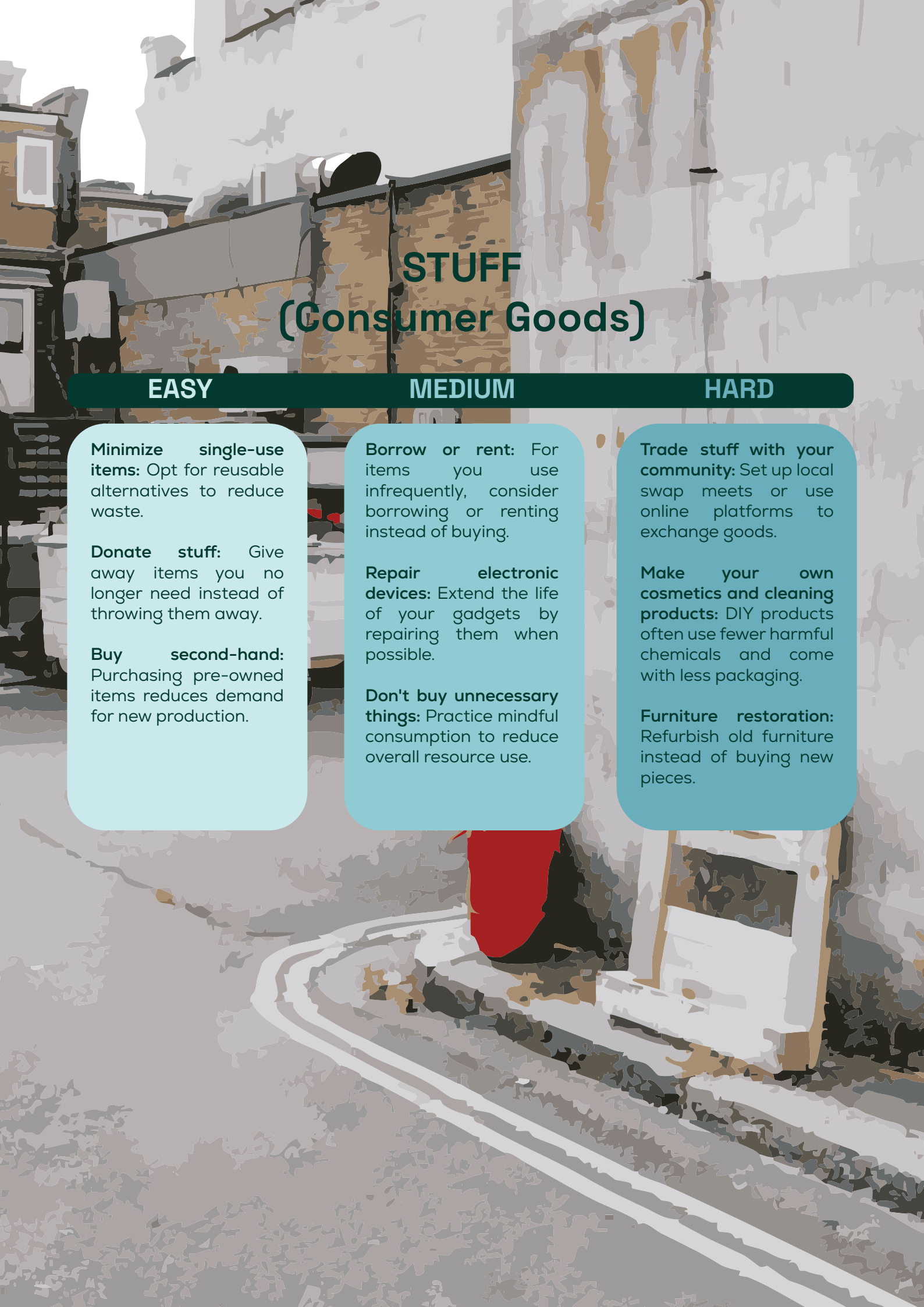
Eat more vegetables, less meat: Plant-based diets generally have a lower carbon footprint.

HARD

Go zero waste: Aim to minimize packaging and food waste in your kitchen.

Make compost: Composting food scraps reduces methane emissions from landfills and creates nutrient-rich soil.

Implement raw diet once a week: Eating raw foods occasionally can reduce energy used for cooking.



STUFF (Consumer Goods)

EASY

Minimize single-use items: Opt for reusable alternatives to reduce waste.

Donate stuff: Give away items you no longer need instead of throwing them away.

Buy second-hand: Purchasing pre-owned items reduces demand for new production.

MEDIUM

Borrow or rent: For items you use infrequently, consider borrowing or renting instead of buying.

Repair electronic devices: Extend the life of your gadgets by repairing them when possible.

Don't buy unnecessary things: Practice mindful consumption to reduce overall resource use.

HARD

Trade stuff with your community: Set up local swap meets or use online platforms to exchange goods.

Make your own cosmetics and cleaning products: DIY products often use fewer harmful chemicals and come with less packaging.

Furniture restoration: Refurbish old furniture instead of buying new pieces.

TRAVEL

EASY

Walk whenever you can: Walking is the most environmentally friendly way to travel short distances.

Use a bike: Cycling is an efficient, zero-emission mode of transport for longer trips.

Use public transport: Buses and trains generally have lower per-person emissions than private cars.

MEDIUM

Use a hybrid car: If you must drive, hybrid vehicles have lower emissions than traditional gasoline cars.

Work remote: When possible, working from home eliminates commuting emissions.

Go short, go green: For short trips, always opt for the greenest transportation method available.

HARD

Avoid using planes for short distances: Air travel has a high carbon footprint, especially for short trips.

Carpool: Sharing rides reduces the number of vehicles on the road and cuts per-person emissions.

Pay the green fee when using buses: Some transport services offer carbon offset options.

Remember, reducing your carbon footprint is a journey, not a destination. Every action you take, no matter how small, contributes to a larger positive impact on our environment. As you implement these changes, you'll likely find that many of them not only reduce your carbon footprint but also improve your quality of life and often save you money.

Don't be discouraged if you can't do everything at once. Start with the easy actions that fit your lifestyle, then gradually challenge yourself with medium and hard actions as you become more comfortable. Celebrate your progress along the way, and remember that by taking these steps, you're part of a global community working towards a more sustainable future.

Your efforts matter, and together, we can make a significant difference in combating climate change and preserving our planet for future generations.

Understanding and Reducing Energy and Gas Consumption

Energy production and consumption play a crucial role in our carbon footprint. To effectively reduce our impact, it's essential to understand the differences between various energy sources and how our choices affect greenhouse gas emissions.

The Impact of Energy Choices

The energy we use in our homes and for transportation significantly contributes to our personal carbon footprints. Traditional energy sources, such as coal, oil, and natural gas, release substantial amounts of carbon dioxide and other greenhouse gases when burned. These emissions trap heat in the atmosphere, leading to global warming and climate change.

Non-Green Energy Sources

Non-renewable energy sources, often referred to as "non-green" energy, include:

Coal: One of the most carbon-intensive energy sources, coal emits about 2.2 pounds of carbon dioxide per kilowatt-hour (kWh) of electricity produced.



Natural Gas: While cleaner than coal, natural gas still emits about 0.9 pounds of CO₂ per kWh.



Oil: Used primarily for transportation and heating, oil releases about 1.6 pounds of CO₂ per kWh when burned.



These sources not only contribute to climate change but also lead to air pollution and environmental degradation through mining and drilling activities.

Green Energy Alternatives

Renewable or "green" energy sources offer a much lower carbon footprint:

Solar: Photovoltaic panels produce no emissions during operation and have a life-cycle emission of about 0.07 to 0.18 pounds of CO₂ per kWh.



Wind: Wind turbines produce no direct emissions and have life-cycle emissions of 0.02 to 0.04 pounds of CO₂ per kWh.



Hydroelectric: While dam construction can have environmental impacts, operating hydroelectric plants produces very low emissions, typically 0.1 to 0.5 pounds of CO₂ per kWh.



Geothermal: Harnessing Earth's heat produces about 0.1 to 0.2 pounds of CO₂ per kWh.



Transitioning to these green energy sources can dramatically reduce our carbon footprint. For instance, switching from coal to solar power can reduce energy-related emissions by over 90%.

Gas Production and Consumption

Natural gas, while often touted as a "cleaner" fossil fuel, still contributes significantly to greenhouse gas emissions. Its production, transportation, and consumption all have environmental impacts:

Production: Extracting natural gas, especially through hydraulic fracturing (fracking), can lead to methane leaks. Methane is a potent greenhouse gas, about 25 times more effective at trapping heat than CO₂ over a 100-year period.



Transportation: Gas is transported through pipelines, which can leak, or as liquefied natural gas (LNG), which requires energy-intensive cooling and pressurization processes.



Consumption: When burned, natural gas produces CO₂, albeit less than coal or oil for the same energy output.



Green Alternatives to Natural Gas

Several green alternatives can replace natural gas in various applications:

Green Alternatives to Natural Gas

Several green alternatives can replace natural gas in various applications:

Biogas: Produced from organic waste, biogas can be used for heating and electricity generation with a much lower net carbon footprint.



Green Hydrogen: Produced using renewable electricity, green hydrogen can replace natural gas in many industrial processes and potentially in home heating and cooking.



Electrification: Replacing gas appliances with electric versions powered by renewable energy can significantly reduce emissions.



Strategies for Reducing Energy and Gas Consumption

To minimize your energy-related carbon footprint:

Energy Efficiency: Invest in energy-efficient appliances, improve home insulation, and adopt energy-saving habits.

Renewable Energy: Consider installing solar panels or switching to a green energy provider.

Electrification: Replace gas-powered devices with electric alternatives where possible.

Conscious Consumption: Be mindful of your energy use, turn off unused devices, and optimize heating and cooling.

Support Green Policies: Advocate for policies that promote renewable energy and energy efficiency in your community.

By understanding the impact of our energy choices and taking steps to reduce consumption and shift to greener alternatives, we can significantly decrease our carbon footprint. Remember, every kilowatt-hour saved or switched to a renewable source makes a difference in our collective fight against climate change.



VOLUME 3

CLIMATE and RECYCLING

5 CHAPTER

Into the Topic

What is Recycling?

Recycling transforms waste materials into new, reusable products, reducing landfill waste and conserving natural resources. It involves collection, sorting, cleaning, processing, and remanufacturing. Commonly recycled materials include paper, glass, plastic, and metals. Recycling not only limits raw material extraction but also shifts our mindset to view waste as a resource rather than disposable trash.

Recycling is an ancient practice. As early as 400 BC, ancient Greeks melted bronze to forge new weapons and tools. The Roman Empire recycled glass, while 11th-century Japan repulped used paper into new sheets. By the 1600s, Japan had a thriving paper recycling industry. In medieval Europe, blacksmiths repurposed old metal, and households reused fabric for rags, quilts, and stuffing.

During the Industrial Revolution, recycling gained momentum as factories generated more waste and needed more raw materials. Wartime recycling campaigns in the 20th century further ingrained the habit. In World War I and II, citizens collected rubber, tin, paper, and scrap metal to support the war effort. Slogans like "Waste Not, Want Not" reinforced resourcefulness, laying the foundation for modern recycling systems. Recycling is a key pillar of the circular economy, which emphasizes keeping materials in use as long as possible. It encourages companies to design products for durability and recyclability, and inspires individuals to consider the full lifecycle of the products they consume. While not a cure-all for environmental challenges, recycling is a practical step toward a zero-waste future.



Recycling has evolved from ancient necessity to modern responsibility. Today, it plays a critical role in global efforts to reduce environmental impact and protect the planet. Understanding its history, benefits, and role in sustainable systems empowers us to make better choices and contribute to a cleaner, more resilient world.



Benefits of Recycling

Recycling plays a vital role in protecting the environment and creating a healthier, more sustainable future. By turning used materials into new products, we reduce the strain on our planet, conserve resources, and lessen pollution. Here are some of the **key benefits of recycling**:

1

Conservation of Natural Resources

Recycling helps preserve the Earth's limited resources. By reusing materials, we reduce the need to extract new resources such as timber, minerals, oil, and water. For instance, recycling paper and wood helps protect forests, including irreplaceable ecosystems like rainforests and ancient woodlands. Recycling plastic cuts down on the need for new plastic production, which relies heavily on fossil fuels. Recycling metals decreases the demand for costly and environmentally damaging mining. Even glass benefits from recycling, as it helps conserve sand, a natural resource that is becoming increasingly scarce in parts of the world.

2

Combating Climate Change

Recycling generally uses less energy than making new products from raw materials, leading to lower greenhouse gas emissions. It also prevents waste from going to landfills, where materials like food scraps release methane, a powerful greenhouse gas. According to the EPA, recycling and composting municipal waste in 2018 prevented over 193 million metric tons of CO₂ equivalent from entering the atmosphere a significant contribution to fighting climate change.

3

Energy Savings

Using recycled materials typically requires much less energy: Recycling aluminum saves up to 95% of the energy compared to producing new aluminum.

Steel: about 70% energy savings.

Paper: around 40% energy savings.

Recycling a single glass bottle can power a 100-watt light bulb for 4 hours, and recycling 10 plastic bottles can power a laptop for more than 25 hours.

4

Protection of Ecosystems and Wildlife

Recycling helps reduce the need for extracting new raw materials, which in turn protects ecosystems. This means fewer forests are destroyed, rivers are less likely to be diverted, and wildlife is not displaced from their habitats. It also helps prevent plastic waste from polluting waterways and oceans, where it can travel thousands of miles and cause harm to marine life.

5

Economic Benefits

Recycling can also be financially beneficial. According to Lambeth Council in London, it is 6 times cheaper to dispose of recycled waste compared to general refuse. The EPA's 2020 REI Study found that in just one year, recycling and reuse activities in the U.S. supported:

681,000 jobs
\$37.8 billion in wages
\$5.5 billion in tax revenue

That's roughly 117 jobs per 1,000 tons of recycled material and \$65.23 in wages per ton.

6

Positive Local Impact

Recycling reduces the pressure on communities located near landfills and waste-processing plants. These areas often suffer from poor air quality, lowered property values, and health concerns. More recycling means less waste, leading to cleaner, healthier, and more livable neighborhoods.

Fun Recycling Facts

Recycling

1 aluminum can saves enough energy to power a TV for **3** hours.

Making paper from recycled content reduces air pollution by **74%**

The average person could recycle over

25.000 cans in their lifetime.

Recycling

1 ton of paper saves **17** trees and **7.000** gallons of water.



A plastic bottle can take up to

450 years to decompose in a landfill.

Recycling Myths & Truths

Myth 1: Everything with a Triangle Icon Can Be Recycled

Truth: The triangle just identifies the type of plastic. It does not guarantee recyclability—check your local recycling rules.

Myth 2: Most Plastic Products Can't Be Recycled

Truth: Many household plastics like shampoo and soap bottles can be recycled. Items like polystyrene, toothpaste tubes, and blister packs usually can't.

Myth 3: Recycling Takes More Energy Than It Saves

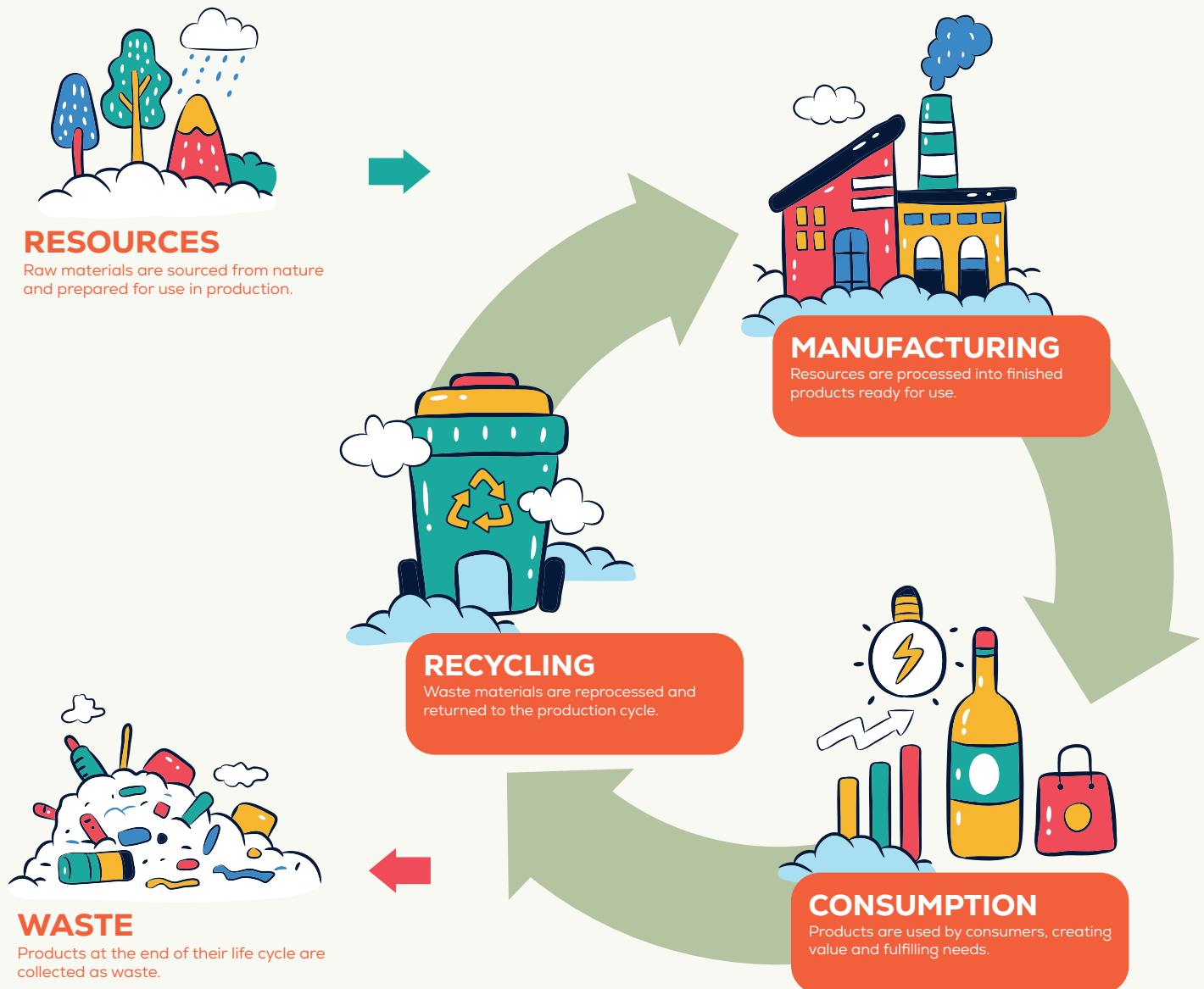
Truth: It's actually the opposite. Recycling saves significant energy, especially with materials like aluminum and steel.

Myth 4: Recycled Materials Are Lower Quality

Truth: Recycled materials today often match the quality of new materials. Proper sorting helps prevent contamination and ensures higher quality output.

CIRCULAR ECONOMY and ZERO WASTE PRINCIPLES

The circular economy is a production and consumption model focused on maximizing the use of resources by encouraging activities like sharing, leasing, reusing, repairing, refurbishing, and recycling. This approach aims to extend the lifespan of products and materials for as long as possible. In practice, this means minimizing waste generation. When a product is no longer usable, its components are recycled and reintegrated into the economy. This continuous use of materials helps generate ongoing value and supports a more sustainable system.



What are the benefits, if it would be considered to be implemented, of a Circular Economy?

Protecting the Environment

The process of recycling is slowing down the use of natural resources and it would limit the use of Biodiversity. One more advantage that comes with applying the Circular Economy system is the significant reduction of Green House Emissions. Packaging waste is a big problem, on average the EU is producing 190 kg of waste.

Reducing raw material dependence

As the global population grows, so does the demand for raw materials—many of which are finite. This makes the EU increasingly reliant on imports. In 2022, the average European used 14.9 tonnes of raw materials, and by 2023, the EU had a €29 billion trade deficit in raw materials. Recycling and reusing materials can help protect against supply shortages, price volatility, and geopolitical risk. This is particularly important for critical raw materials essential for green technologies like electric vehicles, batteries, and renewable energy infrastructure. Creating jobs and saving consumers money The transition to a circular economy can drive innovation, enhance competitiveness, and strengthen economic growth. It's projected to create up to 700,000 new jobs in the EU by 2030. Designing products for circular use not only benefits the environment but also spurs innovation across sectors. Consumers stand to gain access to more reliable, longer-lasting products—saving them money while improving their quality of life.

What is the EU doing to become a circular economy?

The European Union is committed to becoming a circular and climate-neutral economy by 2050. To support this transformation, it has introduced or updated a range of legislative measures focused on sustainability and waste reduction. These include:

- Ecodesign regulations to ensure products are made to last, be repaired, and be recycled
- Packaging reforms to reduce waste and encourage reuse
- The right to repair, empowering consumers to extend the life of their products
- Anti-greenwashing rules, ensuring transparency in environmental claims
- Improved waste management systems, supporting more efficient recycling and recovery

Together, these policies aim to build a more resilient, sustainable, and circular future for Europe.

BASIC ZERO WASTE PRINCIPLES

The first important thing to understand is that there is not a set of like 10 particular solutions that are going to save this Planet, but there are some extremely important principles you need to know. The First One is learning to avoid the single use items. The negative impact that these objects produce during the production is not offset by a long time use of this item. The important thing is to be aware of how many plastic we consume and try to reduce it in the years (don't become part of plastic fobia). Another important principle everyone of us can adopt is being mindful and not exaggerating when buying stuff. The third principle is reuse and repurpose things to extend their life cycle. An example can be using second hand stuff. And the last principle is called boycott. It is the ability to support all the brands and associations that are good for our planet. So it is really important to make some kind of choices, also because of the next generations.



RECYCLING SYSTEM AROUND THE WORLD

Recycling practices vary worldwide, influenced by economic development, policies, cultural values, and public awareness. Some countries, like Germany and Sweden, have highly efficient recycling systems, supported by strict regulations, advanced technology, and strong citizen participation. Residents sort waste into multiple categories, ensuring high recycling rates. In contrast, many developing nations rely on the informal recycling sector, where waste pickers play a key but often undervalued role in managing recyclables.

Global Recycling Best Practices

1. Reduce Landfill Waste

Implement strict waste sorting regulations.

Promote deposit return systems for bottles and cans.

Develop waste-to-energy solutions for non-recyclable materials.

2. Improve Public Participation

Launch awareness campaigns on recycling benefits.

Provide accessible recycling bins in public spaces.

Introduce incentive programs to encourage recycling.

3. Strengthen Recycling Infrastructure

Establish efficient waste collection systems.

Support public-private partnerships to expand facilities.

Encourage businesses to use sustainable packaging.

4. Embrace Innovation Utilize

AI-powered sorting systems.

Invest in chemical recycling for plastics.

Develop biodegradable materials.

EXAMPLES FROM PARTICIPANT COUNTRIES



This chapter builds a foundation for understanding recycling's role in the circular economy and zero waste movement. By sharing global insights and real-world examples, we highlight both success stories and challenges, inspiring participants to reflect on their own countries' systems. This perspective encourages active engagement and meaningful discussions throughout the presentation.



- ✔ Deposit Return System encourages bottle recycling.
- ⚠ Needs improved public participation.



- ✔ Zero Waste Project promotes sustainability.
- ⚠ Struggles with illegal dumping.



- ✔ Strict sorting laws ensure high recycling rates.
- ⚠ Needs better plastic and e-waste management.



- ✔ Awareness campaigns encourage participation.
- ⚠ Faces illegal dumping issues.



- ✔ Milan's door-to-door system improves urban recycling.
- ✔ CONAI (National Packaging Consortium) enhances recycling efficiency and awareness.
- ⚠ Regional disparities in waste management.



- ✔ Public-private partnerships enhance recycling.
- ⚠ Lacks infrastructure and awareness.

NATURE'S WAY

LEARNING FROM NATURE

DECOMPOSITION IN NATURE: HOW FOREST RECYCLE ORGANIC MATTER

Decomposition in the forest is a team effort. Meet the key players behind nature's ultimate recycling system:

Fungi – The Master Recyclers

Fungi break down tough stuff like wood and leaves using powerful enzymes. Examples: Bracket fungi, mycorrhizal fungi (which also help tree roots absorb nutrients). Without fungi, dead trees would stick around forever.

Bacteria – The Microscopic Clean-Up Crew

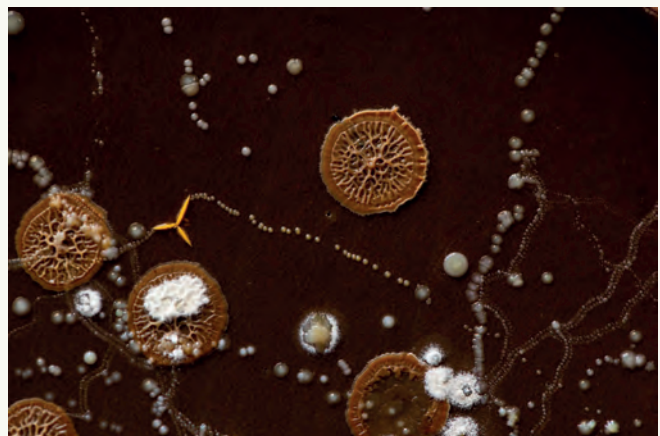
Tiny but mighty, bacteria decompose organic material into nutrients plants can reuse. Examples: Soil bacteria, nitrogen-fixers. They're the invisible workers turning rot into renewal.

Detritivores – The Shredders

These invertebrates chew up dead matter, making it easier for fungi and bacteria to finish the job. Examples: Earthworms, beetles, millipedes, woodlice. Think of them as nature's recyclers with big appetites.

Scavengers – The First Responders

Larger animals that feed on dead plants and animals, breaking things down quickly. Examples: Foxes, wild boars, ants, vultures. They start the process and pass the rest to the clean-up crew.



BIOMIMICRY: WHAT NATURE TEACHES US ABOUT REUSE AND BALANCE

Biomimicry is the practice of learning from and imitating nature's time-tested strategies to solve human problems in sustainable ways. Nature is a master of efficiency—organisms reuse materials, minimize waste, and operate within closed-loop systems. Through biomimicry, humans can create designs, technologies, and systems that are both innovative and environmentally friendly.

Key Principles from Nature

- **Waste = Resource:** In natural ecosystems, nothing is wasted. Dead leaves become soil, animal waste feeds plants, and every byproduct is reused.
- **Efficiency Through Design:** Nature uses simple, elegant structures that achieve maximum effect with minimal materials.
- **Balance and Adaptability:** Natural systems are interconnected and able to adapt to changing conditions without collapsing.



Real-World Examples of Biomimicry

1. Kingfisher-Inspired Bullet Trains (Japan)

The Shinkansen train's nose was redesigned based on the beak of a kingfisher bird to reduce noise and improve energy efficiency. This change allowed the train to exit tunnels silently and consume less electricity.

2. Termite Mound-Inspired Architecture (Zimbabwe)

Termite mounds maintain constant internal temperatures despite extreme outside heat. Architects mimicked this for buildings like the Eastgate Centre in Harare, which uses natural ventilation instead of air conditioning.

3. Lotus Leaf-Inspired Self-Cleaning Surfaces

The lotus leaf has microscopic structures that repel water and dirt. This has inspired paints and glass coatings (like in self-cleaning windows) that minimize the need for chemical cleaning agents.

4. Namib Beetle-Inspired Water Collection

In the desert, the Namib beetle captures water from fog on its bumpy back. Engineers have used this concept to create materials that gather water from humid air, helping drought-prone areas.

5. Whale Fin-Inspired Wind Turbines

The bumps (tubercles) on humpback whale fins improve movement through water. These inspired the design of more efficient and quieter wind turbine blades.

THE ROLE OF BIODIVERSITY IN ECOSYSTEM RESILIENCE

What is Ecosystem Resilience?

Ecosystem resilience refers to an ecosystem's ability to withstand disturbances—such as climate change, natural disasters, or human activities—and recover while maintaining its essential functions and structures. Biodiversity plays a pivotal role in enhancing this resilience by providing a variety of species that can respond differently to environmental changes, ensuring the stability and continuity of ecosystem services.

How Biodiversity Enhances Resilience

- 1. Functional Redundancy:** Multiple species often perform similar roles within an ecosystem. This overlap means that if one species is lost, others can fulfill its function, maintaining ecosystem stability.
- 2. Response Diversity:** Different species and even individuals within a species may respond uniquely to environmental stressors, providing a buffer against disturbances.
- 3. Adaptive Capacity:** Genetic diversity within species allows populations to adapt over time to changing conditions, enhancing long-term ecosystem resilience.



Unsplash
Daniel Mirlea, 2024

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Real-World Examples

• **Coral Reefs:** These ecosystems are among the most biodiverse on Earth. High biodiversity in coral reefs contributes to their resilience against threats like bleaching and storms.

Biodiversity plays a crucial role in the resilience of coral reef ecosystems. Coral reefs are among the most diverse ecosystems on Earth, hosting thousands of marine species—from fish and crustaceans to sea turtles and algae. This biodiversity enhances the reef's ability to recover from disturbances like storms, bleaching events, or pollution. The variety of species means that if one is affected, others can often fill its role, maintaining the overall function of the ecosystem.

One well-known case of coral reef recovery is the Great Barrier Reef's recovery after the 2006 cyclone. That year, Cyclone Larry caused significant physical damage to coral structures, especially in the central part of the reef. However, thanks to the reef's high biodiversity, certain fast-growing coral species like *Acropora* began to repopulate the damaged areas relatively quickly. Over the next few years, herbivorous fish and sea urchins helped control algae growth, which allowed new coral larvae to settle and grow. This example shows how biodiversity supports recovery, as different species played specific roles in rebuilding the ecosystem.



• **Mangrove Forests:** Mangroves support a wide range of species and protect coastlines from erosion and storm surges. Their complex root systems provide habitats for various marine life, contributing to ecosystem resilience.

Mangrove forests consist of multiple species of trees with varying root structures. This diversity strengthens the ecosystem's ability to reduce coastal erosion and absorb storm surges, protecting shorelines from extreme weather events. A diverse community of plants, microbes, and animals contributes to efficient nutrient cycling, maintaining soil fertility and supporting the overall health of the ecosystem. Different species often perform similar ecological functions (e.g., carbon sequestration, sediment trapping). If one species is lost due to environmental stress, others can fill the role, preventing system collapse. Genetic diversity within species allows for adaptation to changing environmental conditions, such as increasing salinity or temperature fluctuations, ensuring long-term survival.

Diverse mangrove ecosystems host various predator-prey relationships, controlling pest populations and preventing outbreaks that could damage tree populations.

• **Grassland Ecosystems:** Diverse plant species in grasslands ensure that some can thrive under changing conditions, maintaining productivity and soil health.

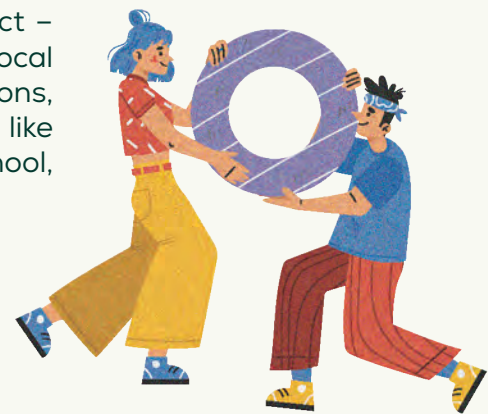
A diverse mix of deep-rooted and shallow-rooted grasses, along with nitrogen-fixing plants, helps prevent soil erosion, retain moisture, and maintain nutrient cycling. This keeps the grassland productive even in harsh conditions. Different plant species have varying drought tolerance. Biodiversity ensures that even if some species struggle under extreme weather, others will continue to thrive, maintaining ecosystem functions. Many grassland species are fire-resistant or regenerate quickly after burning. A mix of fire-adapted species ensures the ecosystem can recover after natural or human-induced fires.

Biodiversity supports a range of herbivore species, which in turn helps regulate plant populations. Predators help control herbivore numbers, preventing overgrazing and promoting plant regrowth. Grasslands support diverse pollinators (bees, butterflies) and seed dispersers (birds, small mammals), ensuring plant reproduction and genetic diversity. Diverse plant and animal communities reduce the risk of disease

Community Recycling From Global to Local

Recycling is more than a habit – it's a community mindset. Around the world, local initiatives show how powerful people can be when they come together for a shared cause. Community-based recycling creates real change, starting small but often spreading wide. A good example is the village of Reka, where children spend an entire week each year focused only on recycling. Regular school lessons are paused, and students get involved in sorting, collecting, crafting, and raising awareness. Families, teachers, and neighbors work together.

This hands-on experience teaches the value of recycling in a fun, memorable way – and it strengthens community ties. In contrast, cities like Milan lack this kind of initiative. Despite having access to recycling systems, many residents feel disconnected. Recycling becomes a boring chore rather than a shared goal. This shows that without community support and creative education, even the best infrastructure can fail to engage people. Awareness is key. To pull people in, initiatives must be creative and emotional. Storytelling, local campaigns, and school programs can help. One powerful idea is collecting plastic caps to fund wheelchairs for people in need. It's a simple action with a big impact – making recycling a tool for social inclusion. Global problems need local solutions. When people feel involved and see the results of their actions, they are more likely to keep going. Let's learn from inspiring places like Reka and bring the spirit of community recycling into every town, school, and street.



Challenges & Strengths for Small Communities

Small communities face a unique mix of challenges and strengths when it comes to recycling. On one hand, there's a strong local spirit and the ability to organize easily. On the other hand, there are serious obstacles like lack of information, awareness, and infrastructure. One major challenge is limited access to information. Without proper education or campaigns, many people in villages don't understand what recycling really means or how to do it correctly. Unlike big cities with billboards, apps, and social media campaigns, small communities often miss out on clear messages about waste management. Marketing and awareness are also weak points. If no one talks about recycling or promotes it locally, people won't see it as a priority.

In many villages, there are no recycling bins at all, or they are placed far from homes, making it inconvenient to participate.

However, small communities also have strengths. People know each other, and it's easier to organize locally. A group of motivated residents or a local school can quickly start a small recycling project or a composting system. Unlike urban areas, there is often less waste overall, since many people grow their own food, reuse materials, and compost as part of daily life.

In the end, while small communities face real barriers, they also have the power to create simple, efficient, and personal recycling solutions – especially when supported by the right information and tools.

Connection to Rimella

Small villages like Rimella are often overlooked when it comes to environmental strategies, but they hold great potential for circular economy models – even beyond recycling. Supporting these villages means supporting a more sustainable and connected future. One key idea is to “adopt the village” – not just as a place to visit, but as a space to invest time, care, and resources. When people from the city come to the village, they contribute to the local economy, help revive traditions, and support small-scale, organic living. This connection benefits both sides: villagers gain support, and city dwellers reconnect with nature and simpler lifestyles.

Rimella can also be a model of circular living. In small communities, things are often reused naturally: food waste becomes compost, materials are passed down or repurposed, and buying is done locally. Even if recycling infrastructure is missing, the lifestyle itself is sustainable. Organic products, often cheaper and fresher in villages, are another advantage. With more awareness, visitors can help boost this model – buying locally, sharing knowledge, and encouraging responsible tourism. Governments or national campaigns could help by promoting visits to rural areas like Rimella. When more people come, they bring ideas, energy, and interest – all of which can lead to better recycling practices and stronger communities. Supporting villages means more than just preserving tradition – it means building a future that is greener, fairer, and more connected.

Involving Residents through Awareness & Other Creative Ways

Getting people involved in recycling and composting doesn't happen by chance – it requires effort, creativity, and clear communication. One of the biggest mistakes is expecting residents to search for information on their own. Instead, we should bring the information to them. Workshops, local events, and hands-on demonstrations are powerful tools. For example, organizing a session every two weeks in the community – in a school, park, or community center – can help people understand how to compost properly. Seeing it in action is much more effective than reading about it.

People are more likely to participate when they feel included and informed. That's why local organization is key. It's not just about rules, but about showing people why recycling and composting matter, how they can do it easily, and how it benefits their daily lives. Creative methods like games for children, DIY activities using recycled materials, or friendly neighborhood competitions can turn awareness into action. It also helps build a stronger sense of community.

In small towns or villages, these actions are easier to organize. When the right knowledge reaches people in a friendly, direct way, they are far more likely to join and stay engaged. Recycling becomes not just a habit – but a shared value.



Reflection on the Cleaning Activity and Its Impact

Cleaning activities are a great way to raise awareness, but they also show us a simple truth: if everyone was already aware and responsible, we wouldn't need them at all. Picking up trash shouldn't be necessary – and yet, it often is.

During our local clean-up, we noticed specific patterns. Construction sites and areas near schools or playgrounds were often full of waste. This tells us where awareness is missing and where we need to focus our efforts. But one thing stood out more than anything else: cigarette butts. They were everywhere. Small, hard to pick up, and easily ignored – but incredibly harmful for the environment. This highlights a major issue: some waste is not about quantity, but about frequency and habit.

People don't think twice before throwing away a cigarette, but millions of small actions add up. These activities help people realize the problem is real and visible. They also remind us that awareness must come before action. Cleaning once is not enough. We need to change habits, educate others, and prevent pollution before it starts. The goal is not to clean every week – the goal is to live in a community where there's no need to.



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Nguyen Minh, 2024

VOLUME 4

ENERGY, ECO-GARDEN and CLIMATE

6 CHAPTER

Key Terms Related to Climate, Energy and Eco-Garden

Energy-related key-terms



Renewable Energy:

Energy that comes from naturally replenishing sources such as sunlight, wind etc. It is considered clean and sustainable, unlike fossil fuels.



Geothermal Energy:

Heat Energy derived from the Earth's interior often used for electricity generation or heating buildings in geologically active areas.



Solar Thermal Collector:

A system that uses sunlight to heat water or air directly, used in domestic hot water systems or space heating.

Photovoltaic Panel:

A device that converts sunlight directly into electricity using semiconductor materials. Commonly referred to as solar panels.

Greenhouse Gas Emissions:

Gases such as carbon dioxide (CO₂) and methane (CH₄) that trap heat in the Earth's atmosphere, contributing to global warming. Renewable energy reduces these emissions.

Energy Efficiency:

Using less energy to perform the same task – for example, LED lighting or well-insulated buildings – reducing the overall energy demand.

Wind Turbine:

A machine that converts the kinetic energy of wind into mechanical energy, which is then used to generate electricity.

Off-grid System:

Reduction in a forest's ability
An independent energy system not connected to the public electricity grid. Often powered by renewable sources, especially in remote areas.

Hydropower:

Electricity generated by harnessing the movement of water, typically through a dam or river system. It is one of the oldest and most established renewable technologies.

Biomass:

Organic material from plants and animals used as fuel. It includes wood, crop residues, and manure, and can be burned or converted into biofuels.

Key Terms Related to Climate, Energy and Eco-Garden

Eco-Garden related key terms



Eco-Gardening:

A sustainable gardening approach that emphasizes organic practices, biodiversity, water conservation, and soil health.

Compost:

Decomposed organic matter (like food scraps and garden waste) used to enrich soil naturally and improve its fertility.

Natural Fertilizer:

Plant or animal-based substances that add nutrients to the soil without chemicals, such as compost, manure, or compost tea.

Organic Gardening:

A method of gardening that avoids synthetic chemicals and relies on natural processes to maintain soil and plant health.



Permaculture:

A system of agricultural and social design principles centered around simulating or directly utilizing the patterns and features observed in natural ecosystems

Pollinator-Friendly Plants:

Plants that attract bees, butterflies, and other pollinating insects, which are essential for healthy ecosystems and crop production.

Greywater:

Wastewater from sinks, showers, or washing machines that can be safely reused to irrigate gardens when properly managed.



Rainwater Harvesting:

A system that uses sunlight to heat water or air directly, used in domestic hot water systems or space heating.

Rainwater Harvesting:

The collection and storage of rainwater for reuse, typically for irrigation, reducing demand on municipal water systems.

Mulch:

A layer of organic or inorganic material placed on top of soil to retain moisture, suppress weeds, and improve soil health.

Raised Bed:

A planting area built above ground level, often used in eco-gardening to improve drainage, reduce soil compaction, and control soil quality.

Renewable Energy: Resources and The Basics

Renewable energy refers to energy derived from natural processes that are continuously replenished. Unlike fossil fuels such as coal, oil, or gas which take millions of years to form and contribute significantly to pollution and climate change **renewable energy** is **clean, sustainable, and abundant**. Common sources include sunlight, wind, water, organic materials, and heat from beneath the Earth's surface.

The global shift toward renewable energy is essential to reducing greenhouse gas emissions, combating climate change, and ensuring long-term access to affordable and reliable energy. These energy sources are not only environmentally friendly, but they also promote innovation, community development.
International Energy Agency (2023)



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There are **five** main types of **renewable energy**

1 Solar Energy

Solar energy is generated by capturing sunlight and converting it into electricity or heat. This can be done using photovoltaic (PV) panels or solar thermal collectors. Solar energy is widely accessible, especially in sunny regions, and is used for powering homes, heating water, or charging small devices. It is one of the most scalable renewable technologies.

2 Wind Energy

Wind energy harnesses the power of moving air to turn turbines that produce electricity. Wind farms are often located in open, windy areas such as plains, coastal zones, or hilltops. Wind power is now one of the fastest-growing sources of electricity worldwide and is widely adopted in both large and small-scale applications.

3 Hydropower

Also known as hydroelectric power, hydropower uses flowing or falling water to spin turbines that generate electricity. It is one of the oldest and most reliable forms of renewable energy.

4 Biomass

Biomass energy is produced from organic materials, such as wood, crop residues, or animal waste. These materials can be burned to generate heat or converted into biofuels like biogas or biodiesel. Biomass is considered renewable when it uses waste or sustainably harvested sources, and it can contribute to reducing reliance on fossil fuels when managed responsibly.

5 Geothermal Energy

Geothermal energy comes from the heat stored beneath the Earth's surface. It can be used to generate electricity or directly heat buildings, especially in regions with volcanic or tectonic activity. Geothermal systems are low-emission and provide a constant energy supply, regardless of weather conditions.



How Youth Can Use Renewable Energy?

Young people play a vital role in advancing renewable energy and sustainability. Even without access to major investments or large-scale technologies, they can take impactful steps in their daily lives and communities. Simple habits like turning off unused appliances, using natural light, or adopting solar-powered devices can significantly reduce energy consumption and reliance on fossil fuels. These small-scale actions, when practiced widely, contribute meaningfully to the clean energy transition.

In schools and youth organizations, young people can **lead or support sustainability initiatives** such as advocating for solar panels, forming environmental clubs, or organizing awareness events about renewable energy. Educational kits and hands-on activities like building mini wind turbines or solar cars help them learn through doing and foster innovation and engagement.

Beyond personal and school-based efforts, youth can act as **advocates by sharing knowledge with peers and the public through social media or community projects.** Campaigns, workshops, or clean energy demonstrations led by young people can influence local policy and build momentum for change. Choosing to support eco-conscious businesses and avoiding energy-intensive products also reinforces responsible consumer behavior aligned with clean energy goals.

Finally, by **pursuing studies or careers in renewable energy, environmental science, or sustainability fields,** youth contribute long-term to the growing green economy. In all these ways, young people are not just participants but leaders in the shift toward a more sustainable, climate-resilient future turning renewable energy into a shared cultural norm.

International
Energy Agency (2023).



“ Small actions, bold voices
youth power
the **future of clean energy.**

”



Eco-Gardening: Theory and Benefits

Eco-gardening is a method of **growing plants that respects natural ecosystems and minimizes harm to the environment.** It promotes sustainable living by using natural resources wisely, avoiding chemicals, and creating green spaces that support biodiversity. Unlike industrial farming or decorative gardening that often relies on synthetic inputs, eco-gardening is based on organic principles and low-impact practices.

At its core, **eco-gardening combines ecological awareness with practical action.** It can be practiced on any scale from a school garden or backyard to a small balcony with pots and containers. It is accessible to people of all ages, especially young people who want to engage directly with nature and learn how to grow food or flowers in a responsible way. WWF (2022).



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© Jed Villego

key principles behind eco-gardening

Use of natural inputs: Fertility is maintained using compost, mulch, and organic materials rather than chemical fertilizers or pesticides. This helps keep the soil healthy and avoids pollution.

Water conservation: Eco-gardens use efficient watering techniques, such as drip irrigation or rainwater harvesting, to minimize water waste.

Support for biodiversity: A variety of plants, especially native species and pollinator-friendly flowers, are included to attract bees, butterflies, and birds. This strengthens the local ecosystem.

Waste reduction: Organic waste is recycled into compost. Recycled materials, like old containers or wood pallets, are used for garden beds and structures.

Low energy and low cost: Eco-gardening does not require heavy machinery or expensive inputs, making it suitable for youth groups, schools, or community projects.

The **benefits of eco-gardening** go beyond environmental impact. It offers educational, personal, and social advantages:

Learning through doing: Gardening teaches biology, ecology, and climate principles in a hands-on way. It helps young people understand how food grows and what plants need to thrive.

Health and well-being: Spending time in nature and growing your own food encourages physical activity, reduces stress, and can improve nutrition. Home-grown vegetables and herbs are often fresher and more nutritious than store-bought options.

Community building: Eco-gardens are great tools for teamwork and cooperation. School or community gardens bring people together, promote social inclusion, and can support local food-sharing or donation efforts.

Importantly, **eco-gardening empowers young people to take action on climate and sustainability issues** in a direct and visible way. Even a small herb pot on a windowsill or a raised bed in a shared space can inspire others and spark positive change.



A background image showing a person's hands holding a small green plant in a brown pot. A shovel is visible in the bottom left corner. The image is slightly blurred and has a warm, earthy color palette.

Starting Your Own Eco-Garden

A Step-by-Step Guide Starting an eco-garden is a rewarding way to connect with nature and contribute to sustainability. Whether you have a backyard, a balcony, a rooftop, or just a few containers near a window, you can create a small green space that benefits both you and the environment. This section offers a practical guide to help young people begin their own eco-gardening journey.

1.Choose Your Space

Find a sunny spot – balcony, windowsill, rooftop, or yard – and start small.

2.Select Your Plants

Pick easy, local plants like herbs (basil, mint), vegetables (lettuce, tomatoes), and flowers that attract pollinators.

3.Prepare the Soil

Use compost or organic mix. Avoid chemicals and enrich with natural materials.

4.Plant with Care

Follow spacing rules, water properly, label plants, and observe daily.

5.Water Efficiently

Water early/late in the day, focus on roots, and collect rainwater if possible.

6.Reuse and Recycle

Use old containers, kitchen waste, and biodegradable materials to reduce waste.

7.Maintain Naturally

Weed and feed regularly. Use natural pest control and rotate crops seasonally.

Using Natural Fertilizers

Natural fertilizers are eco-friendly, cost-effective alternatives to chemical fertilizers. They enrich soil health, reduce pollution, and promote a sustainable gardening cycle by reusing organic waste. Common types include:

Compost: Made from food and garden scraps, compost is nutrient-rich and improves soil quality. It's created by layering green (wet) and brown (dry) materials, turning occasionally, and letting them decompose over time.

Compost Tea: A liquid fertilizer made by soaking compost in water for a few days. It provides a quick nutrient boost and is great for seedlings.

Eggshell Powder: Crushed or blended eggshells add calcium to the soil, helping prevent plant diseases like blossom-end rot.

Banana Peel Water: Soaking banana peels in water creates a potassium-rich liquid for flowering or fruiting plants.

Coffee Grounds & Tea Leaves: Used grounds and leaves offer nitrogen and organic matter, especially for acid-loving plants. They should be used in moderation.



Practical Workshop Tips for Youth Groups



Eco-workshops are powerful tools for teaching sustainability, encouraging teamwork, and engaging young people in climate action. This guide provides practical tips for planning and running effective workshops on themes like renewable energy, eco-gardening, composting, and rainwater harvesting.

1. Choose a Clear Focus:

Each workshop should center around a single topic for better engagement—such as making compost, building a solar oven, or starting a recycled container garden.

2. Use Simple, Low-Cost Materials:

Materials like used containers, seeds, compost, foil, and cardboard are often enough. Reuse and local sourcing are encouraged.

3. Plan Interactive Sessions:

Divide the workshop into parts—intro, demonstration, hands-on activity, group reflection, and a takeaway challenge. Keep sessions engaging and age-appropriate.

4. Make It Inclusive and Fun:

Use simple language, visual aids, and creative tasks (e.g., drawing, games, music). Encourage expression and participation from all.

5. Involve the Community:

Partner with local schools or groups for support and visibility. Document the activity through photos or short reflections to share outcomes.

Workshops empower youth as change-makers. With creativity and teamwork, even small groups can lead impactful activities that promote environmental responsibility.

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Eco-Literacy Guide

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