

Colourful World:

an educational game for children
about Sustainable Development



Implementation Guide

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Colourful World: an educational game for children about Sustainable Development
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As climate change, overpopulation, and inequalities begin to take their toll on our planet and on global human development, Sustainability has become increasingly important for a prosperous future.

The United Nations (UN) defines Sustainable Development (SD) as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. As such, SD calls for concerted efforts towards building an inclusive, sustainable and resilient future for people and the planet, by harmonizing: economic growth, social inclusion and environmental protection. Science, Technology, Engineering and Mathematics (STEM) has, at this level, a huge role to play as it can provide answers to this vital harmonization.

In recent years, SD has become prominent in the political agenda of the European Union (EU). In 2001, the EU established a SD Strategy and more recently was a major contributor to the UN's 2030 Agenda for SD.

One cannot talk about SD without highlighting the role of education. Education is central to efforts to develop and promote sustainable solutions for the development needs of both people and the planet (UN, 2013).

Education for Sustainable Development (ESD) should be understood as an integral part of quality education and lifelong learning. All educational institutions ranging from preschool to tertiary education and including both non-formal and informal education should consider it their responsibility to address sustainable development and to foster the development of key cross-cutting competencies related to sustainability. (Issues and Trends in ESD, UN, 2018)

As noted, ESD should start early in school (UN, 2018). It is in early childhood that children often experience the greatest environmental challenges, and it is a time when the foundations of many of their fundamental attitudes and values are established. We know from research and from experience that even very young children are capable of sophisticated thinking in relation to socio-environmental issues and that the earlier ESD ideas are introduced, the greater their impact and influence can be.

In the EU Member States, SD tends to be covered at the higher levels of school education (EACEA, 2017). In primary schools ESD is insufficiently addressed. It is common to find some SD related topics covered in class (e.g. environmental protection, waste), but usually not as part of a holistic approach.

The Colourful World project aims to develop an innovative and playful pedagogy for the Sustainable Development education of children (6 to 10 years old) and to raise their interest in STEM. This pedagogy is based on a computer learning game for formal, non-formal and informal learning contexts.

Alongside the Game, this guide is produced for educators to facilitate the use of the game in

learning contexts.

This initiative gathers 6 partners from the UK, Portugal, Poland and Greece, encompassing a higher education institution, primary school and companies.

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Education for sustainable development and citizenship education using gaming

Foreword

In our effort to design a learning Game about Sustainability, we considered many relevant reports and sources.

In this guide we discuss the 2030 Sustainable Development Goals adopted by the United Nations and present the 17 Education for Sustainable Development Goals adopted by the United Nations in 2015.

Additionally, we are mindful of the World Organization for Early Childhood Education's (OMEP) contribution to Education for Sustainable Education in the Early Years.

Talking about Education for Sustainable Development is always related to Citizenship Education. Education for Sustainable Development, the fight to transform our world towards the 2030 Sustainable Development Goals in order to mitigate the effects of Climate Change, all require informed and active citizens. So, Citizenship Education is crucial and we have to consider Citizenship Education at School in Europe as it was presented in the Eurydice study in 2017.

In the context of contemporary technology, new learning tools have emerged with the use of Information and Computer Technology (ICT). Among them, the gamification solution; a playful way to use modern technology in order to present important issues and problems to sensitize children and adult citizens, and to urge them to be part of the solution by understanding and addressing social and environmental problems.

Finally, considering all the above, we set Learning Goals for Education for Sustainable Development and Citizenship Education involving a gamification solution.

Education for Sustainable Development Goals

“UNESCO has been promoting Education for Sustainable Development (ESD) since 1992. It led the UN Decade for ESD from 2005 to 2014 and is now spearheading its follow-up, the Global Action Program (GAP) on ESD.

The momentum for ESD has never been stronger. Global issues, such as Climate Change, urgently require a shift in our lifestyles and transformation of the way we think and act. To achieve this change, we need new skills, values and attitudes that lead to more sustainable societies.

Education systems must respond to this pressing need by defining relevant learning objectives and learning contents, introducing pedagogies that empower learners, and urging the institutions to include sustainability principles in their management structures.

The new 2030 Agenda for Sustainable Development clearly reflects the vision of the importance of an appropriate educational response. Education is explicitly formulated as a stand-alone goal – Sustainable Development Goal 4. Numerous education-related targets and indicators are also contained in the Sustainable Development Goals (SDGs).

Education is both a goal in itself and a means for attaining all the other SDGs. It is not only an integral part of sustainable development, but also a key enabler for it. That is why education represents an essential strategy in the pursuit of the SDGs” Qian Tang, PhD, Assistant Director General for Education (UNESCO, Education for Sustainable Development Learning Objectives, Paris, France, 2017)

As stated in Sustainable Development Goal 4:

SDG 4, Target 4.7: By 2030, ensure that all learners acquire knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture’s contribution to sustainable development.

In 2016, UNESCO declared:

“[Quality education] also develops the skills, values and attitudes that enable citizens to [...] respond to local and global challenges through education for sustainable development (ESD) and global citizenship education (GCED). In this regard, we strongly support the implementation of the Global Action Program on ESD launched at the UNESCO World Conference on ESD in Aichi-Nagoya in 2014.”

The Role of ESD in Achieving the 2030 Agenda

Professor Dr. Marco Rieckmann (University of Vechta, Faculty of Educational and Societal Sciences Department of Education, Germany) in the European Conference on Educational Research 2017 (22-25 August 2017, Copenhagen, Denmark), talking about Education for Sustainable Development Goals (SDGs) stated:

“ESD enables all individuals to contribute to achieving the Sustainable Development Goals (SDGs) by equipping them with the knowledge and competencies which are needed to not only understand what the SDGs are about, but to become engaged in promoting the transformation needed.

ESD promotes key competencies needed for achieving the SDGs:

- *Systems thinking competence*
- *Anticipatory competence*
- *Normative competence*
- *Strategic competence*
- *Interpersonal competence*
- *Personal competence*
- *Critical thinking*
- *Integrated problem-solving competence*

ESD also brings forth specific cognitive, socio-emotional and behavioral learning outcomes which enable individuals to deal with the particular challenges of each SDG:

- The **cognitive domain** comprises knowledge and thinking skills necessary to better understand the SDG and the challenges in achieving it.
- The **socio-emotional domain** includes social skills that enable learners to collaborate, negotiate and communicate to promote the SDGs as well as self-reflection skills, values, attitudes and motivations that enable learners to develop themselves.
- The **behavioral domain** describes action competencies.”

The 17 Education for Sustainable Development Goals

On 25 September 2015, the UN General Assembly adopted the 2030 Agenda for Sustainable Development. This new global framework to redirect humanity towards a sustainable path was developed following the United Nations Conference on Sustainable Development (Rio+20) in Rio de Janeiro, Brazil in June 2012, in a three-year process involving UN Member States, national surveys engaging millions of people and thousands of participants from all over the world.

At the core of the 2030 Agenda are 17 Sustainable Development Goals (SDGs). The universal, transformational and inclusive SDGs describe major development challenges for humanity. The aim of the 17 SDGs (see box 1.1) is to secure a sustainable, peaceful, prosperous and equitable life on earth for everyone now and in the future.



The 17 Sustainable Development Goals (SDGs)

1. **No Poverty** – End poverty in all its forms everywhere
2. **Zero Hunger** – End hunger, achieve food security and improved nutrition and promote sustainable agriculture
3. **Good Health and Well-Being** – Ensure healthy lives and promote well-being for all at all ages
4. **Quality Education** – Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
5. **Gender Equality** – Achieve gender equality and empower all women and girls
6. **Clean Water and Sanitation** – Ensure availability and sustainable management of water and sanitation for all
7. **Affordable and Clean Energy** – Ensure access to affordable, reliable, sustainable and clean energy for all
8. **Decent Work and Economic Growth** – Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
9. **Industry, Innovation and Infrastructure** – Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
10. **Reduced Inequalities** – Reduce inequality within and among countries
11. **Sustainable Cities and Communities** – Make cities and human settlements inclusive, safe, resilient and sustainable
12. **Responsible Consumption and Production** – Ensure sustainable consumption and production patterns
13. **Climate Action** – Take urgent action to combat climate change and its impacts
14. **Life below Water** – Conserve and sustainably use the oceans, seas and marine resources for sustainable development
15. **Life on Land** – Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
16. **Peace, Justice and Strong Institutions** – Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
17. **Partnerships for the Goals** – Strengthen the means of implementation and revitalize the global partnership for sustainable development

Source: <http://www.un.org/sustainabledevelopment/sustainable-development-goals>

Education for Sustainable Development in the Early Years

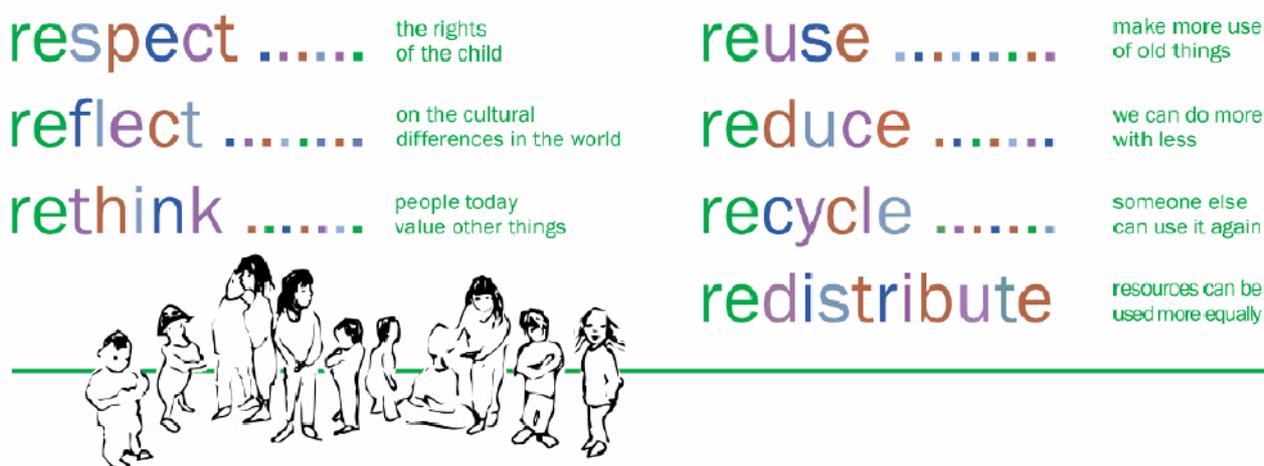
The United Nations Sustainable Development Goals for 2015-2030 (SDG) include two important statements relevant to the field of early childhood development, education, and care. **Target 4.2** states that by 2030 all Member States *should “ensure that all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education.”* **Target 4.7** states *“ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture’s contribution to sustainable development.”*

Taking these statements into consideration the World Organization for Early Childhood Education, OMEP states:

“Global issues urgently require a shift in our lifestyles and a transformation of the way we think and act. With these critical outcomes in mind, it is imperative for everyone in the field of early childhood development, education and care to become as knowledgeable and skillful as possible about high quality pedagogies and curricula for Education for Sustainable Development during the early years.

Toward this goal, the World Organization for Early Childhood Education, OMEP, has run ESD world projects since 2009. Over 50,000 children, 20,000 adults, 1,200 schools and/or projects, in 70 countries have participated in the ESD world projects.

We believe that children must be recognized as important agents in the shaping of a sustainable future. We would like to gladly share these outcomes with early childhood teachers, teacher educators, parents, and others who share our desire to teach young children about sustainability and to capitalize on young children’s capacities to contribute to healthy environments, viable economies, and equitable and just societies.” OMEP brochure, Children in a Sustainable Society. OMEP has worked with various development projects on education for sustainable development since 2010. The overall aim of the Education for Sustainable Development (ESD) project is to enhance the awareness of Education for Sustainable Development among OMEP members, young children and early childhood education at large. The work began with an interview study based on a logo where children were portrayed cleaning the world. The next phase involved projects with children engaged in preschool practices based on the **7Rs**, **respect, reflect, rethink, reuse, reduce, recycle, redistribute**.



Anna-Karin Engberg

A third project has involved intergenerational dialogues, where three generations were involved. Around 35 countries from all regions of the world have participated and thousands of children and teachers around the world have been involved in the three parts of the ESD projects.

Citizenship Education

Faced with increasing threats to fundamental values such as peace, equality and human rights, there has been a strong focus in recent years on the promotion of citizenship education, with several countries changing their official guidelines for this area of study.

The Citizenship Education at School in Europe – 2017 Eurydice report answers questions and

provides a comparative overview of how citizenship education is approached across Europe. It covers the 28 EU Member states as well as Bosnia and Herzegovina, the Former Yugoslav Republic of Macedonia, Iceland, Liechtenstein, Montenegro, Norway, Serbia, Switzerland and Turkey.

Among the findings of this study are:

- **Citizenship education goes beyond political knowledge aiming at the development of democratic, social, but also personal and inter-personal competences:** Modern citizenship education is more ambitious and multi-dimensional in comparison to earlier periods when it confined its remit to knowledge of political institutions and processes. “In primary education, the focus tends to be on encouraging personal development and on developing inter-personal competences. In secondary education interacting effectively and constructively with others gives way to acting in a socially responsible manner. Learning how to act democratically is taught mostly in the upper secondary level, while competences related to critical thinking receive comparatively more attention at lower secondary level.” (Eurydice Highlights, Citizenship Education at School in Europe, 2017).
- **Students receive citizenship education at primary and secondary levels at almost all countries:** It is compulsory at each level in almost all European countries, in three main ways, a) a separate subject, b) integrated in a broader subject or learning areas such as social sciences, or c) cross-curricular objective delivered by all teachers). Most countries use the last two approaches.
- **Less attention is given to citizenship education in school based Initial Vocational Education and Training (IVET), compared to general education.**
- **The majority of countries offer opportunities for learning beyond the classroom:** 29 countries provide top-level recommendations on extra-curricular provision supporting citizenship education, most frequently at lower and upper secondary levels. Countries most commonly recommend environmental activities, closely followed by activities to raise awareness of political life. In contrast, voluntary work was the least common, particularly at primary and lower secondary levels. A majority of countries (27) also directly support national programmes of extracurricular activities linked to citizenship education, with different approaches such as debating networks in Germany, youth empowerment activities as part of a Youth Guarantee provision in Estonia or a National Citizen Service in the United Kingdom. Citizenship education activities which take place beyond the classroom are widely recognized to have a high impact on learners, and it is important to ensure access for learners to a range of opportunities at all levels.
- **Half of countries organize standardized assessment during general education:** There are such tests in Poland, England and Wales but not in Portugal and Greece.

Why Learning through Gaming for Sustainability?

According to the Federation of American Scientists *“50% of all Americans and 75% of American heads of household play computer and video games... On average, kids aged 8-18 spend about 50 minutes per day playing video games. As Don Thompson, assistant director, Education and Human Resources, National Science Foundation, says: “Perhaps the most fatal flaw in the education of young people is that we apprentice young people into 19th century science rather than letting them play 21st century scientist”.*

Learning can and does occur within a casual game, but it is a by-product and not an intentional outcome of game play. On the other hand, gamification in learning (or immersive learning simulations, online game-based learning etc.) are designed with the intention of improving some specific aspect of learning, and players come to learning games with that expectation. Gamification solutions are used in emergency services training, military training, in corporate education, in health care, at every level of education, at all

kinds of schools and universities around the world.

Play is an important contributor to human development, maturation and learning and play is a mandatory ingredient of any gamification solution. A learning game requires, apart from the learning goals, a number of distinct elements, such as narrative context, rules, goals, rewards, multisensory cues and interactivity, in order to stimulate desired learning outcomes.

It is also important for the gamification solution to be learner-centric, highly individualized, and aimed at encouraging exploration of a large body of content. A learning game could additionally enable teachers to develop their own content to add to the learning environment. The players of a learning game can be a community of knowledge and for that purpose in-game communication capabilities are crucial. Chat, e-mail functions, game blogs, team wikis and other Web 2.0+ communication technologies; all these create a team spirit and add learning value and opportunities of additional learning.

Studies have showed that online gamification solutions accelerate learning, increase motivation and support the development of higher order cognitive thinking skills. There is also a generational acceptance of games as a significant part of everyday life. But there are limits to the effectiveness of games where learning outcomes and the learner specification are not taken fully into account at the development stage. Hence, gamification solutions should be a part of a blended learning solution (de Freitas, S. and Jarvis, S., 2007).

Learning goals of a Learning Game for Sustainability

Learning Objectives

Knowledge:

- Understand the greenhouse effect as a natural phenomenon caused by an insulating layer of greenhouse gases
- Understand the current climate change as an anthropogenic phenomenon resulting from increased greenhouse gas emissions
- Know which human activities contribute most to climate change, environmental destruction and loss of biodiversity
- Know about strategies that help mitigate climate change and prevent environmental destruction

Skills:

- Be able to explain ecosystem dynamics and the impact of climate change
- Be able to encourage others and collaborate with others in order to protect the climate and the environment
- Be able to understand their personal impact to climate change and environmental destruction
- Be able to recognize that the protection of the global climate and environment is an essential task for everyone and that we must re-evaluate our daily behaviours in the light of this

Competencies:

- Be motivated to evaluate whether their private and public activities are environmental and climate friendly and revise them when necessary
- Be inclined to act in favour of the environment and of people affected by climate change

- Be keen to promote and support climate and environmental friendly activities.

Setting the goals and the possible learning outcomes of a Learning Game for Sustainability, we need to set specific cognitive, socio-emotional and behavioral learning outcomes which enable individuals to deal with the particular challenges of each Sustainable Development Goal (SDG), as well as with the challenges of Citizenship Education, since active citizens are needed in order to achieve the 17 ESD goals:

- The **cognitive domain** comprises knowledge and thinking skills necessary to better understand the SDG and the challenges in achieving it.
- The **socio-emotional domain** includes *social skills* that enable learners to collaborate, negotiate and communicate to promote the SDGs as well as *self-reflection skills, values, attitudes and motivations* that enable learners to develop themselves.
- The **behavioral domain** describes *action competencies*.

Cognitive learning objectives

The learner:

1. Understands the concepts of climate change, loss of biodiversity and habitats, extreme and relative poverty and is able to critically reflect on their underlying cultural and normative assumptions and practices.
2. Knows about the local, national and global distribution of climate change, environmental problems, extreme poverty and extreme wealth.
3. Knows about causes and impacts of climate change, environmental problems, poverty such as unequal distribution of resources and power, colonization, conflicts, disasters caused by natural hazards and other climate change-induced impacts, environmental degradation and technological disasters, and the lack of social protection systems and measures.
4. Understands how climate change, environmental degradation, extremes of poverty and extremes of wealth affect basic human rights and needs.
5. Knows about poverty reduction strategies and measures and is able to distinguish between deficit-based and strength-based approaches to addressing poverty.
6. Knows the importance of ICT tools in addressing problems and finding solutions.
7. Is informed about the 17 ESD goals.

Socio-emotional learning objective

The learner:

1. Is able to collaborate with others to empower individuals and communities to affect change in the distribution of power and resources in the community and beyond.
2. Is able to raise awareness about extremes of poverty and wealth, climate change, environmental degradation and encourage dialogue about solutions.
3. Is able to show sensitivity to the issues of poverty, climate change and environmental protection as well as empathy and solidarity with poor people and those in vulnerable situations.
4. Is able to identify their personal experiences and biases with respect to environmental protection
5. Is able to critically reflect on his/her own role in maintaining global structures of inequality, human-related climate change and environmental destruction.
6. Is able to critically use ICT tools in retrieving valid information and communicate and collaborate

with other individuals and communities.

7. Is able to critically reflect upon her/his role in achieving the 17 ESD goals.

Behavioral learning objectives

The learner:

1. Is able to plan, implement, evaluate and replicate activities that contribute to address the consequences of climate change and meet the need to reach the 17 ESD goals.
2. Is able to publicly demand and support the development and integration of policies that promote social and economic justice, risk reduction strategies as well as environmental protection actions.
3. Is able to evaluate, participate in and influence decision-making related to management strategies of local, national and international authorities and enterprises concerning climate change and environmental protection.
4. Is able to include climate change and environmental protection, social justice and anti- corruption considerations in their consumption activities.
5. Is able to propose solutions to address systemic problems related to climate change and environmental degradation.
6. Is able to act in a socially and environmentally responsible manner.
7. Is able to interact effectively and constructively with others working in teams.

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Colourful World: Key Facts – levels 1, 2, and 3

Information related to the theme and topics of each level.

The material in this section is intended primarily for the teachers and instructors who will be using Colourful World with children. Some of the information offered here is sufficiently straightforward that it might be immediately comprehensible to young learners, while the complexity of other parts means it would likely require adaptation by teachers, according to the age/abilities of the children. It will serve as a support for teachers/instructors who wish to enhance their knowledge of environmental and sustainable development matters. It draws together facts, figures and conclusions from a range of recent, relevant and authoritative sources. These sources are listed at the end, and each point is keyed to its source by a reference. This means that anyone wishing to further research the topics themselves could begin by reviewing those sources.

Level one

Climate change – drought and flooding cycles, etc.

Impacts of climate change include wildfires, droughts, flooding, hurricanes, sea-level rise, ocean acidification and melting of the permafrost. These impacts are growing. UN 2019, p4.

Reduction in bee populations

In recent years, public attention has been drawn to the plight of honeybee populations, which have seen losses in the EU and around the world. Behind this highly publicized phenomenon is a problem of a much larger scale, namely the dramatic decline in the occurrence and diversity of all kinds of European wild insect pollinators, including wild bees, hoverflies, butterflies and moths. EC 2018, p1.

Loss of habitats and pesticide use are identified as key problems for pollinators. EC 2018, p4-5.

Measures to help pollinators include buffer strips and land lying fallow for nectar- and pollen-rich plants. EC 2018, p5.

Deforestation

Forests around the world are under threat from deforestation and forest degradation. The main cause of deforestation is agriculture (poorly planned infrastructure is emerging as a big threat too) and the main cause of forest degradation is illegal logging. We're losing 18.7 million acres of forests annually, equivalent to 27 soccer fields every minute. WWF.

Reasons why the soil is getting exhausted

Soil erosion is identified as an impact of climate change in an important United Nations report of 2019. UN 2019, p13.

Using soil for agriculture directly affects its quality, and good practices can both maintain and enhance the productive capacity of soils. But several economic activities have indirect effects on soil health and performance. Deforestation leads to soil erosion. Grasslands are overgrazed and abandoned to become deserts. Fertile soils around towns are built-upon as they grow into cities, at a pace increased by population growth, migration and urbanization. UNGC 2016, p3.

Unsustainable farming practices

Globally, the expansion of areas under agriculture and forestry has contributed to increasing net

greenhouse gas emissions and the loss of natural ecosystems (for example forests, savannahs, natural grasslands and wetlands) and to declining biodiversity. IPCC 2019, p2-3.

Data available since 1961 show the per capita supply of vegetable oils and meat has more than doubled and the supply of food calories per capita has increased by about one third. Roughly a quarter of food produced is lost or wasted. These factors are associated with additional greenhouse gas emissions. IPCC 2019, p3.

Greenhouse gas emissions from agricultural production are projected to increase, driven by population and income growth and changes in consumption patterns. IPCC 2019, p11.

Use of pesticides

Evolving technology in pesticide manufacture, among other agricultural innovations, has certainly helped agricultural production to feed a growing human population. However, this has come at the expense of human health and the environment. Pesticides cause an array of harms. Runoff from treated crops frequently pollute the surrounding ecosystem and beyond, with unpredictable ecological consequences. Furthermore, reductions in pest populations upset the complex balance between predator and prey species in the food chain, thereby destabilizing the ecosystem. Pesticides can also decrease biodiversity of soils. UNGA 2017, p3.

Pesticides can persist in the environment for decades and pose a global threat to the entire ecological system upon which food production depends. Excessive use and misuse of pesticides result in contamination of surrounding soil and water sources, causing loss of biodiversity, destroying beneficial insect populations that act as natural enemies of pests and reducing the nutritional value of food. UNGA 2017, p9.

How to minimize the exhaustion of the soil

Practices that contribute to climate change adaptation and mitigation in cropland include increasing soil organic matter, erosion control, improved fertilizer management, and use of varieties and genetic improvements for heat and drought tolerance. IPCC 2019, p25.

Balanced diets, featuring plant-based foods, such as those based on coarse grains, legumes, fruits and vegetables, nuts and seeds, and animal-sourced food produced in resilient, sustainable and low greenhouse gas emission systems, present major opportunities for adaptation and mitigation to climate change while also benefitting human health. IPCC 2019, p26.

Changes in dietary choices, reducing post-harvest losses, and reducing food waste can all help to address climate change. IPCC 2019, p21.

The United Nations Global Compact 'Principles for Sustainable Soil Management' are laid out below:

- 1. Protect soil from physical, chemical and biological degradation*
- 2. Limit erosion and avoid deforestation*
- 3. Develop extension services, knowledge systems, and Promote innovation*
- 4. Enhance soil productivity according to its natural capacity*
- 5. Maintain soil-based ecosystem services, water availability and quality*
- 6. Restore soils on degraded, stranded and marginal lands*
- 7. Communicate the importance of soil. UNGC 2016, p1.*

Organic farming

A rise in organic agricultural practices in many places illustrates that farming with less or without any pesticides is feasible. UNGA 2017, p19.

Importance of biodiversity and Crop rotation

In ecological farming, crops are protected from pest damage by enhancing biodiversity and encouraging the presence of natural enemies of pests. Examples include developing habitats around farms to support natural enemies and other beneficial wildlife or applying functional agro-biodiversity, using scientific strategies to increase natural enemy populations. Crop rotation and usage of cover crops also help protect the soil from various pathogens, suppress weeds and increase organic content, while more resistant crop varieties can help prevent plant disease. UNGA 2017, p20.

Level Two

How climate is changing as a result of global warming

The last 4 years were the warmest on record and greenhouse gas emissions are still rising. UN 2019, p4.

On current trends, someone born today risks spending their old age in a world that is 3.0°C warmer than in pre-industrial times – twice the toughest ceiling of 1.5°C set by governments in Paris in 2015. UN 2019, p9.

Greenhouse gas emissions totaled 50.8 billion tonnes in 2016, up 48% since 1990. UN 2019, p13.

However, the European Union's greenhouse gas emissions were down 22% from 1990 levels in 2017 at 4.3 billion tons, even while the economy grew by 58% over the same period. UN 2019, p18.

With increasing warming, the frequency, intensity and duration of heat related events including heat waves are projected to continue to increase through the 21st century. IPCC 2019, p15.

Ways in which climate is changing and effects (flood, hurricanes, droughts...)

Impacts of climate change include wildfires, droughts, flooding, hurricanes, sea-level rise, ocean acidification and melting of the permafrost. These impacts are growing. UN 2019, p4.

Temperatures are already up about 1.0°C from pre-industrial times. UN 2019, p7.

How can we minimize the negative effects of human actions?

We must reduce global greenhouse gas emissions by 45% by 2030 and achieve carbon neutrality by 2050. UN 2019, p4.

An important United Nations report of 2019 identifies that climate action is “inseparable from sustainable development”. It is recognized that integrating climate and development policies is key to improving people's lives (especially in poorer countries) at the same time as tackling climate change. UN 2019, p22.

Recycling, Re-using, and responsible consumption

In Europe, we currently use 16 tonnes of material per person per year, of which 6 tonnes become waste. Although the management of that waste continues to improve in the EU, the European economy currently still loses a significant amount of potential 'secondary raw materials' such as metals, wood, glass, paper and plastics. In 2010, total waste production in the EU amounted to 2,5 billion tonnes.

From this total only a limited (albeit increasing) share (36%) was recycled, with the rest landfilled or burned, of which some 600 million tons could be recycled or reused. EC Waste.

If we re-manufacture, reuse and recycle, and if one industry's waste becomes another's raw material, we can move to a more circular economy where waste is eliminated and resources are used in an efficient and sustainable way. EC Waste.

Rivers and river re-wilding

European waters are under pressure from a range of human activities. These pressures often act at the same time and affect the good functioning of ecosystems, contribute to biodiversity loss and threaten the valuable benefits that water brings to society and the economy. EW 2018, p7.

Agricultural production is a major source of diffuse pollution, mostly as a result of excessive emissions of nutrients and chemicals such as pesticides. Other drivers include rural dwellings, run-off from urban areas and forestry. EW 2018, p9.

Methods of restoring the natural flow of a river include:

- employing measures related to river continuity, such as removing obstacles and installing fish passes;*
- employing measures focused on restoring aquatic habitats, such as improving physical habitats;*
- managing sediment in a way that ensures that it is transported along the length of rivers;*
- reconnecting backwaters and wetlands to restore lateral connectivity between the main river channel, the riparian (riverbank) area and the wider floodplain;*
- implementing natural water retention measures that restore natural water storage, for example inundating flood plains and constructing retention basins;*
- restoring the natural water flow regime through, for example, setting minimum flow and ecological flow requirements;*
- developing master or conservation plans for restoring the population of threatened fish species. EW 2018, p9*

Importance of forests to prevent soil erosion and retain rain water

Trees soak up carbon dioxide from the atmosphere as they grow. This both helps to reduce global warming and protects biodiversity. UN 2019, p28.

Ethiopia says it planted more than 350 million tree seedlings on 29th July 2019, in what the government reckons was a one-day world record in a broader campaign to promote sustainable development and slow down climate change. UN 2019, p28.

Deforestation is a particular concern in tropical rain forests because these forests are home to much of the world's biodiversity. For example, in the Amazon around 17% of the forest has been lost in the last 50 years, mostly due to forest conversion for cattle ranching. WWF

Soil erosion by water is one of the major threats to soils in the European Union, which has a negative impact on ecosystem services, crop production, drinking water quality, flood regulation and carbon stocks. SE 2017, p7.

Forests retain excess rainwater, and help to moderate run-off patterns, preventing extreme run-offs. This in turn reduces damage from flooding, and also helps to mitigate the effects of droughts. EEA 2015, p5.

Sources of atmospheric pollution

Several key sectors contribute to emissions of air pollutants, including transport, businesses/industry and households, energy production and distribution, agriculture, and waste (including landfill and incineration of waste). EEA 2019, p20.

How pollution impacts human and animal health

Air pollution has significant impacts on the health of Europe's population, particularly in urban areas. Europe's most serious pollutants, in terms of harm to human health, are Particulate Matter, Nitrogen Dioxide, and ground level ozone. Older people, children, and those with pre-existing health conditions are more vulnerable. EEA 2019, p8.

Air pollution is currently the most important environmental risk to human health. EEA 2019, p10.

According to the World Health Organization, heart disease and stroke are the most common reasons for premature death attributable to air pollution, followed by lung diseases and lung cancer. EEA 2019, p13.

Air pollution leads to environmental degradation and has impacts on natural ecosystems and biodiversity. Ground-level ozone can damage crops, forests and other vegetation, impairing their growth and impacting on biodiversity. EEA 2019, p73.

How can we minimize the negative effects of human actions on the quality of the air?

There are many measures that can improve air quality. In a city these could include using cleaner fuels for heating, introducing low-emission transport zones, switching to cleaner buses or trams, promoting cycling, lowering speed limits and issuing congestion charges. EEA 2019, p17.

Other ways of improving air quality include reducing the use of fertilizers in agriculture and stopping the uncontrolled burning of solid and agricultural waste. EEA 2019, p15.

As greenhouse gases and air pollutants share the same emissions sources, benefits can arise from limiting emissions of one or the other. EEA 2019, p14.

Renewable energies vs fossil sources of energy

A well-established energy system supports all sectors: from businesses, medicine and education to agriculture, infrastructure, communications and high-technology. Access to electricity in poorer countries has begun to accelerate, energy efficiency continues to improve, and renewable energy is making impressive gains. Nevertheless, more focused attention is needed to improve access to clean and safe cooking fuels and technologies for 3 billion people. For many decades, fossil fuels such as coal, oil or gas have been major sources of electricity production, but 3 billion people lack access to clean cooking fuels, resulting in nearly 4 million premature deaths each year. Burning carbon fuels produces large amounts of greenhouse gases which cause climate change and have harmful impacts on people's well-being and the environment. Countries can accelerate the transition to an affordable, reliable, and sustainable energy system by investing in renewable energy resources, prioritizing energy efficient practices, and adopting clean energy technologies and infrastructure. UN.ORG

Chile announced plans in June 2019 to close eight coal-fired power plants in the next five years and set a long-term goal to become carbon neutral by 2050. UN 2019, p34.

Importance of forest to improve air quality

Plants are involved in the uptake, transport and assimilation (or, in some cases, decomposition) of many gaseous or particulate pollutants. Therefore, trees and vegetation can play an important role in influencing urban air quality, and in mediating some of the negative effects of pollutants. Vegetation also removes carbon dioxide (CO₂) – the main greenhouse gas associated with climate change - from the atmosphere. FR

Environmental citizenship

Environmental citizenship is the idea that we all should take responsibility for how we interact with the environment. Some ways of doing this are listed below:

- *Adopt a green lifestyle – for example ‘reduce, re-use, recycle’*
- *Participate in Environmental Decision Making – get involved locally, nationally and internationally*
- *Hold Businesses to Account – for example, reject products with excessive packaging, ask retailers about take-back schemes for old appliances. EL.ORG*

The importance of biodiversity

Biodiversity is the variety of life at genetic, species and ecosystem levels. UN BFA 2019, p xxxvii.

Nature embodies different concepts for different people, including biodiversity, ecosystems, Mother Earth, systems of life and other analogous concepts. Nature’s contributions to people embody different concepts, such as ecosystem goods and services and nature’s gifts. Both nature and nature’s contributions to people are vital for human existence and good quality of life. UN IPBES, p3.

The biosphere, upon which humanity as a whole depends, is being altered to an unparalleled degree across all spatial scales. Biodiversity – the diversity within species, between species and of ecosystems – is declining faster than at any time in human history. UN IPBES, p3.

Nature across most of the globe has now been significantly altered by multiple human drivers, with the great majority of indicators of ecosystems and biodiversity showing rapid decline. UN IPBES, p4.

Sources:

EC Waste - <https://ec.europa.eu/environment/waste/index.htm>

EC 2018 – ‘EU Pollinators Initiative.’ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions.

{SWD(2018) 302 final}

EEA 2019 – ‘Air Quality in Europe – 2019 report.’ EEA report No 10/2019. European Environment Agency.

EEA 2015 – ‘Water-retention potential of Europe's forests: A European overview to support natural water-retention measures.’ EEA Technical report No 13/2015.

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EL.ORG - <http://www.environmentlaw.org.uk/rte.asp?id=199>

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IPCC 2019 – ‘Climate Change and Land: An IPCC Special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems.’ Summary for Policymakers. Intergovernmental Panel on Climate Change, 2019.

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UN 2019 – ‘The Heat Is On: Taking Stock of Global Climate Action.’ United Nations Development Program, Global Outlook Report 2019.

UNGC 2016 - The United Nations Global Compact: ‘Principles for Sustainable Soil Management’, 2016.

UNGA 2017 - ‘Report of the Special Rapporteur on the right to food’ United Nations General Assembly A/HRC/34/48, 2017.

UN IPBES 2019 – ‘Report of the Plenary of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services on the work of its seventh session’. Addendum: Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. 2019.

UN ORG - <https://www.un.org/sustainabledevelopment/wp-content/uploads/2016/08/7.pdf>

WWF - <https://www.worldwildlife.org/threats/deforestation-and-forest-degradation>

Purpose and Goals of the Activity Sheets

The purpose of this educational process is to enhance the students' critical ability with regard to ecological issues, to promote respect for nature and thus for themselves.

The goals and objectives are:

Cognitive goals / Knowledge

- Familiarize children with the natural and anthropogenic environment.
- Understand the mechanisms of the natural environment and its interaction with the anthropogenic.
- Understand how fragile the balance of the natural environment is.
- Realize that human activities and interventions can have dangerous consequences on the natural environment.
- Learn how valuable protecting the natural and anthropogenic environment is.

Emotional goals / Attitude, values

- To develop critical thinking and responsible attitudes towards environmental issues through an experiential approach.
- To understand the personal responsibility and power of each of us, as active citizens, in shaping the environmental policy of the community as a whole.
- To change attitudes and behaviours so that they can be able to play an essential role in sustainable development, a goal that is fulfilled by mobilizing the emotional and psychomotor domain through the process.

Psychomotor goals / Skills

Develop abilities to:

- Search for and collect information
- Observe, distinguish and classify
- Make assumptions (what if...), and forecasts (what to do in the future).

The following activities are sorted in a logical order according to the age of the children to whom it is addressed. As the age increases, so does the degree of difficulty and skills required. Of course, the order of classification is simply a suggestion that does not preclude each teacher from taking a different approach depending on the level of their class.

The colour marking of each activity sheet indicates the suggested time for the activity to take place: before, during or after the game. Again, it is the teacher who finally chooses the right time, knowing the game and the level of his/her class.



Before the game



During the game



After the game

Picture: <https://imgbin.com/free-png/>

Have fun!!!

Activity sheets

Age target: 6 – 10 years old

Animal Name

- Pairing activity sheet -



Orangutan of Borneo



Duck



Rabbit



Dog



Balearic Shearwater



Polar bear



Bee



Caretta Caretta



Habitat

- Pairing activity sheet -



Mediterranean Sea



All over the world



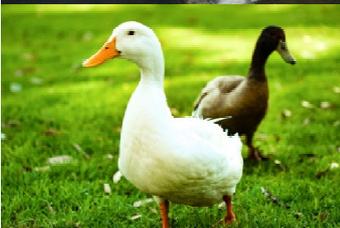
North Pole



All over the world



Balearic Islands



All over the world



Borneo wild forest



All over the world



Where do animals live

- True or False activity sheet -

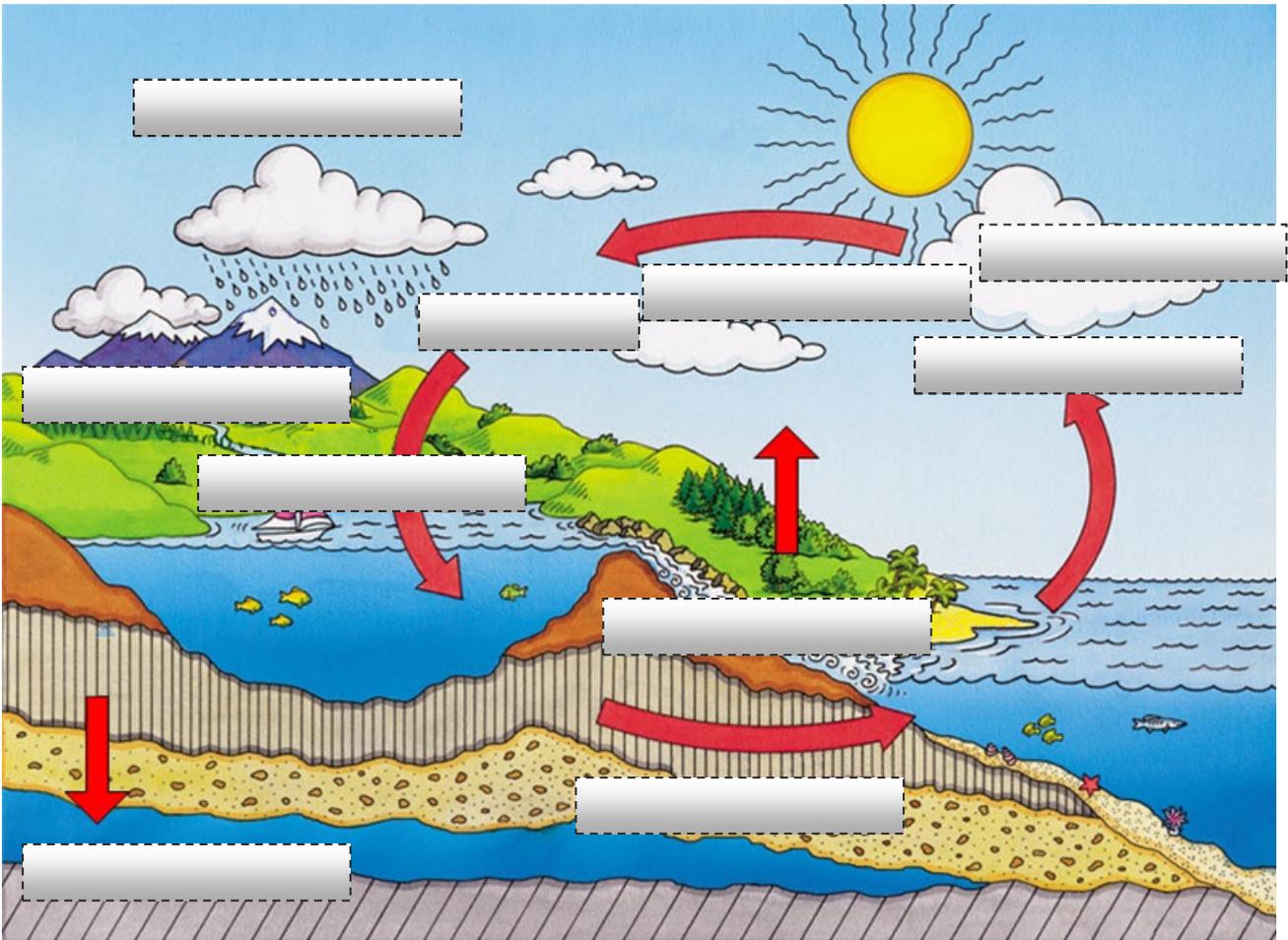
Which is the natural habitat of each one of these animals?

1. The Polar Bear lives in North Pole TRUE / FALSE
2. The Caretta Caretta turtle lives in rivers TRUE / FALSE
3. The Balearic shearwater lives in Asia TRUE / FALSE
4. The Borneo orangutan lives in Asia TRUE / FALSE
5. Lamas live in America TRUE / FALSE
6. Lions live in Europe TRUE / FALSE
7. Elephants live in Africa and Asia TRUE / FALSE
8. Kangaroos live in Australia TRUE / FALSE
9. Giraffes live in America TRUE / FALSE
10. Tigers live in Africa TRUE / FALSE



Water Cycle

- Fill out activity sheet -



Picture: Water Cycle http://geoviews4students.blogspot.com/2015/11/blog-post_29.html

Photocopy the following phrases, cut them out and put them in the right place into the picture:

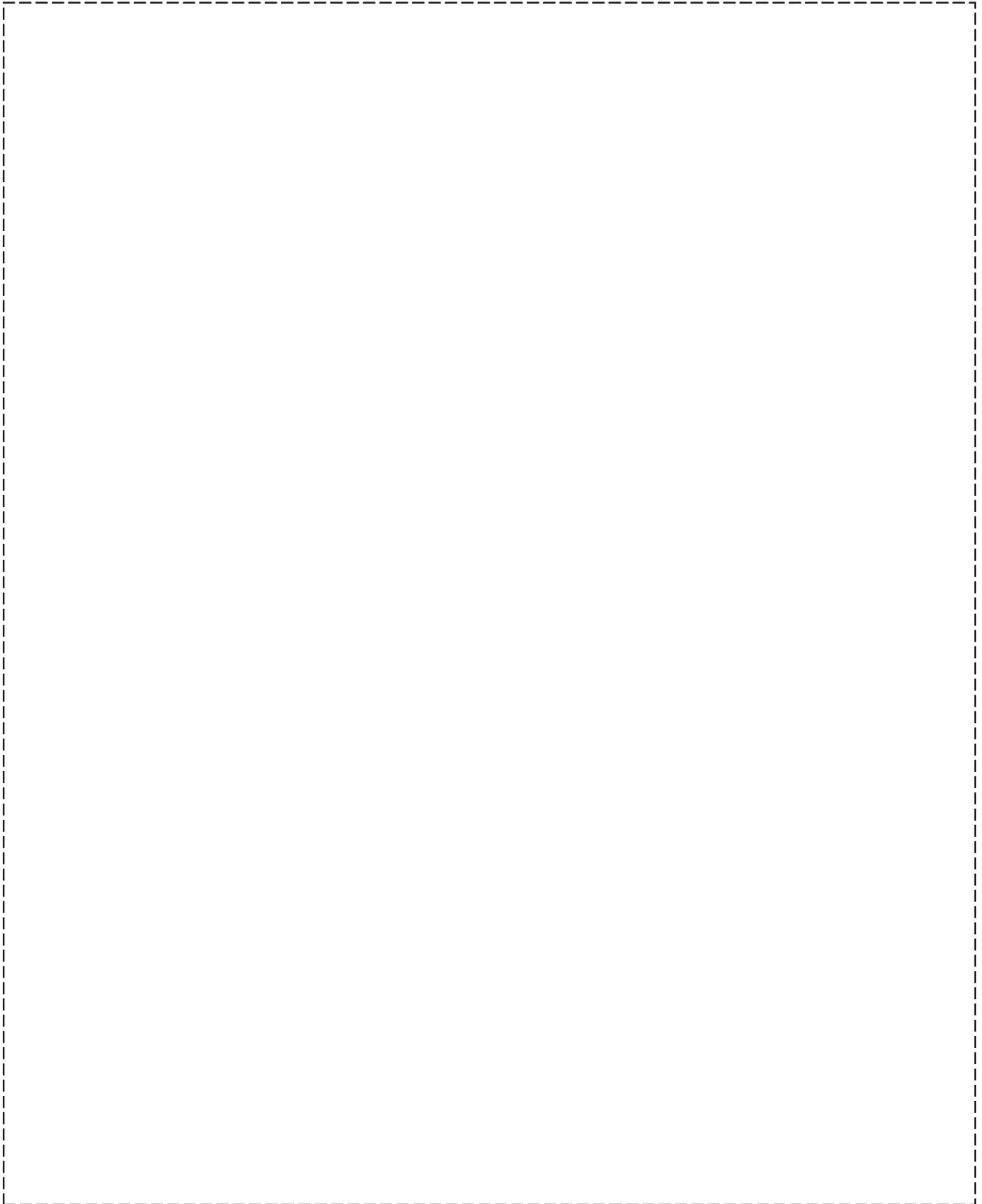
- Rain
- Transpiration by plants
- Condensation
- Evaporation
- Underground water
- Surface water flow
- Snow melting
- Cloud creation
- Underground water flow
- Surface water



Water Cycle

- Writing activity sheet -

Now, use the phrases given to describe the water cycle:

A large, empty rectangular box with a dashed border, intended for students to write their descriptions of the water cycle.

Water waste

- Yes or no activity sheet -

In each sentence, tick YES or NO accordingly

1. Do you dispose of used oil in the sink?	YES	NO
2. Do you wash the dishes by hand?	YES	NO
3. Do you have taps in your house that drip?	YES	NO
4. Do you leave the tap running when brushing your teeth?	YES	NO
5. When a tap is dripping, do you collect the water (e.g., for watering plants) until you repair it?	YES	NO
6. During the shower, do you leave the tap running at all time while washing your hair or body?	YES	NO
7. Do you wash your backyard, terraces etc. with constant flow (constant running water) in the hose?	YES	NO
8. Do you wash the family car more than once a week?	YES	NO
9. Do you water the flowers using a hose?	YES	NO
10. You do not collect rainwater from a gutter at home into a water barrel or a bucket.	YES	NO
11. Do you wash fruits and vegetables in the sink, rather than in a basin?	YES	NO
12. When you see a pipe leaking in the street, do you feel that you can't do anything so you tell noone?	YES	NO
13. Do you use the washing machine even for a few clothes?	YES	NO
14. Do you prefer to bathe in the bathtub instead of showering?	YES	NO
15. In the bathroom / shower, you don't collect the cold water in a bucket until it reaches the desired temperature.	YES	NO
16. At the beach, do you shower after each swim in the sea?	YES	NO
17. When you paint, do you wash the brushes in the sink, rather than in a jar?	YES	NO
18. Do you remove mud from shoes and boots with a water hose, rather than in a basin?	YES	NO
19. Do you choose to plant lawn, that needs excess water, in your garden instead of trees/shrubs/wildlife?	YES	NO
20. Do you dispose of the grey water (i.e., from washing vegetables) instead of reusing for other purposes such as watering plants?	YES	NO



Water waste activity sheet: Count the 'Yes' you have circled

BETWEEN 0 AND 5

Congratulations. You are very economical when it comes to the energy you consume. You love the environment and care about the future of this planet. If all children were to think like you, the future of the earth would be auspicious. Go on like this, inspire others with your lifestyle!

BETWEEN 6 AND 10

Nice try. You love the planet, but you can do better. Try to avoid some wastage, so that some of your choices above might change from YES to NO. However, you are also trying to improve the state of our planet.

BETWEEN 11 AND 15

Not such a good effort. Try more. Your choices will determine the future of the planet. You have to change many of your above choices to NO, as of today. Consider the options above and see what you can change in your daily life to improve your score and therefore the situation in our planet.

BETWEEN 16 AND 20

Disaster! Do something, or else we are lost. You can change many of your daily habits to benefit both your pocket and the planet. And there is a lot you can do. Save on the water you consume!

Report back with:

All of us ...

Most of us ...

Many of us ...

A few of us ...

Not many of us ...

Hardly any of us ...

None of us ...

Reduce - Reuse - Recycle

- Yes or no activity sheet -

In each sentence, tick YES or NO accordingly

1. Do you look for recycling signals when buying a product?	YES	NO
2. Do you reuse the wrapping items (packages, ribbons, etc.) from gifts that you receive?	YES	NO
3. When you go shopping, do you prefer products with simpler packaging?	YES	NO
4. Do you separate and collect food waste for recycling?	YES	NO
5. Have you modified your needs in order to reduce waste?	YES	NO
6. Do you put old electrical appliances that don't work anymore, in special Recycling bins?	YES	NO
7. Do you dispose of plastic, metal and paper packaging in Recycling?	YES	NO
8. Do you separate the rubbish (e.g. bottle caps) before you put them in Recycling?	YES	NO
9. Do you shut down your computer screen and TV when you are not using it?	YES	NO
10. Do you use a compost bin at home or at school?	YES	NO
11. Do you turn off the lights when you leave a room?	YES	NO
12. When a device breaks down, do you see if it can be fixed before you buy a new one?	YES	NO
13. Do you throw litter on the ground?	YES	NO
14. Do you prefer local products (e.g. food, clothes)?	YES	NO
15. When shopping at the supermarket, do you use a reusable bag (e.g. made of cloth).	YES	NO
16. Do you reuse packaging such as jars, plastic boxes, etc.?	YES	NO
17. Do you remodel old clothes or do you give them to other people when you no longer need them?	YES	NO
18. Do you encourage others to recycle?	YES	NO
19. Do you recycle used batteries in special bins?	YES	NO
20. Do you use both sides of paper to draw or sketch?	YES	NO



Reduce - Reuse - Recycle activity sheet: Count the 'NOs' you have circled

BETWEEN 0 AND 5

Congratulations. You are very economical when it comes to the energy you consume. You love the environment and care about the future of this planet. If all children were to think like you, the future of the earth would be auspicious. Go on like this, inspire others with your lifestyle!

BETWEEN 6 AND 10

Nice try. You love the planet, but you can do better. Try to avoid some wastage, so that some of your choices above might change from NO to YES. However, you are also trying to improve the state of our planet.

BETWEEN 11 AND 15

Not such a good effort. Try more. Your choices will determine the future of the planet. You have to change many of your above choices to YES, as of today. Consider the options above and see what you can change in your daily life to improve your score and therefore the situation in our planet.

BETWEEN 16 AND 20

Disaster! Do something, or else we are lost. You can change many of your daily habits to benefit both your pocket and the planet. And there is a lot you can do. Turn off the electrical devices that you do not use, save on the water you consume and try to recycle as much materials as you can.

Report back with:

All of us ...

Most of us ...

Many of us ...

A few of us...

Not many of us ...

Hardly any of us ...

None of us ...

Cleaning action - Counting trash

- Experiential outdoor activity sheet –
- With adult supervision & using protection gloves -

Choose a school yard or another public space (e.g., a beach) for a clean-up action. Keep a record of the garbage that you pick up categorized by type/material (plastic, paper, aluminum, non-recyclable). After completing the action, you can discuss:

- the results
- reduction of the garbage
- reduction of the garbage that ends up in the nature
- behavior changes
- improvement of our environment
- passing the message through to others (parents, neighbours etc.) or invite them to participate.

Type of waste	Number of items	Ratio (fraction)
Paper		
Plastic		
Aluminum /metals		
Food		
Other		
TOTAL		

To find the ratio, e.g. of papers in the sum of trash and to turn it into a fraction we have to make a fraction with the number of papers we found in the area as a numerator, and the total number of rubbish-items (of all kinds) found in the same area as a denominator:

$$\text{Paper Ratio} = \frac{\text{Number of papers}}{\text{Total number of trash}}$$

Accordingly, the proportion of plastic is a fraction with the number of plastic as a numerator, and the total number of waste as a denominator, the ratio of metals is a fraction with the number of metals as a numerator and the total number of metals as a denominator, and so on.

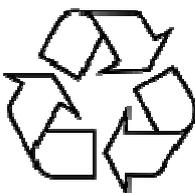
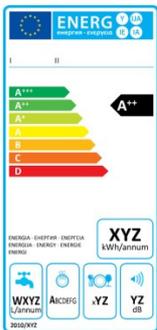
Example: If we found 50 items of garbage in the school yard and 25 of them were plastic, then the proportion of plastic in our trash was 25/50.



Signs

- Pairing activity sheet -

Match the signs with their meanings:



- a. The manufacturer of this product has paid for recycling
- b. I am electrical appliance. Do not throw me away into the common bin, I can be recycled
- c. I meet European Union standards
- d. I am made of 0-100% recyclable materials. The Mobius Loop
- e. My number shows the type of plastic I am made of – Resin Identification Code'
- f. Look at me to see how much power I consume
- g. Recycle me so I don't get wasted, for your own benefit



Waste reuse ideas

- Brainstorming activity sheet -

Students work in pairs or small groups. They discuss how people can reuse things they throw away every day. Then, they present their ideas to the rest of the class.

Waste	Reuse ideas
a newspaper	
a styrofoam cup	
a jar	
a glass bottle	
a cardboard box	
a plastic bag	
a tin	
a plastic bottle	



Write a story

- Writing activity sheet -

Students work in pairs or small groups. They create their own story about an environmental issue.

Story
Map

Title:

Characters:

Author:
Illustrator:

Setting:

Problem:

X Solution:

The form is a story map template. It consists of several rectangular boxes connected by dashed lines. At the top left, the words 'Story' and 'Map' are written in a stylized font, with the first letters 'S' and 'M' being large and filled with a star pattern. To the right of this is a box labeled 'Title:'. Below the 'Title' box is a box labeled 'Author:' and 'Illustrator:'. To the left of the 'Author' box is a box labeled 'Characters:'. Below the 'Characters' box is a box labeled 'Setting:'. To the right of the 'Setting' box is a box labeled 'Problem:'. Below the 'Problem' box is a box labeled 'Solution:'. A large 'X' is drawn to the left of the 'Solution' box. Dashed lines connect the boxes in a sequence: Title to Author, Author to Characters, Characters to Setting, Setting to Problem, Problem to Solution, and Solution back to Setting.

Picture: <https://www.template.net/design-templates/print/story-map-template/>



Activity sheets

Age target: 8 – 10 years old

Broken sentences

- Pairing activity sheet -

Students work in groups trying to match the broken sentences. Each group reads one sentence/term. Then, the activity is checked and discussed together with the teacher.

Reforestation is
the process of

using an item more than once for
the same purpose, this helps save
money, time, energy and resources.

Recycling is
about

planting trees in forest lands to
replace those that have been cut
down.

Global warming is
the process of

breaking waste items down into their
raw materials, which are then used to
re-make the original item or make
new items.

Organic food
is

the gradual increase in temperature
of the Earth's surface caused by
human activities that cause high
levels of carbon dioxide and other
gases to be released into the air.

Reusing is
about

food made from plants and animals
that are grown or reared without the
use of synthetic fertilizers,
pesticides or hormones.



Causes & environmental problems

- Pairing activity sheet -

Students match the environmental problems with their causes.

floods

soil erosion

water pollution

**prolonged heavy
rains**

**animals leaving
their habitats**

**periods without
rain**

**lower crop
yields**

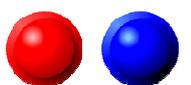
**fertilizers
and
pesticides**

droughts

intensive farming

**build-up of
greenhouse gases**

deforestation



Animals facing extinction

- Study activity sheet -

Activity proposal: Split into groups and find images and information about animals threatened with extinction:

⇒ In your region

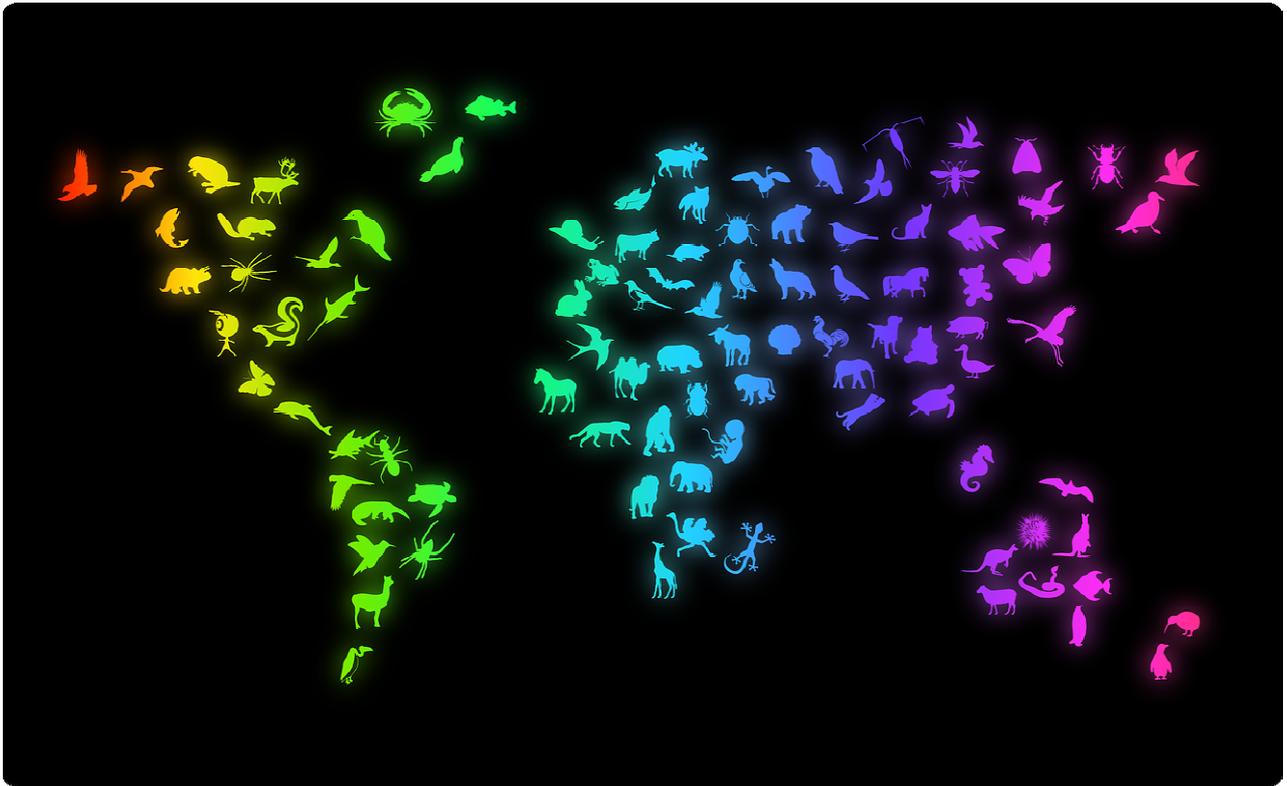
⇒ In your country

⇒ In other countries and continents

Project/display the pictures and/or organize a picture exhibition of the animals threatened with extinction in your class or your school.

Why are they threatened with extinction?

What can we do to save them?



Picture from Pixabay.com



Sea Animals facing extinction

- Study activity sheet -

Activity proposal: Split into groups and find images and information about sea animals like the Caretta Caretta sea turtle threatened with extinction:

⇒ in your region

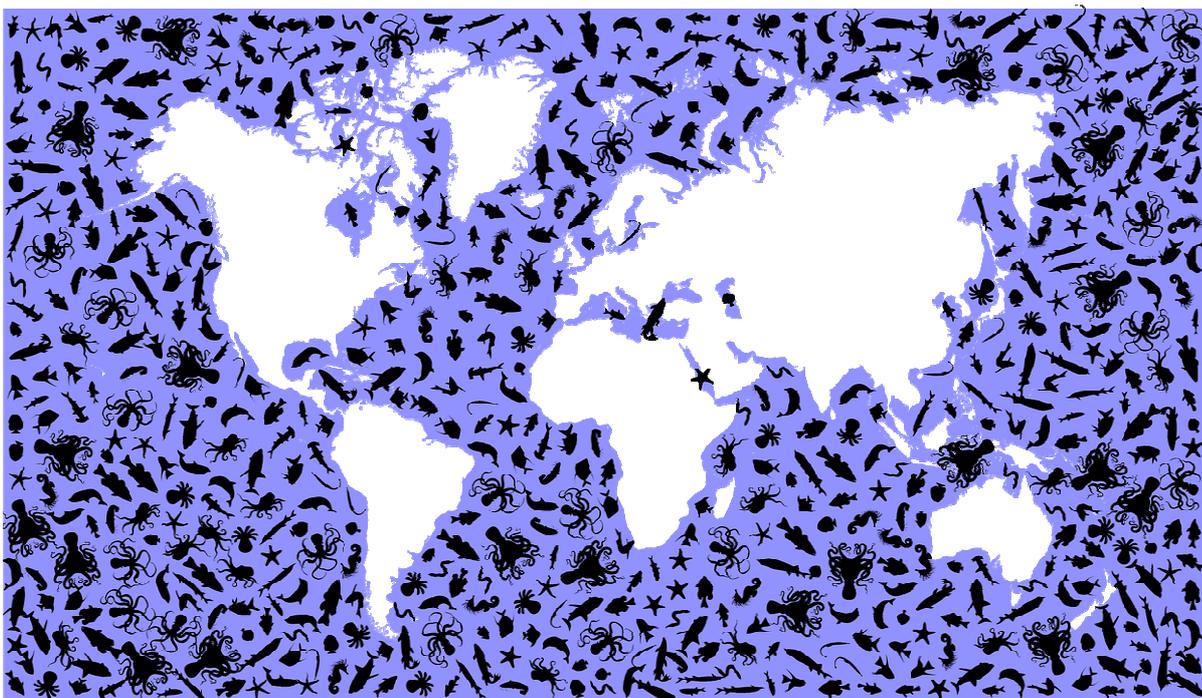
⇒ in your country

⇒ in other countries and continents

Project/display the pictures and/or organize a picture exhibition of the animals threatened with extinction in your class or your school.

Why are they threatened with extinction?

What can we do to save them?



Picture from Pixabay.com



True or false statements

- True or false activity sheet -

Students in groups discuss the statements and decide whether they are true or false. Then, the activity is checked and discussed with the teacher.

Statements	True	False
Floods have occurred more frequently in recent years		
Deforestation helps prevent flooding		
Floods don't influence the lives of aquatic animals		
Straight riverbeds are less prone to flooding		
Junk in the riverbed doesn't affect the flow of water		
Air pollution does not affect the earth's ecosystems		
Asthma is something impacted by pollution		
Pesticides are used by farmers to protect their crops		
Greenhouse gases protect the atmosphere and the oceans		
Global warming is caused by increased levels of greenhouse gases		
Organic farming uses artificial fertilizers and pesticides.		
Biological pest control relies on natural mechanisms		

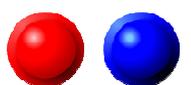


Environmental problems

- Team study activity sheet -

Students work in pairs or small groups. They discuss the problems together and then present the table to the rest of the class. The issues (plants and animals, water, air) can be discussed separately.

Natural environment	What are their possible threats?	How can we protect them?
plants and animals		
water		
air		



Plastic bag

- Calculating activity sheet -

11 million (!!!) plastic bags are consumed daily in Greece. With just the plastic bags that are used in Greece, we could wrap our planet 60 times over.

How many plastic bags do you use?

1	How many times a week do you or your family visits the Supermarket for your shopping? x 5 bags =	
2	Do you put vegetables and fruits in a plastic bag when you weigh them? If so add 4 bags.	
3	When you buy bread from the oven, do they place it in a plastic bag; If so, add 5 bags.	
4	When you buy new clothes, do they place them in plastic bag; If so, add 2 bags.	
5	Generally, how many other plastic bags do you use per week?	
Total (per week)		
Calculate how many plastic bags you use per year (A year is 52 weeks, so you multiply total by 52)		

Is the number you found too big?

Think of ways to reduce the plastic bags you use.

E.g., Use satchels or totes made of durable fabrics, for your shopping.

In the middle of the Pacific Ocean circular currents have created a huge dustbin of plastic that is 10 times the size of Greece!



Water Consumption Calculation

- Calculating activity sheet -

Calculate how much water you could save weekly/annually.

1. How many times do you brush your teeth every day?

..... x 15 litres = litres x 7 days = litres per week

2. How many times do you shower every day?

..... x 50 litres = litres x 7 days = litres per week

3. How many times do you wash your family car weekly?

..... x 150 litres = litres x 7 days = litres per week

4. How many times your family use a washing machine weekly?

..... x 150 litres = litres x 7 days = litres per week

5. How often do your family wash fruits and vegetables weekly?

..... x 30 litres = litres x 7 days = litres per week

6. How often do your family wash your dishes weekly?

a. If you wash them by hand (constant water flow):

..... x 100 litres = litres per week or

b. If you wash them in the washing machine:

..... x 10 litres = litres per week

7. How many times do you wash your hands every day?

..... x 15 litres = litres x 7 days = litres per week

Weekly Sum = litres per week

Multiply the weekly amount by 52 (52 weeks a year) to find the litres of water you consume per year.

Annual Sum = (weekly sum) x 52 weeks = litres per year

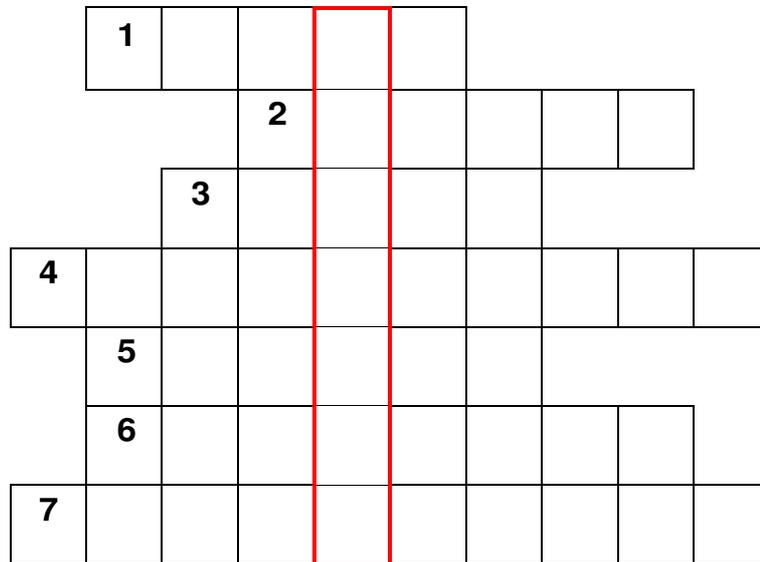
Is the number big???

Report back with: All of us..., Most of us..., Many of us..., A few of us..., Not many of us..., Hardly any of us..., None of us...



Crossword

- Fun & revision activity sheet -



1. They pollinate crops.
2. Oats or barley.
3. The upper layer of earth in which plants grow.
4. Harmful substances introduced into the environment.
5. It is caused by prolonged heavy rains.
6. Food produced without the use of chemicals.

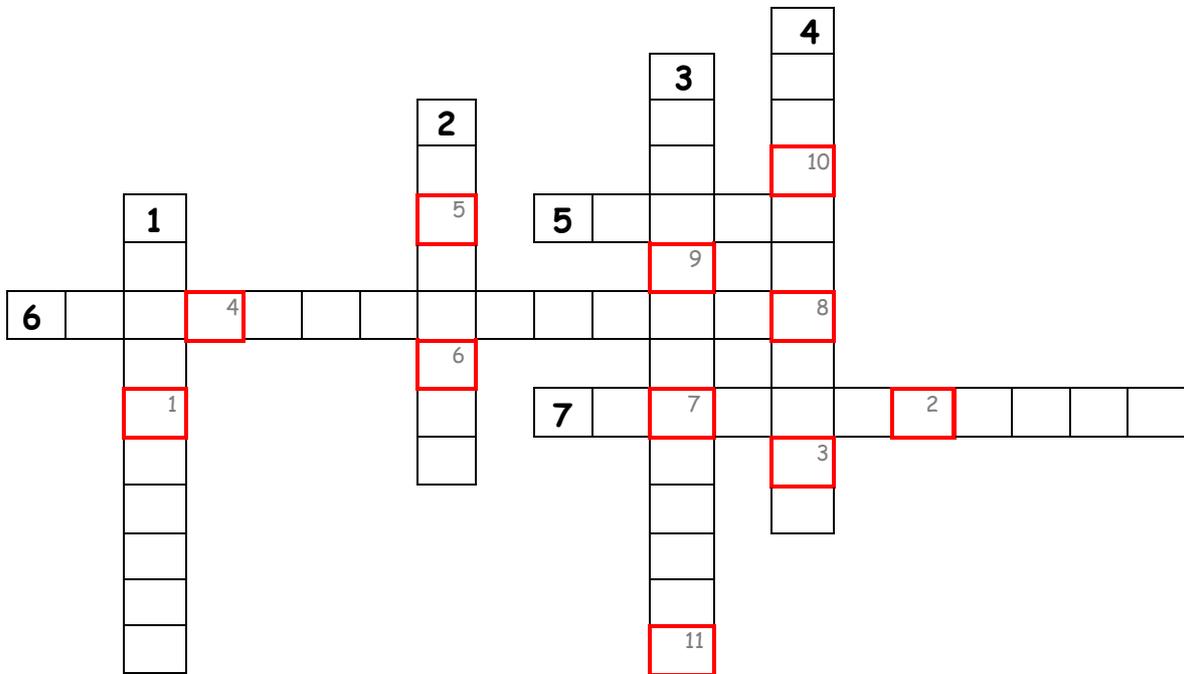
Red frame: Reprocessing waste into new materials and objects.



Crossword

- Fun & revision activity sheet -

Solve the crossword and find the letters that will give the password.



Across

1. One of the fossil fuels which is a main contributor to global warming.
2. The process of cutting down trees in a large area.
3. Harmful chemicals used by farmers.

Down

4. Energy produced from sources like sunlight, wind, rain.
5. The process of damaging soil.
6. The variety and variability of living species on Earth.
7. An insect that carries pollen.

Password

1	2	3		4	5	6	7	8	9	10	11



Activity sheets

Age target: 10 years old

Trees

- Calculating activity sheet -

Calculate how many trees you could save each week/year!

- 1) How many packets of paper napkins do you consume in your family, on average, weekly?

$$\underline{\hspace{2cm}} \times 0.2 \text{ kg} = \underline{\hspace{2cm}} \text{ kg}$$

- 2) How many newspapers do you consume, on average, on a weekly basis?

$$\underline{\hspace{2cm}} \times 0.5 \text{ kg} = \underline{\hspace{2cm}} \text{ kg}$$

- 3) How many rolls of kitchen paper do you consume, on average, per week?

$$\underline{\hspace{2cm}} \times 0.4 \text{ kg} = \underline{\hspace{2cm}} \text{ kg}$$

- 4) How many cartons (cartons, paper bags, etc.) do you consume, on average, weekly?

$$\underline{\hspace{2cm}} \times 0.5 \text{ kg} = \underline{\hspace{2cm}} \text{ kg}$$

- 5) How many magazines do you read, on average, per week?

$$\underline{\hspace{2cm}} \times 0.3 \text{ kg} = \underline{\hspace{2cm}} \text{ kg}$$

- 6) How many A4 sheets do you consume, on average, per week?

$$\underline{\hspace{2cm}} \times 0.05 \text{ kg} = \underline{\hspace{2cm}} \text{ kg}$$

$$\text{Weekly Sum} = \underline{\hspace{2cm}} \text{ kg}$$

Multiply the total amount by 52 (52 weeks a year) to find out the weight of paper you consume annually.

$$\text{Annual sum} = \text{Weekly Sum} \times 52 = \underline{\hspace{2cm}} \text{ kg}$$

If 1000 Kg of recycled paper save 17 trees, how many trees could you save a year if you use less or you recycle the above amount of paper?



Environmental problems

- Quiz -

1. Which of these cannot be recycled?
 - a) plastic bottles
 - b) light bulbs
 - c) metal cans
 - d) paper
2. True or false?
Car fumes have a big impact on air pollution. T / F
3. Name three actions a farmer can take to support sustainability.
 - 1)
 - 2)
 - 3)
4. Fill in the gaps
You can use renewable energy to provide _____ and heat for _____ and businesses. (electricity/homes)
5. The process of converting waste materials into new materials and objects is called:
 - a) segregation
 - b) reusing
 - c) recycling
 - d) reducing
6. List three sources of air pollution.
 - 1)
 - 2)
 - 3)
7. If something is sustainable, it ...
 - a) pollutes the environment
 - b) should be stopped immediately
 - c) is good for the environment
 - d) has a negative impact on people
8. Which of these is not the effect of intensive farming?
 - a) animals leaving their habitats
 - b) biodiversity
 - c) water pollution
 - d) soil degradation
9. Why are bees so important for farmers?
 - a) They keep other insects away
 - b) They make honey
 - c) They pollinate crops
 - d) They stop land pollution
10. Which of these factors do not contribute to vast flooding?
 - a) deforestation
 - b) habitats of water animals
 - c) straight riverbed
 - d) junk in the riverbed.



Environmental problems

- Quiz -

bitats.

hat it breaks down
radable / pollution)

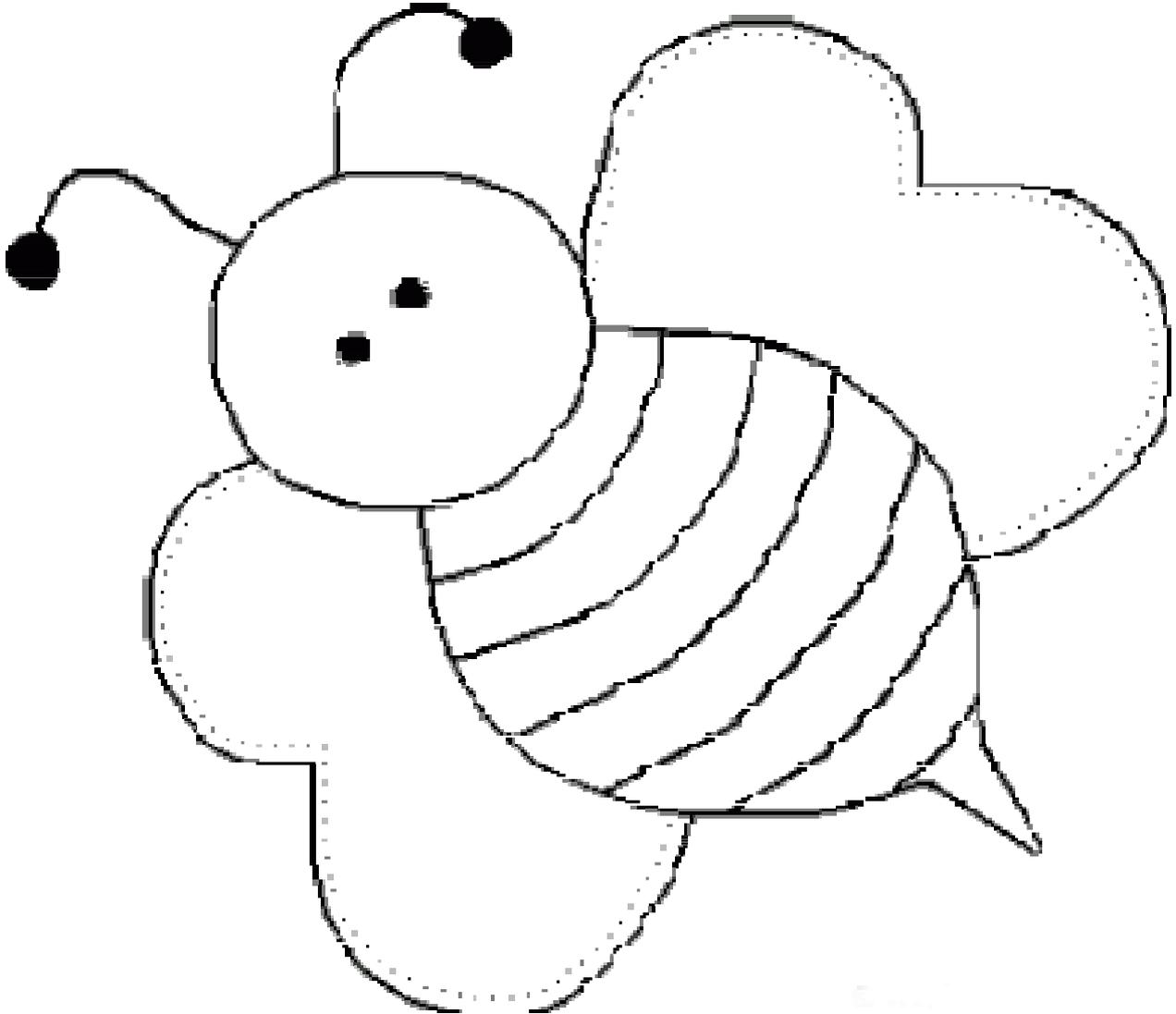


Fun activity sheets

Age target: 6 - 10 years old

Colouring page

- Fun activity sheet -

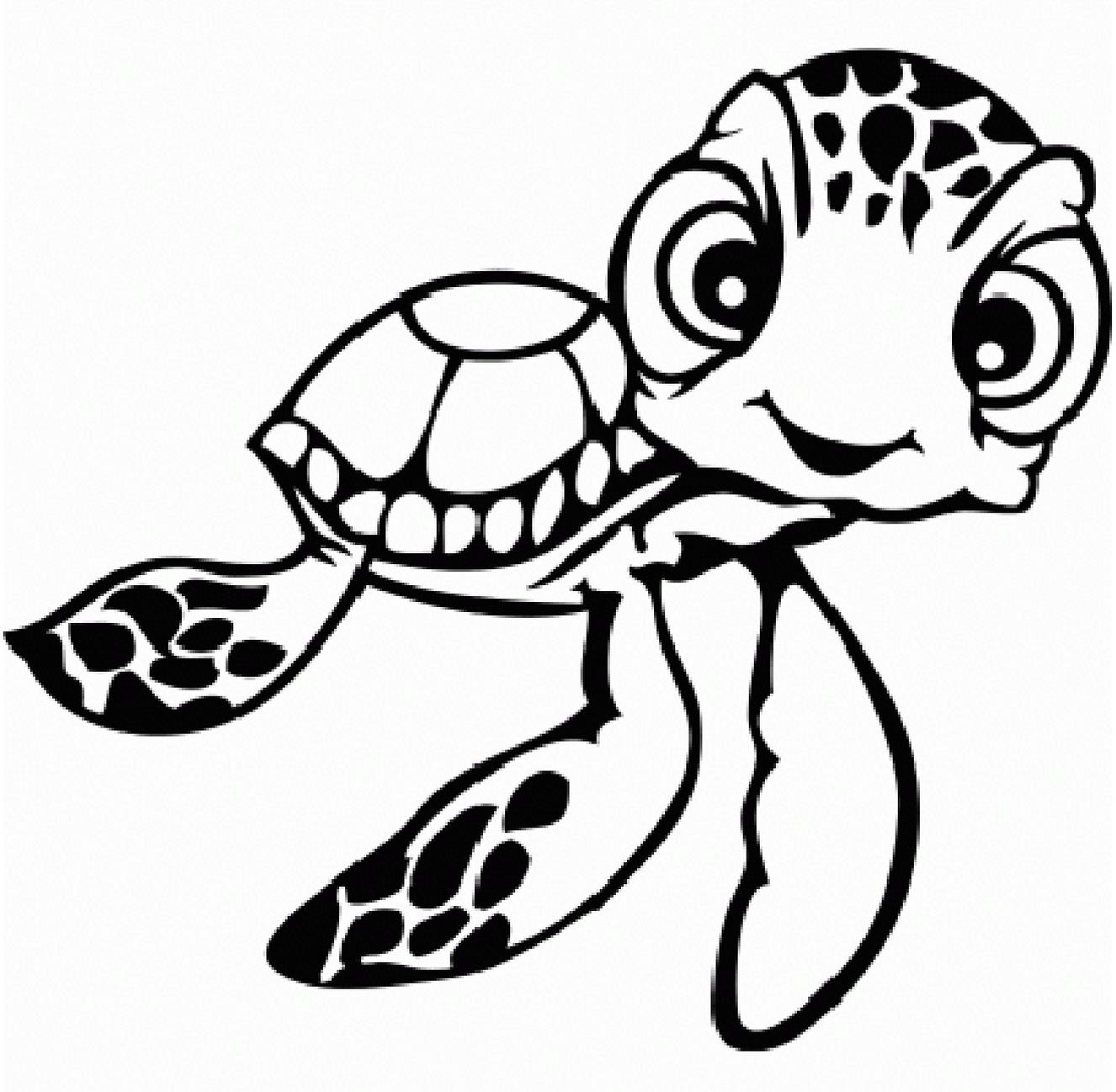


Picture: <https://s-karatheodoris.gr/zografizo-zoakia>



Colouring page

- Fun activity sheet -



Picture: <https://s-karatheodoris.gr/zografizo-zoakia>



Colouring page

- Fun activity sheet -

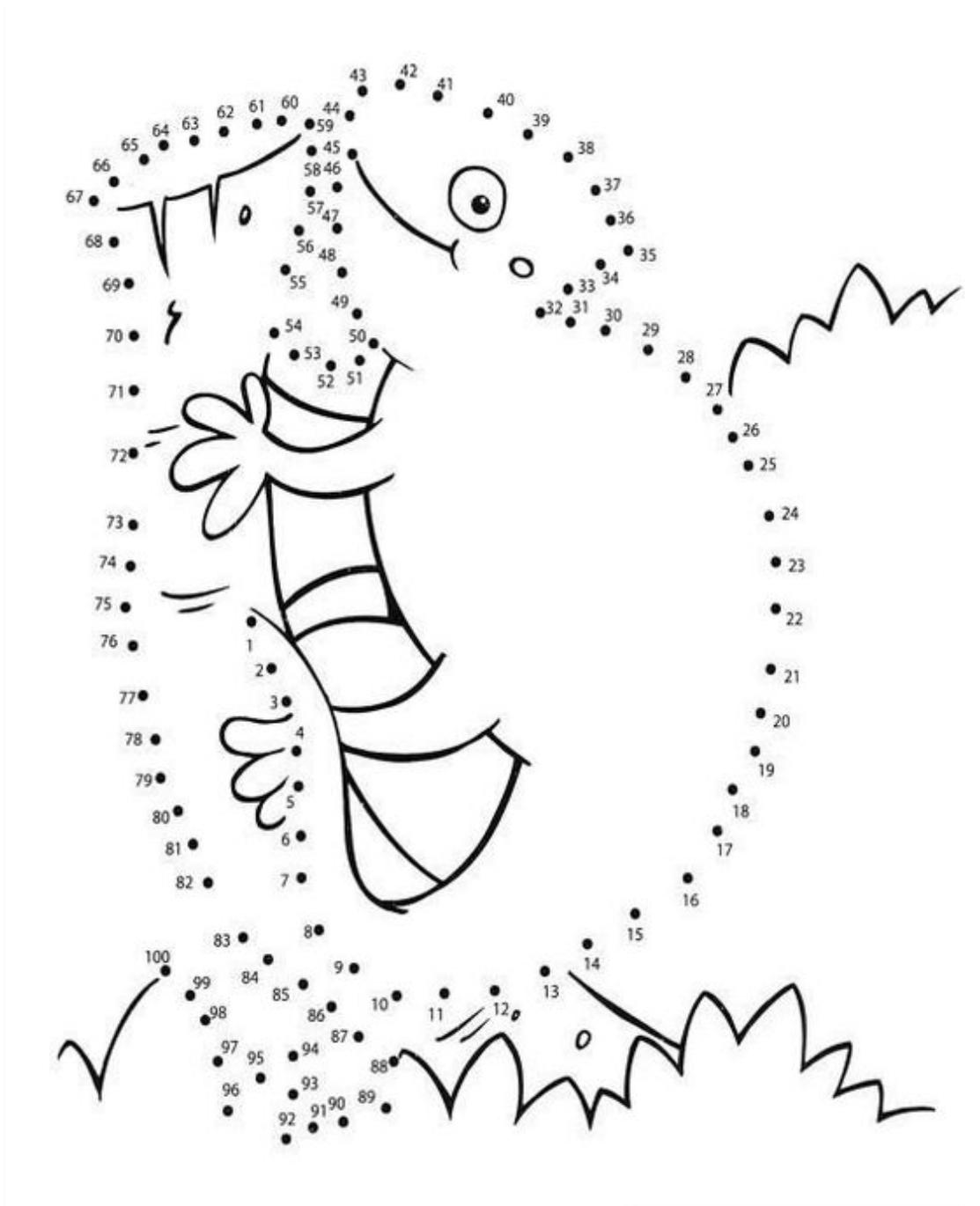


Picture: <https://s-karatheodoris.gr/zografizo-zoakia>



Connect the dots and colour the image

- Fun activity sheet -

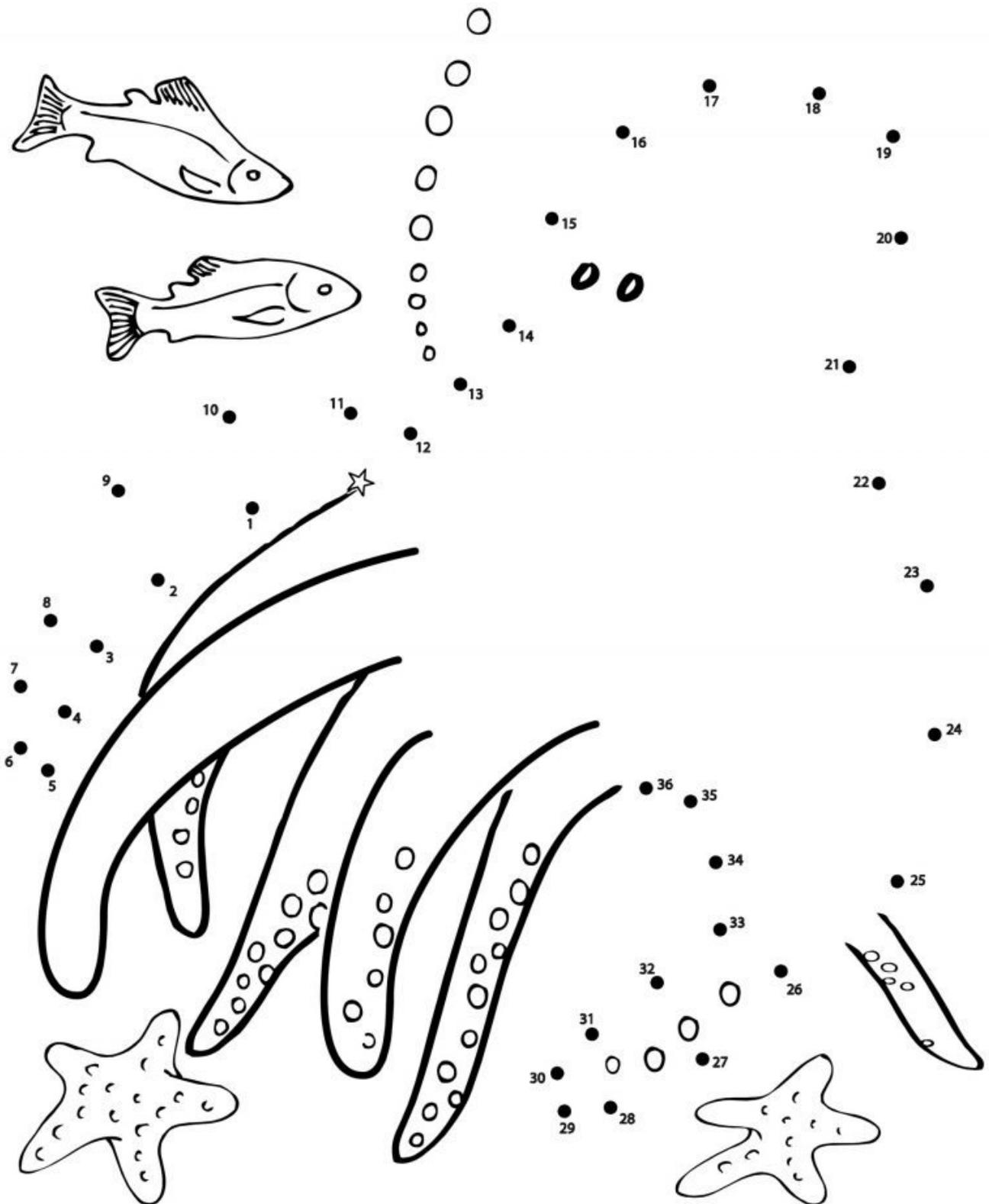


Picture: <https://qr.pinterest.com/pin/708613322595707629/>



Connect the dots and colour the image

- Fun activity sheet -



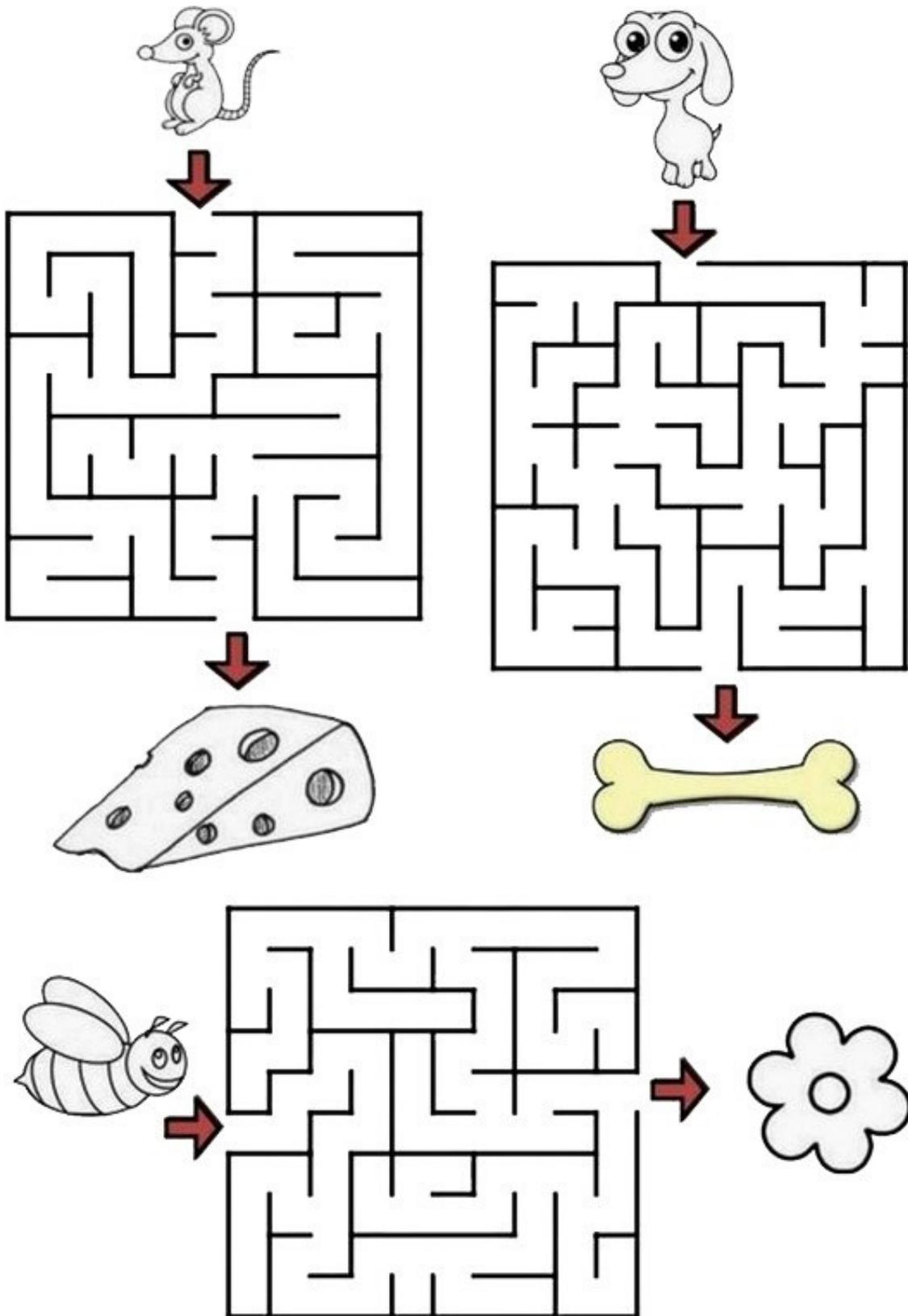
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Labyrinth

- Fun activity sheet -

Help the mouse, the dog and the bee find the way to their food!



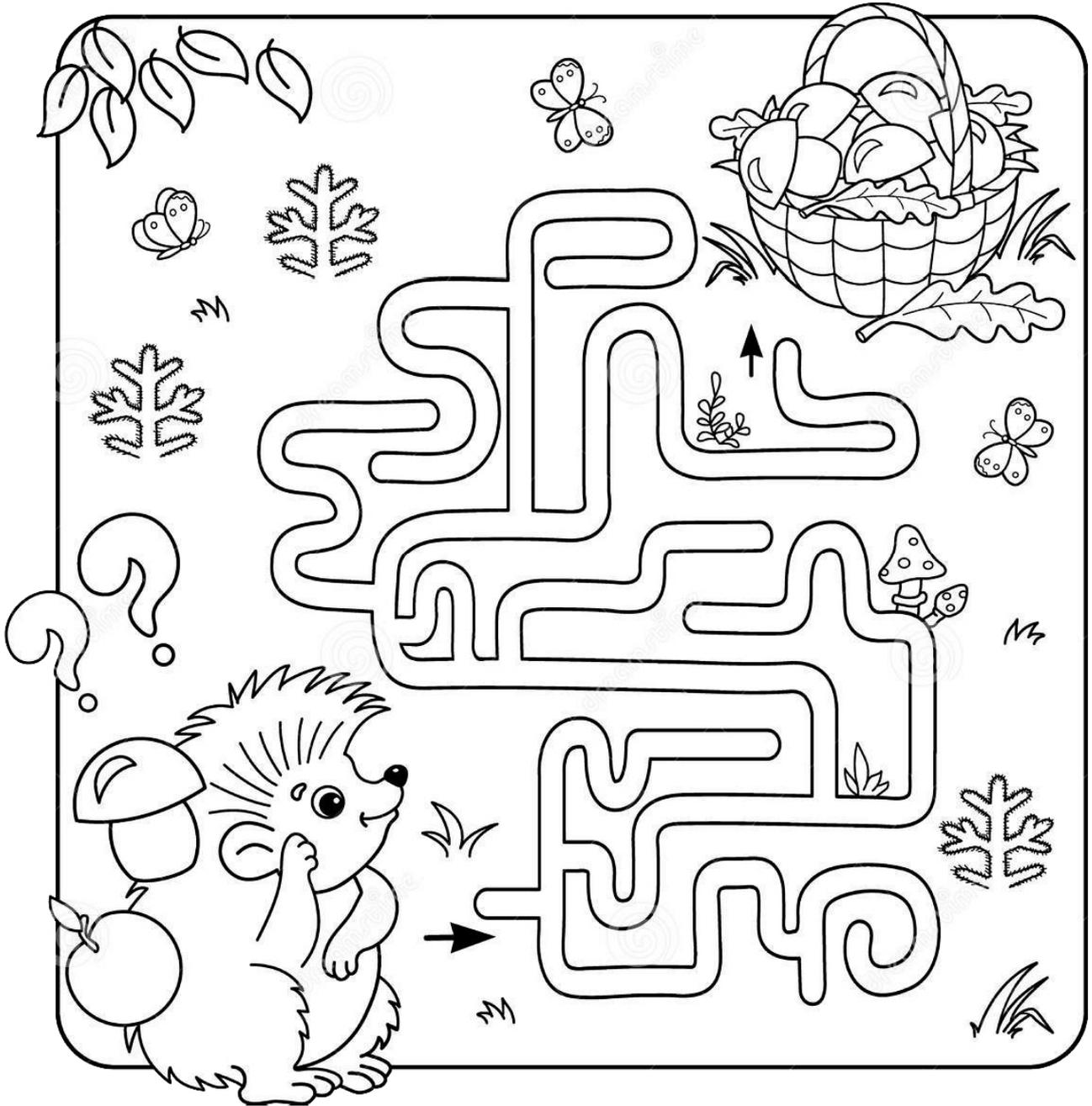
Picture: https://efibarlou.blogspot.com/2017/02/blog-post_18.html



Labyrinth

- Fun activity sheet -

Help the hedgehog find the way to its food!



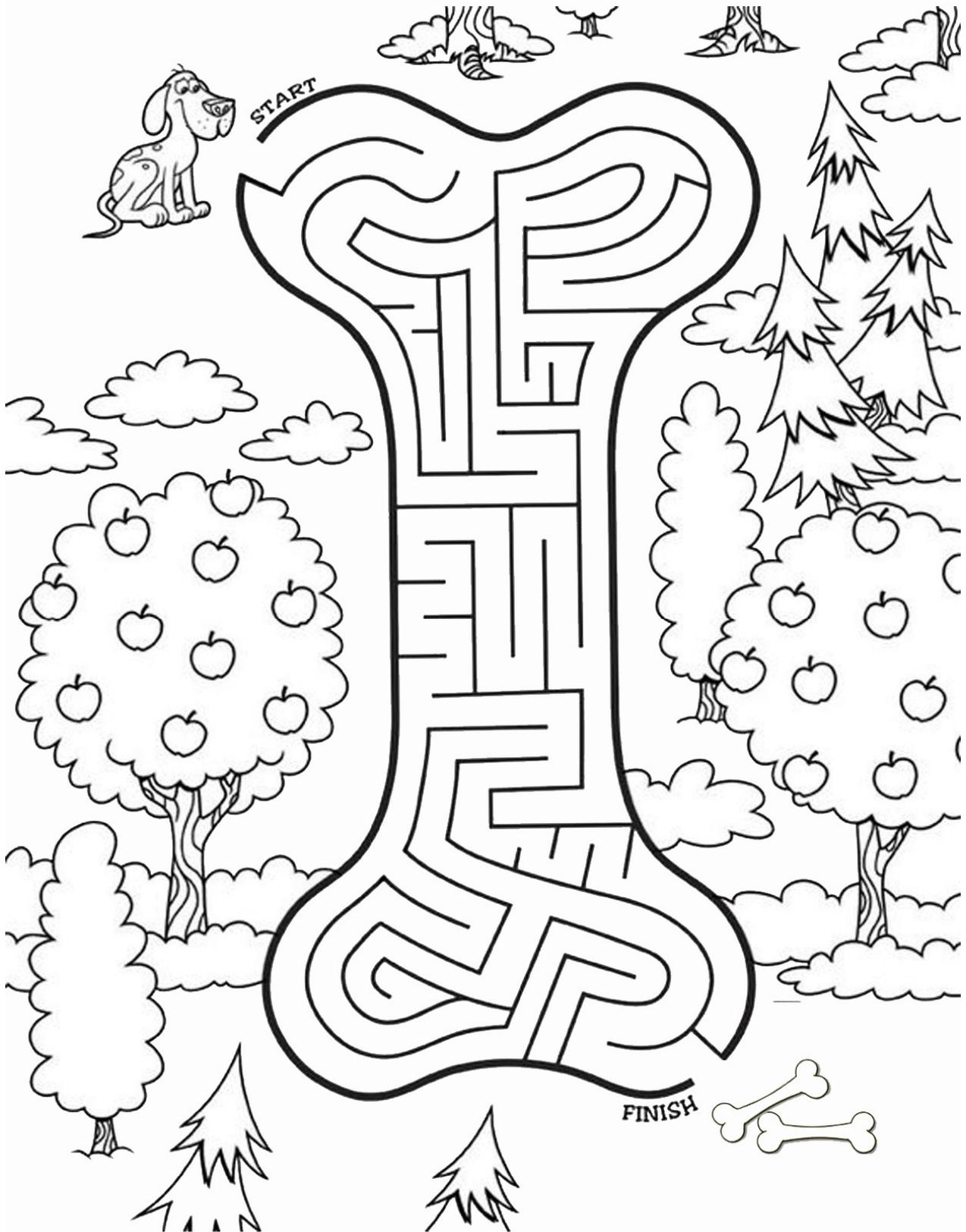
Picture: https://es.123rf.com/photo_70665282_ilustraci%C3%B3n-vectorial-de-dibujos-animados-de-la-educaci%C3%B3n-laberinto-o-juego-de-laberinto-para-ni%C3%B1os-en-edad-p.html



Labyrinth

- Fun activity sheet -

Help the dog find its food!



Picture: <https://gr.pinterest.com/pin/862298659874264194/?lp=tru>



Glossary

- by The University of West London -

Active citizenship	<p>People getting involved in their local communities and democracy at all levels, from towns and cities, to nationally and globally; often to benefit society and the environment.</p> <p>This is about recognizing that we are all mutually dependent and that by making a positive contribution to the direction society takes, we are helping ourselves as well as others.</p>
Air pollution	<p>A type of environmental pollution that affects the air and is usually caused by smoke or other harmful gases. A danger to human health and Earth's ecosystems.</p> <p>The presence of toxic or harmful chemicals/compounds in the air, which are usually not present and which lower the quality of the air or cause detrimental changes to the quality of life.</p>
Alternative energy	<p>Energy that can supplement or replace conventional energy sources such as fossil fuels</p>
Anthropogenic	<p>Resulting from human activity. Often used to describe pollution and environmental damage.</p>
Asthma	<p>A health condition that affects the lungs and can make breathing difficult.</p> <p>The condition can be made worse by air pollution</p>
Atmosphere	<p>The layer of gases held around the earth by gravity.</p>
Biodiversity	<p>The variety of plant and animal life in the world or a particular habitat. A high level of biodiversity is important.</p>
Biofuel	<p>Fuel made from plants. It makes use of captured solar energy stored in plants.</p>
Biological pest control	<p>A method of controlling pests such as insects, weeds and plant diseases using other organisms. It relies on natural mechanisms – such as animals eating insects that might otherwise eat a farmer's crop - but usually involves active management by farmers too.</p>
Carbon dioxide	<p>A greenhouse gas. A molecule of one carbon atom and two oxygen atoms.</p>
Climate	<p>The average weather experienced in a place, measured over a long period.</p>
Climate change	<p>Change in the earth's weather patterns caused by the build-up of greenhouse gases in the atmosphere. These gases trap the sun's heat, changing the climate locally and globally.</p>

Crop rotation	Growing a series of different crops in the same area in a sequence across the seasons. It helps in reducing soil erosion and increases soil fertility and the overall yield from farming.
Deforestation	Clearing an area of trees without replanting. This destroys the habitat for affected animals as well as contributing to the build-up of greenhouse gases since trees absorb carbon dioxide .
Drought	A continuous period of dry weather, when an area gets less than its normal amount of rain. This is generally bad for the plants, animals and humans in the areas or habitats affected. Increases in droughts and flooding are occurring as a consequence of climate change .
Ecosystem	A large community of living things – such as plants and animals – whose lives are linked together in a particular area.
Emissions	Gases added to the atmosphere by human activities (especially the use of fossil fuels) as well as from animals' digestive systems (particularly from farming) and from plants decomposing.
Energy	The ability to do work. In the case of 'Colourful World' it particularly means the power for transport, heating/cooling our homes, powering factories, appliances etc.
Fertilizer	A substance that fertilizes the soil, helping plants to grow. These can be natural (such as manure from animals) or chemical (that is, made artificially). Intensive farming of crops usually relies on inputs such as chemical fertilizers.
Field margin	An area of land surrounding a field that lies between the planted crop and the boundary. Field margins and hedges can provide important habitats for plants and animals, including encouraging biological pest control . This can reduce the need for chemical pesticides and encourage biodiversity .
Fossil fuels	For example – coal, oil and gas. Made from fossilized plants and animals over millions of years. When burned they produce energy but also release harmful greenhouse gases and other pollutants .
Global Warming	The rise in average temperatures in the atmosphere and the oceans caused by increased levels of greenhouse gases .
Greenhouse effect	Warming of the atmosphere caused when heat is trapped and cannot escape into space. Greenhouse gases increase this effect.
Greenhouse gas	A gas that contributes to the greenhouse effect . For example, carbon dioxide and methane .
Habitat	The natural environment lived in by a particular species of animal, plant, or other organism.
Intensive farming	A kind of agriculture where a lot of money and labour are used to increase the yield obtained per area of land. The use of large amounts of chemical

fertilizers and pesticides for crops, and of medication for animals is common.

Landfill	A way of getting rid of garbage by burying it between layers of earth. Landfill sites can pollute the environment when rainwater flushes chemicals into streams and rivers, and when gases such as methane escape from them into the atmosphere .
Methane	A greenhouse gas made of one carbon atom and four hydrogen atoms.
Non-renewable energy	Energy sources that are limited – such as oil, coal, gas and uranium – because they are not naturally replaced as fast as they are used.
Organic farming	A farming method that involves growing and nurturing crops without the use of artificial fertilizers and pesticides. It relies on ecologically balanced agricultural principles like crop rotation, organic waste for manure, and biological pest control but usually yields less per area of land than intensive farming .
Pesticide	Chemicals used to kill unwanted animals or plants. Typically, this means those that eat, damage, or compete with crops grown by farmers.
Photovoltaic	Technology that converts the sun's energy directly into electricity.
Pollination	An important part of the life cycle for plants. It is often achieved by insects travelling between plants, transferring pollen which fertilizes egg cells and causes them to grow into seeds. However, birds, bats, and the wind can also act as pollinators.
Pollution	When harmful substances are added to the environment.
Pollutant	A harmful substance added to the environment. For example, vehicle fumes in the air, chemicals from a landfill leaking into the local water supply, or an oil spill in the sea.
Recycling	Turning waste into reusable material. Recycling is a way to reduce the amount of garbage that goes to landfill and that might otherwise cause pollution .
Renewable energy	Alternative – typically cleaner - sources of energy , such as wave, wind or sun/solar which do not use up the earth's limited natural resources such as fossil fuels .
Responsible consumption	Using products and services to meet our needs and enhance life while minimizing the use of natural resources, toxic materials as well as the emissions of waste and pollutants . Understanding how things are made, and especially where our energy comes from, is an important first step towards responsible consumption.
Reusing	Using things again when possible. This helps to reduce waste as well as reducing the consumption of energy and natural resources that happens when new things are made. Using the same water bottle

rather than disposable water bottles is a good example.

Riverrewilding

Restoring the natural flow of a river. Removing barriers and creating wetland areas can help to avoid the problems associated with flooding from heavy rainfall as well as encouraging **biodiversity**.

Soil erosion

When soil or dirt is washed away exposing the ground beneath. Soil erosion is bad for farmers because it washes away the fertile topsoil in which plants grow.

Soil fertility

The capacity of soil to provide essential nutrients for plants to grow.

Solar power

Energy generated directly from sunlight. A **renewable energy** source.

Sustainable development

A way for people to use resources without those resources running out. It has also been defined as development which “meets the needs of the present without compromising the ability of future generations to meet their own needs.”

Crosswords - Key

Crossword on page 45

1	B	E	E	S					
		2	C	R	O	P	S		
		3	S	O	I	L			
4	P	O	L	L	U	T	I	O	N
	5	F	L	O	O	D			
	6	O	R	G	A	N	I	C	
7	R	E	C	Y	C	L	I	N	G

Crossword on page 46

											4									
										3	P									
										B	O									
										I	L ¹⁰									
				2					5	C	O	A	L							
				E						D ⁹	I									
		1		R ⁵								N ⁸								
		R		O								A								
6	D	E	F ⁴	O	R	E	S	T	A	T	I	O	N ⁸							
		N		I ⁶							V									
		E ¹		O						7	P	E ⁷	S	T	I	C ²	I	D	E	S
		W		N							R		O ³							
		A									S		R							
		B									I									
		L									T									
		E									Y ¹¹									